

Evidence Check

Effective strategies to increase physical activity among adolescents

An Evidence Check systematic review and scoping review
brokered by the Sax Institute for the NSW Ministry of Health—
December 2025

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This report was prepared by: Ben Singh, Nicola D. Ridgers, Alyson Crozier, Grant R. Tomkinson and Carol Maher. Adelaide University.

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Enquiries regarding this report may be directed to the:

Director
Evidence Connect
Sax Institute
www.saxinstitute.org.au
evidence.connect@saxinstitute.org.au

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Disclaimer:

This Evidence Check Review was produced using the Evidence Check methodology in response to specific questions from the commissioning agency.

It is not necessarily a comprehensive review of all literature relating to the topic area. It was current at the time of production (but not necessarily at the time of publication). It is reproduced for general information and third parties rely upon it at their own risk.

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Abbreviations

AMPED: Activity Mentoring Program for Early Secondary School (name of a school physical activity intervention)

ASReview: AI-assisted screening software for evidence reviews

eHealth: Electronic health (digital health delivered via electronic technologies)

EPHPP: Effective Public Health Practice Project (Quality Assessment Tool)

Go4Fun: NSW healthy lifestyle program (including Aboriginal program adaptation)

HIIT: High-intensity interval training

MeSH: Medical Subject Headings (controlled vocabulary used in database searching)

mHealth: Mobile health (health support delivered via mobile devices)

MVPA: Moderate- to vigorous-intensity physical activity

NHMRC: National Health and Medical Research Council

NSW: New South Wales

PA: Physical activity

PE: Physical education

PICOS: Population, Intervention, Comparator, Outcomes, Study design

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

RCT: Randomised controlled trial

RE-AIM: Reach, Effectiveness, Adoption, Implementation, Maintenance (evaluation framework)

SES: Socioeconomic status

SMS: Short message service (text messaging)

UK: United Kingdom

US: United States of America/United States

Glossary of key terms

Active transport/travel: Travel in which the sustained physical exertion of the traveller directly contributes to their motion. This includes walking, wheeling, bike riding, skateboarding and scootering. Active travel also includes the use of e-mobility devices such as e-bikes even though their use typically requires less physical effort.ⁱ

Adherence: The extent to which participants do what the program asks (e.g., attend sessions, complete activities).

Attrition: Participants dropping out or being lost to follow-up during a study.

Built environment: The human-made, modified, or maintained surroundings that provide the setting for human activity, from buildings and parks to infrastructure such as transport, water, and energy networks.ⁱⁱ

Culturally responsive intervention/program: An initiative designed and delivered in ways that reflect and respect culture, often involving community leadership, co-design, cultural safety, and locally relevant activities.

Cultural safety: An Aboriginal and Torres Strait Islander-specific concept in Australia that refers to an experience defined by Aboriginal and Torres Strait Islander peoples themselves, with its presence or absence determined by them. It describes environments where First Nations people feel welcomed and respected, their experiences and cultures are valued, their knowledge is recognised, their voices are acted upon, and they do not experience racism.ⁱⁱⁱ

Device-based physical activity measure: Measurement using devices (e.g., accelerometers) rather than self-report.

Dose (intervention dose): How much of the program is delivered/received (e.g., minutes of activity provided, number of sessions, intensity).

Effectiveness: Whether an intervention works under real-world conditions (as distinct from controlled “ideal” conditions).

Engagement: How actively participants take part (e.g., attendance, participation, use of program components such as apps).

ⁱ National Heart Foundation of Australia. Glossary. Healthy Active by Design [Internet]. Australia: Heart Foundation; n.d. Available from: <https://www.healthyactivebydesign.com.au/glossary> (accessed 5 Feb 2026).

ⁱⁱ Australian Institute of Health and Welfare (AIHW). Built environment and health. Australia's Health [Internet]. Canberra: AIHW; 2024 [cited 2026 Feb 5]. Available from: <https://www.aihw.gov.au/reports/australias-health/built-environment-and-health>

ⁱⁱⁱ NSW Ministry of Health. (2024). NSW Aboriginal Health Governance, Shared Decision Making and Accountability Framework. NSW Ministry of Health. ISBN 978-1-76023-927-5.

Equity impacts: Whether effects differ across groups (e.g., by gender, SES, rurality), including whether an initiative narrows or widens gaps.

Fidelity: Whether the program was delivered as intended (e.g., correct content, frequency, and duration).

Feasibility: Whether a program can be delivered in practice with available time, staff, resources, and systems.

Implementation (implementation conditions): Practical factors that determine delivery success (e.g., staff training, leadership support, protected time, roles/responsibilities, resources).

Implementation infrastructure: The supports that enable consistent delivery at scale (e.g., training, materials, monitoring systems, staff roles, leadership endorsement).

Intervention (policy/program intervention): A policy, program, or strategy intended to increase physical activity (e.g., school programs, active travel initiatives, community sport programs).

Light-touch intervention: A low-intensity approach with limited contact or structured activity (e.g., brief education, messaging only).

Moderators (effect modifiers): Factors that may influence whether an intervention works better or worse for different people or contexts (e.g., gender, SES, delivery fidelity).

Multi-component intervention: A program with several coordinated elements (e.g., curriculum/PE changes + teacher training + whole-school reinforcement + home components).

Out-of-school approach: Programs, policies, or strategies delivered outside formal school curriculum or school hours to promote physical activity or health behaviours. These may occur in community, home, sport, recreation, transport, or digital settings (e.g., community sport programs or after-school activities).

Peer-led approach: An intervention where people of the same age group take leadership roles (e.g., peer mentors/leaders) to encourage participation.

Physical activity: Any bodily movement produced by skeletal muscles that requires energy expenditure. Physical activity refers to all movement including during leisure time, for transport to get to and from places, or as part of a person's work or domestic activities.^{iv}

Pragmatic trial: A study designed to test an intervention under routine, real-world conditions (often at scale, with typical staffing and constraints).

Process evaluation: Evaluation of how a program was delivered and experienced (e.g., reach, fidelity, barriers/enablers), alongside or separate from outcomes.

Reach: Who the program reaches (and how many), including whether priority groups participate.

Scalability: The likelihood an intervention can be expanded to larger populations while maintaining quality and outcomes.

^{iv} World Health Organization. Physical activity [Internet]. Geneva: World Health Organization; 2024 Jun 26 [cited 2026 Feb 5]. Available from: <https://www.who.int/news-room/fact-sheets/detail/physical-activity>.

Self-report: Measurement of physical activity based on questionnaires or diaries (subject to recall and reporting bias).

Sedentary behaviour: Waking behaviour with low energy expenditure while sitting, reclining or lying down (e.g., screen time).

Socioeconomic status: A measure of an individual's or group's social and economic position relative to others, typically based on factors such as income, education, occupation, and area-level disadvantage.

Walkability: The extent to which the built environment supports walking as a safe, convenient, and comfortable mode of transport for daily needs.^v

Whole-of-school approach: A coordinated school strategy that goes beyond a single class or teacher (e.g., policies, culture, environment, staff practices).

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^v Transport for NSW (NSW Government). Shared definitions and terminology. Movement and Place. Accessed February 5, 2026. <https://www.movementandplace.nsw.gov.au/place-and-network/guides/network-planning-precincts-guide/appendix/shared-definitions-and-terminology>.

Executive summary

Background

Regular moderate-to-vigorous intensity physical activity (MVPA) during adolescence supports heart and metabolic health, muscle and bone strength, mental health, and learning and social development, with many of these benefits continuing into adulthood. However, physical activity levels typically decline during adolescence while sedentary screen time increases. In NSW, only 14% of adolescents aged 9–15 years met the physical activity component of the Australian 24-hour Movement Guidelines in 2023–2024, down from 24% in 2014–2015 (a relative decline of ~40%). This trend highlights the need for effective, scalable, and equitable policy and program strategies to increase adolescent physical activity levels across settings.

Review questions

This review aimed to address the following specific questions:

Question 1: For adolescents aged 13–17 years, which types of policy and program interventions across key settings (e.g., community, sport, family, schools) are most effective in increasing physical activity levels?

Question 2: In adolescents aged 13–17 years participating in physical activity initiatives, how do individual, socio-cultural, environmental, and policy-related factors (e.g., gender, socioeconomic status, cultural background, geographical location [rural/regional vs urban], family support, access to recreational spaces, active transport infrastructure/walkability, school physical activity policies/programs), compared to their absence or variation, influence the success or failure of these initiatives?

Question 3: In Aboriginal and Torres Strait Islander adolescents aged 13–17 years, how effective are culturally responsive physical activity interventions, particularly those developed in partnership with Aboriginal and Torres Strait Islander communities, compared to standard or non-tailored approaches in increasing physical activity levels or program engagement?

Summary of methods

This Evidence Check involved two components:

- Questions 1 and 2 were addressed by a systematic review.
- Question 3 was addressed by a scoping review.

Questions 1 and 2 – Systematic review

A systematic review of academic literature (published over the period 2015–2025) was conducted to examine intervention effectiveness (Question 1) and determinants of intervention success/failure (Question 2) for adolescents aged 13–17 years. Searches were developed in consultation with an academic librarian and the NSW Ministry of Health and run in MEDLINE, Scopus and SPORTDiscus. Eligible studies were NHMRC Level II to III-2 intervention designs, including randomised controlled trials (RCTs) (Level II) and non-randomised controlled studies with a concurrent comparison group (Level III-2). Included studies compared an intervention with a control or usual practice group and reported outcomes such as physical activity, related behaviours, and implementation, engagement, or economic outcomes. Records were screened using ASReview for title/abstract screening and Covidence for full-text screening, with two reviewers working independently and disagreements resolved by discussion/third reviewer. Companion papers from included intervention studies that examined implementation, context or subgroup effects were used to address Question 2. Study quality was assessed in duplicate using the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool.

Question 3 – Scoping review

A scoping review was undertaken to identify and map culturally responsive sport, recreation and physical activity programs for Aboriginal and Torres Strait Islander adolescents aged 13–17 years, recognising that relevant evidence is often diverse and reported outside traditional trial designs. Searches were undertaken across academic databases (SportDiscus, PsycINFO, Scopus, MEDLINE, Informit Indigenous Collection and AUSPORT), Google Scholar, and targeted grey literature searches (Google and relevant government/sector websites). Screening was completed in Covidence by two reviewers independently. Given the scoping focus and heterogeneity of evidence, study quality appraisal was not undertaken for Question 3.

Key findings

Questions 1 and 2

Across 56 included papers, 43 studies evaluated intervention effectiveness (Question 1) and 13 additional companion papers examined factors influencing success or failure (Question 2). Most interventions were delivered in school settings (n=28), with several (n=8) using hybrid home-school models. Several were delivered outside schools (n=7), including community- or sport-based programs (n=2) and fully home-based interventions (n=5); meaning, the evidence base

in these settings is limited. Overall, effects on total daily MVPA were typically small in large real-world trials, but some approaches showed more consistent promise.

For Question 1, multi-component school-based interventions, especially those embedded within PE/curriculum and supported by teacher training and whole-of-school reinforcement, consistently improved physical activity outcomes or slowed the usual age-related decline in MVPA levels. In contrast, light-touch classroom or education-only approaches generally produced modest or short-lived effects, often because they did not deliver a sufficient “activity dose.” Peer-led and school culture programs showed mixed results: smaller pilots sometimes suggested benefit, but larger trials often reported null effects when engagement and fidelity varied between schools. Digital and mHealth approaches were most effective when they actively supported behaviour change (e.g., prompting, feedback, structured goal-setting); stand-alone apps and wearables deployed at scale commonly had limited impact due to declining engagement.

For Question 2, implementation conditions frequently determined outcomes. Programs were more likely to succeed when schools had protected delivery time, clear staff roles, and leadership support, and were less likely to succeed when fidelity and the dose were inconsistent. Equity effects varied: self-directed and digital components often had lower uptake among adolescents from lower socioeconomic backgrounds, with benefits for girls or less active adolescents inconsistent and typically dependent on high-quality implementation and sustained engagement. Environmental and transport constraints also had limited “spillover” beyond school, meaning increases in school-day activity did not reliably translate into changes in active travel or leisure-time activity without supportive infrastructure and family routines.

Question 3

Only four studies or program evaluations relevant to Aboriginal and Torres Strait Islander adolescents were identified. None provided direct evidence on the effectiveness of culturally responsive interventions for increasing physical activity levels, as the evaluations were not designed to assess behaviour change and generally did not include robust physical activity outcome measures. However, in one evaluation, a culturally adapted program was compared with a non-tailored or mainstream version in terms of engagement-related outcomes. Specifically, an evaluation of the Aboriginal adaptation of the Go4Fun program reported higher engagement, retention, and acceptability compared with the mainstream program. Overall, the available evidence indicates stronger engagement and cultural safety for culturally responsive approaches but does not allow conclusions to be drawn about their effectiveness in increasing physical activity levels.

Background

Regular moderate-to-vigorous intensity physical activity (MVPA) during adolescence is associated with improved cardiorespiratory fitness, muscular strength, healthier body composition, favourable cardiometabolic profiles and stronger bone health, which reduce risk markers for chronic disease across the life course.^{1,2} Physical activity is also linked with better mental health, including less severe symptoms of depression and anxiety and improved psychological well-being.^{3,4} Higher physical fitness and activity levels are associated with better cognitive function, academic performance and social outcomes such as peer relationships and social connectedness, with many of these benefits tracking moderately well into adulthood.^{5,6}

Adolescence is characterised by declining physical activity levels and increased sedentary behaviour, particularly recreational screen time.⁷ In Australia, national surveillance data indicate that a small proportion of children and adolescents engage in recommended daily MVPA levels.⁸ In NSW, recent monitoring shows that only 14% of adolescents aged 9–15 years (the closest available surveillance age group) met the physical activity component of the *Australian 24-Hour Movement Guidelines in 2023–2024*, compared with 24% in 2014–2015, a relative decline of approximately 40% over the decade.⁹ This trend underscores the growing public health challenge of promoting and sustaining physical activity levels during adolescence in NSW.^{8,9}

The *Australian 24-Hour Movement Guidelines for Children and Young People* (5–17 years) recommend at least 60 minutes per day of MVPA, including muscle- and bone-strengthening activities on at least three days per week, alongside limits on sedentary recreational screen time.¹⁰ Despite these recommendations, adolescents face structural and social barriers to participation, including limited access to safe, affordable and inclusive recreational spaces, reduced opportunities for active transport, high engagement in screen-based activities, and competing academic pressures.^{11,12} These barriers are not evenly distributed; adolescents from socioeconomically disadvantaged backgrounds, those in rural and remote areas, and Aboriginal and Torres Strait Islander young people experience additional constraints such as transport difficulties, financial barriers, cultural unsafety and fewer local activity options.^{13,14}

In NSW, adolescent physical activity is influenced by policies and programs across schools, families, organised sport, community organisations, transport systems and the built environment.⁹ Schools represent a major platform for promoting adolescent physical activity in NSW, where state policy mandates a minimum of 150 minutes of planned MVPA per week for students in years K–10. Multi-component school-based interventions, such as Physical Activity 4 Everyone¹⁵ and girls-only physical activity programs¹⁶, have previously been evaluated with mixed findings, and there is limited synthesis on which approaches work best, in which contexts, for which adolescent subgroups, and at what cost.

To address these gaps, the NSW Ministry of Health's Centre for Population Health commissioned this Evidence Check to synthesise contemporary evidence on interventions to increase physical activity levels among adolescents aged 13–17 years. The review aims to identify effective and scalable policy and program approaches across key settings (e.g., schools, community sport, active transport, digital and place-based initiatives), examine factors influencing implementation success or failure (such as context, resources, partnerships and fidelity) and, where evidence is available, assess the effectiveness of culturally responsive physical activity interventions for Aboriginal and Torres Strait Islander adolescents. Given evolving social contexts, growing attention to equity and place-based approaches, and the need for coordinated, cross-sectoral action, a timely synthesis of this evidence is needed to inform future policy, program and investment decisions to support active, healthy adolescents in NSW.

Aims

The aim of this Evidence Check was to find, appraise, and synthesise the available literature examining the effectiveness of policy and program interventions to increase physical activity among adolescents aged 13–17 years. A further aim was to identify factors that influence the success or failure of these initiatives across different population groups and settings, and, where evidence is available, to assess the effectiveness of culturally responsive physical activity interventions for Aboriginal and Torres Strait Islander adolescents.

To achieve these aims, this Evidence Check addressed the following questions:

Question 1: For adolescents aged 13–17 years, which types of policy and program interventions across key settings (e.g., community, sport, family, schools) are most effective in increasing physical activity levels?

Question 2: In adolescents aged 13–17 years participating in physical activity initiatives, how do individual, socio-cultural, environmental, and policy-related factors (e.g., gender, socioeconomic status, cultural background, geographical location [rural/regional vs urban], family support, access to recreational spaces, active transport infrastructure/walkability, school physical activity policies/programs), compared to their absence or variation, influence the success or failure of these initiatives?

Question 3: In Aboriginal and Torres Strait Islander adolescents aged 13–17 years, how effective are culturally responsive physical activity interventions, particularly those developed in partnership with Aboriginal and Torres Strait Islander communities, compared to standard or non-tailored approaches in increasing physical activity levels or program engagement?

Given the differing nature of these research questions, different methods were used to gather relevant evidence.

- **Questions 1 and 2** were assessed by a systematic review of peer-reviewed literature, focusing on intervention effectiveness and factors influencing outcomes across settings and population groups.
- **Question 3** was assessed by a scoping review, including grey literature, to identify evidence relating to culturally responsive physical activity interventions for Aboriginal and Torres Strait Islander adolescents, recognising the anticipated diversity of study designs, outcomes and contextual reporting.

The methods and results of the systematic review (Questions 1 and 2) and the scoping review (Question 3) are reported separately in the subsequent sections of this Evidence Check.

Methods – Questions 1 and 2

A systematic review of peer-reviewed studies published between 2015 and 2025 was conducted using transparent and reproducible methods to identify, appraise, and synthesise the available evidence. Systematic reviews are considered the gold standard for evidence synthesis and are particularly well suited to informing policy and program decision-making due to their comprehensive and rigorous assessment of the literature. The review was conducted in accordance with the PRISMA guidelines¹⁷, which represent established best-practice guidance for systematic reviews.

Restricting the review evidence from 2015 to 2025 ensured the evidence reflects contemporary policy, social and environmental contexts relevant to adolescent physical activity, while allowing sufficient scope to identify patterns across intervention types and settings. Limitations related to the review scope and time frame are outlined in the Limitations section.

Search strategy

The search strategy was developed in collaboration with the NSW Ministry of Health, with support from an academic librarian. An electronic search was conducted in three databases: MEDLINE (via PubMed or Ovid), Scopus, and SPORTDiscus. The search aimed to identify studies that assessed the effectiveness of programs or policies designed to increase physical activity levels among adolescents aged 13–17 years.

Search terms included a combination of subject headings, keywords, and MeSH terms related to “adolescents” and “physical activity”. The full search strategy is provided in Appendix 1. Searches were limited to English-language, peer-reviewed journal articles published between January 2015 and November 2025.

Study selection and screening

Eligibility criteria were developed using the Population, Intervention, Comparator, Outcomes, and Study design (PICOS) framework.¹ Full eligibility criteria for Questions 1 and 2 are detailed in Table 1.

- **Population:** adolescents aged 13–17 years, including mixed-age studies where adolescent data were reported separately.
- **Intervention:** programs or policies delivered in school, community, family/home, sport, digital, or policy settings that aimed to increase physical activity.
- **Comparators:** usual practice, no intervention, wait-list control, or alternative interventions.

- **Outcomes:** physical activity (e.g., MVPA), related behaviours (such as active transport or sport participation), and implementation, engagement, and cost-effectiveness outcomes.
- **Study Design:** the search focused on NHMRC Levels II to III-2 evidence. Eligible study designs included randomised controlled trials (RCTs) and other controlled or quasi-experimental designs, including cohort, case-control, and interrupted time-series studies with concurrent controls.

Table 1: Study eligibility criteria for Questions 1 and 2.

Included	Excluded
Study design	
• NHMRC Levels II to III-2: Intervention studies with a comparator or control evaluating program or policy effectiveness in increasing physical activity • This included RCTs, pseudo-RCTs, non-randomised controlled, quasi-experimental, controlled before-after, cohort, case-control, or interrupted time-series designs with concurrent controls.	• NHMRC Level III-3 & IV • Grey literature, protocols, commentaries, opinion pieces, reviews (except for reference mining), or lab-based/acute exercise studies.
Outcomes of interest	
• PA outcomes, including frequency, duration, intensity (particularly MVPA) and the proportion meeting physical activity guidelines. • Behavioural outcomes related to PA participation, such as active transport, sport participation or recreational movement. • Implementation and engagement outcomes, including reach, adherence, feasibility, acceptability, engagement and sustainability of programs or policies. • Cost-effectiveness and implementation outcomes: economic evaluations and implementation indicators assessing cost, resource requirements, cost-effectiveness, efficiency, and practicality of delivering or sustaining programs or policies.	• Non-physical activity outcomes (diet, academic, clinical) or physiological markers (e.g., VO₂max, biomarkers) without measures of PA.
Study language	
English.	Non-English.

Study Country	
Australia and other high-income, policy-relevant countries (e.g., NZ, the UK, Canada, the US, Sweden), or other nations with contextually comparable health or policy settings.	Low- and middle-income countries that are not comparable to Australian health and policy contexts (e.g., differing health systems, socioeconomic conditions, or policy frameworks).
Year of publication	
Studies published between 2015 and November 2025.	Studies published before 2015.
Other relevant categories	
- Adolescents aged 13–17 years; mixed samples if adolescent data separable or clearly relevant. - General population (i.e., not specifically clinical populations). - School, community, family/home, sport, policy, or digital/social-media initiatives; built-environment or active-transport programs.	Clinical or rehabilitation settings, laboratory-based or single-session studies.
Note: Due to the predominance of school-based studies, the eligibility criteria were broadened to ensure inclusion of interventions delivered across a wider range of settings (e.g., home-based, community, and digital) and countries, including those conducted outside high-income settings where relevant. A broader range of comparative study designs was permitted to capture policy-relevant evidence, even where studies did not meet NHMRC Level I or II criteria, provided all other eligibility criteria were met. Where appropriate, inclusion was prioritised for studies with ≥ 100 participants. Studies in which physical activity was a secondary outcome (e.g., mental health or academic interventions), as well as studies examining muscle-strengthening activities, were also included where all other criteria were met.	

All search results were imported into ASReview (version 2.1.1), an open-source, artificial intelligence-assisted screening tool commonly used in systematic reviews.^{19,20} Title and abstract screening was conducted in ASReview using an active learning approach. As reviewers make inclusion and exclusion decisions, the software learns which characteristics are associated with relevant studies and continuously re-ranks the remaining records so that those most likely to be relevant are prioritised for screening.²⁰ As a result, relevant studies are typically identified early in the screening process, with the likelihood of relevance decreasing as screening progresses. Screening was stopped after 100 consecutive records were assessed as not relevant, a stopping rule commonly used in AI-assisted reviews and supported by methodological research indicating that remaining records are extremely unlikely to be eligible.²¹

Following title and abstract screening, all records considered potentially eligible were imported into Covidence (Veritas Health Innovation, Melbourne, Australia) for full-text screening. Full-text screening was conducted independently by two reviewers. Any disagreements were resolved through discussion or, where required, consultation with a third reviewer, in line with standard systematic review practice.

During screening, eligible studies were separated into:

- 1) Studies that reported results on how effective the intervention was at increasing physical activity (used to address Question 1).
- 2) Companion or secondary publications arising from the studies in Question 1, that examined individual, socio-cultural, environmental, or policy-related factors influencing the intervention or its outcomes (used to address Question 2).

Data extraction and quality appraisal

Data extraction and study quality appraisal were conducted using Covidence software (Veritas Health Innovation). Data extracted from each study included overall study characteristics, participant characteristics, intervention and comparator details, and outcomes relevant to the Evidence Check questions. This included data on physical activity effectiveness outcomes (to address Question 1) and information on individual, socio-cultural, environmental, and policy-related factors influencing intervention outcomes (to address Question 2).

Study quality and risk of bias were assessed independently by two reviewers using the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool²², with disagreements resolved through discussion. The EPHPP tool was selected because it is suitable for assessing a wide range of study designs commonly used in public health and physical activity research, including both randomised and non-randomised studies. This makes it well suited to the diverse, real-world interventions included in this Evidence Check and ensures alignment with NHMRC levels of evidence.

The EPHPP assesses six key domains: 1) selection bias, 2) study design, 3) confounders, 4) blinding, 5) data collection methods, and 6) withdrawals and drop-outs. Each domain is rated on a 3-point scale (strong, moderate, or weak), and these ratings contribute to an overall global study quality rating. The tool also includes assessment of intervention integrity and analyses; however, these components are not included in the calculation of the global rating. Using the EPHPP tool, studies were rated as strong, moderate, or weak across each of the six domains.

All data extraction and quality appraisal were conducted independently by two reviewers, with any discrepancies resolved through discussion or, where required, consultation with a third reviewer.

Methods – Question 3

A scoping review approach was used to examine culturally responsive physical activity interventions for Aboriginal and Torres Strait Islander adolescents aged 13–17 years. Unlike the systematic review conducted for Questions 1 and 2, which focused on assessing intervention effectiveness using peer-reviewed comparative studies, a scoping review was chosen because the available evidence was expected to be limited and diverse.

A scoping review is a method used to identify, map, and describe the range and nature of available evidence on a topic, particularly where the evidence base is limited, diverse, or not well characterised.²³

This approach allowed the review to identify and describe the range of culturally responsive programs developed in partnership with Aboriginal communities, including community-led, co-designed and grey-literature programs, rather than restricting study inclusion to a small number of formally evaluated interventions.

Search strategy

The search strategy for Question 3 was developed with support from an experienced academic librarian and the NSW Ministry of Health. Search terms for Question 3 included terms related to “Aboriginal and Torres Strait Islander peoples” and “physical activity” (see Appendix 2 for full details of all search terms).

Academic database searches were undertaken in SportDiscus, PsycINFO, Scopus, MEDLINE, Informit (including the Indigenous Collection Database), and AUSPORT, with supplementary searches conducted in Google Scholar. To capture unpublished, non-peer-reviewed, and government-commissioned evaluations, grey literature searches were conducted using Google (incognito mode). Searches were limited to English-language documents published between January 2015 and November 2025.

Targeted searches were also undertaken across relevant national and state/territory government and sector websites, including the Australian Government Department of Health and Aged Care, Department of Education, Sport Australia (Australian Sports Commission), Australian Institute of Health and Welfare (AIHW), National Indigenous Australians Agency (NIAA), and state and territory health departments (NSW, SA, QLD, Victoria, Western Australia, Northern Territory, Tasmania, and ACT).

Additional sources were identified through backward citation searching, consultation with key stakeholders, and direct contact with program leads and relevant government officers (e.g. Principal Project Officers, Senior Policy Officers, and Program Managers) across all states and territories to identify unpublished evaluations.

Searches were initially conducted in June 2025 (as part of a prior scoping review on the same topic by the research team) and updated in November 2025 (specifically for this Evidence Check).

Study selection and screening

All records were imported into Covidence, where title, abstract, and full-text screening were completed independently by two reviewers. Discrepancies were resolved through discussion or, where required, consultation with a third reviewer. Eligibility criteria for Question 3 were developed to reflect the broader scoping review approach and are detailed in Table 2. Studies and program evaluations were eligible if they examined culturally responsive physical activity programs for Aboriginal and Torres Strait Islander adolescents aged 13–17 years, including Aboriginal-led or co-designed initiatives delivered in school, community, family, or sport settings. Both peer-reviewed and grey literature were eligible, and comparators were not required.

Following searching, all records were screened against the eligibility criteria. Titles and abstracts (where available) were screened first, followed by full-text screening of potentially relevant sources. Screening focused on identifying programs that reported outcomes related to physical activity, program engagement, cultural acceptability, cultural safety, or community ownership. Studies and programs meeting the eligibility criteria were included in the evidence synthesis to address Question 3, with findings used to describe the effectiveness, acceptability, and key characteristics of culturally responsive physical activity interventions for Aboriginal and Torres Strait Islander adolescents.

Table 2: Study eligibility criteria for Question 3

Included	Excluded
Study design	
- Interventions designed to increase physical activity among Aboriginal and Torres Strait Islander adolescents. - Levels II to IV evidence, including intervention studies evaluating culturally responsive or community-developed programs for Aboriginal and Torres Strait Islander adolescents. Eligible designs included qualitative, quantitative, and mixed-methods studies examining co-design, engagement, implementation, or effectiveness (no comparator required). - Grey literature sources, including government, non-government, or Indigenous-led and/or co-designed	Non-Indigenous programs, or studies without cultural adaptation or community involvement.

initiatives, with a comparator or pre–post assessment of program effectiveness.	
Outcomes of interest	
- Outcomes related to physical activity, including physical activity levels and behaviours (e.g. frequency, duration, intensity, participation, and meeting guidelines), as well as program implementation, engagement, sustainability, and cost-effectiveness, including indicators of reach, adherence, feasibility, acceptability, resource requirements, efficiency, and practicality of delivery. - Outcomes on cultural engagement, acceptability, community ownership, or cultural safety.	Outcomes unrelated to physical activity or program engagement.
Study language	
English.	Non-English.
Study Country	
Australia.	Outside of Australia.
Year of publication	
Studies published between 2015 and November 2025.	Studies published before 2015.
Other relevant categories	
- Aboriginal and/or Torres Strait Islander adolescents aged 13–17 years; mixed samples if adolescent data reported separately. - Aboriginal and/or Torres Strait Islander-led or co-designed programs in school, community, family, or sport settings; traditional activities or connection to Country. - Peer-reviewed or grey literature with adequate methodological detail.	Programs without Aboriginal and/or Torres Strait Islander involvement or cultural tailoring.

Data extraction

Data extraction for Question 3 used the same methods as Questions 1 and 2 (see the Methods section for Questions 1 and 2). In addition, data extraction for Question 3 included information specific to Aboriginal and Torres Strait Islander adolescents aged 13–17 years, focusing on the effectiveness of culturally responsive physical activity interventions, particularly those developed in partnership with Aboriginal communities, compared with standard or non-tailored approaches, in increasing physical activity levels or program engagement.

Data extraction was conducted independently by two reviewers, with any discrepancies resolved through discussion or, where required, consultation with a third reviewer. As this was a scoping review, study quality appraisal was not conducted for studies included in Question 3.

Findings – Questions 1 and 2

Search findings

The MEDLINE (via Ovid), Scopus and SPORTDiscus database search results are shown in Appendix 3. Following database searching and removal of duplicates, 15,854 titles and abstracts and 197 full-text articles were screened. A total of 56 studies were included in the review (see PRISMA diagram in Appendix 4 and the list of full-text exclusions in Appendix 5).

Of these:

- 43 studies addressed **Question 1**, evaluating the effectiveness of policy and program interventions across key settings (e.g. schools, community, sport, family) in increasing physical activity levels among adolescents aged 13–17 years; and,
- 13 additional papers (drawn from those same 43 studies, which were secondary analyses or companion papers), addressed **Question 2** by examining individual, socio-cultural, environmental or policy-related factors influencing the success or failure of the physical activity interventions.

Of note, many of the 43 studies included for Question 1 also reported relevant individual, socio-cultural, environmental or policy-related factors, which was used alongside the 13 additional papers to address Question 2.

Quality appraisal findings

Across the 43 included studies, overall study quality was generally high, with 38 studies (88%) rated as Strong and 5 studies (12%) rated as Moderate using the EPHPP tool, and no studies rated as Weak overall (Appendix 6). Common strengths included the use of robust study designs, valid and reliable outcome measures, and appropriate statistical analyses, while the main limitations related to limited blinding, moderate selection bias, and variable reporting of participant withdrawals and intervention delivery, particularly in large, real-world and school-based programs where these factors are more difficult to control.

Evidence synthesis

Question 1: *For adolescents aged 13–17 years, which types of policy and program interventions across key settings (e.g., community, sport, family, schools) are most effective in increasing physical activity levels?*

Key Points

- Multi-component school-based interventions, particularly those embedded within curriculum or physical education (PE) and supported by teacher training and whole-of-school reinforcement, tended to show the most consistent increases in physical activity levels, including in larger, pragmatic school trials.
- Single-component or light-touch classroom interventions, often delivered to large school cohorts but without a guaranteed activity dose, generally produced modest or short-term effects, with limited evidence of sustained increases in overall MVPA levels.
- Peer-led and school culture approaches, often delivered at scale across multiple schools, showed mixed findings. While some smaller pilot studies suggested potential benefits, larger real-world effectiveness trials typically found little or no sustained improvement in MVPA when engagement and implementation fidelity varied between schools.
- Evidence outside schools was limited, and community/sport and home-based approaches generally showed modest or inconsistent MVPA gains. Improvements were typically short-lived unless programs involved regular, repeated participation and actively supported sustained engagement across weeks or months. Outcomes were strongly influenced by family support and routines, along with accessible community pathways (including transport and built-environment enablers).
- Digital and mHealth approaches were most effective as supports, not stand-alone solutions. Stronger effects were observed in smaller or moderately sized studies when digital components provided active prompting and feedback (e.g., SMS-supported goal setting). Stand-alone apps or wearables deployed at scale generally showed limited population-level impact, largely due to declining engagement.
- Implementation conditions and reach strongly influenced outcomes across settings; interventions delivered to large, diverse samples were less likely to demonstrate MVPA gains unless supported by sufficient intensity, delivery infrastructure and sustained engagement from those delivering the intervention (e.g. teachers, peer leaders, mentors).

Overview of the evidence base

The characteristics, settings, and physical activity outcomes of all included studies addressing Question 1 are shown in Appendix 7, which provides the evidence base for comparing the effectiveness of policy and program interventions across schools, community, sport, and family settings.

Most of the 43 included studies were conducted in school settings, with 28 studies (65%) delivered entirely within schools and a further 8 studies (19%) using hybrid home–school

models. The remaining 7 studies (16%) were delivered outside the school setting, including community- or sport-based interventions (n = 2, 5%) and entirely home-based interventions (n = 5, 12%).

The studies were conducted across various countries, most commonly in the United Kingdom (UK) (n = 8, 19%), Australia (n = 7, 16%), and the United States (US) (n = 4, 9%), followed by Finland (n = 3, 7%), Ireland (n = 3, 7%), joint UK-Ireland samples (n = 2, 5%), Spain (n = 2, 5%), Germany (n = 2, 5%), Norway (n = 2, 5%), and the Netherlands (n = 2, 5%), with the remaining studies conducted in Canada, Denmark, France, Luxembourg, New Zealand, Singapore, Sweden, and Switzerland (combined n = 8, 19%).

The evidence base comprised cluster-randomised controlled trials and individually randomised controlled trials (approximately two-thirds of studies), alongside quasi-experimental, pre-post, pilot, and feasibility evaluations (approximately one-third). Larger cluster RCTs were predominantly conducted in school settings and often involved hundreds to several thousand students across multiple schools, whereas smaller pilot and feasibility studies, frequently used to test novel digital, mentoring, or home-based approaches, typically involved up to a few hundred adolescents.

School-based policies and programs

School-based interventions formed the core of the evidence base (n = 28 studies) and included some of the largest and most policy-relevant evaluations, most often implemented as cluster-randomised controlled trials across multiple secondary schools, with sample sizes ranging from several hundred to several thousand adolescents.

Within this setting, multi-component interventions, combining curriculum-aligned Physical Education (PE) or classroom delivery, structured opportunities for MVPA during the school day, and teacher training or implementation support, were most consistently associated with favourable outcomes. For example, a Finnish cluster RCT of a curriculum-based school physical activity program (n = 1,476 students across 14 schools) reported small but statistically significant short-term improvements in self-reported physical activity outcomes relative to controls, including increases in active days and the proportion meeting activity guidelines, although effects were not sustained at longer follow-up.²⁴ Similarly, the Irish Y-PATH program, evaluated in a cluster RCT involving 490 students across post-primary schools, demonstrated meaningful benefits for MVPA trajectories, particularly among girls, when delivered with teacher training and curriculum integration.²⁵ In the UK, a large cluster RCT of the GoActive intervention involving 2,862 adolescents across 16 secondary schools found modest but policy-relevant effects were not achieved at scale, highlighting the importance of embedding programs within existing school structures and ensuring implementation fidelity.²⁶ A Swedish school-based classroom intervention trial (n = 57 adolescents) also suggested that integrating structured movement opportunities into the school day may help address the typical decline in physical activity seen in late adolescence, despite no statistically significant increases in MVPA.²⁷

Notably, these larger cluster trials, conducted in high-income countries and embedded within existing PE or curriculum structures, were more likely to demonstrate small but meaningful population-level effects, including reducing the typical decline in MVPA during adolescence. While individual-level effects were generally modest in size, the scale and reach of delivery across whole schools or year levels make these findings particularly relevant for policy implementation.

In contrast, single-component classroom-based interventions, often delivered to large cohorts with minimal additional resources, showed limited impact on device-measured MVPA. For instance, a UK-based cluster RCT of the classroom-focused GoActive feasibility and pilot trial involving 460 adolescents found meaningful improvements in device-measured MVPA when delivered primarily through tutor time without a guaranteed activity dose.²⁸ However, in that study, outcomes were measured at baseline and at the end of the 8-week intervention. There was no longer-term follow-up conducted to assess whether any effects were maintained after the program concluded. Similarly, a large UK cluster RCT of the Girls Active programme involving 1,752 adolescent girls reported short-term improvements in light physical activity and engagement at 7 months, but no sustained effects on device-measured MVPA at 14 months.²⁹ A Finnish non-randomised longitudinal school study (n = 240 adolescents) reported improvements in motivational climate and perceived competence, but no statistically significant changes in total MVPA over 12 months.³⁰ Across these studies, the absence of a guaranteed activity dose appeared to constrain effectiveness, particularly when interventions were scaled across multiple schools

Several school-based studies evaluated time-efficient or high-intensity interval training (HIIT)-based physical activity, typically delivered during PE lessons or short breaks and implemented within classes or year levels. For example, an Australian RCT of a school-based HIIT program (n = 65 adolescents) reported significant increases in moderate- and vigorous-intensity activity on HIIT days, but no statistically significant improvements in overall daily MVPA across the intervention period.³¹ A Swiss school-based cluster RCT (n = 143 adolescents) similarly demonstrated substantial increases in moderate, vigorous, and total MVPA following PE-embedded behavioural skill training sessions, although effects were closely tied to the structured PE context rather than broader daily activity exposure.³² These findings suggest that dose and reinforcement beyond PE lessons are critical for translating session-specific gains into sustained whole-day behaviour change.

Peer-led and school culture interventions, including those designed specifically for girls, were frequently implemented as large, pragmatic trials across multiple secondary schools. For example, the Girls Active programme in the UK, evaluated in a cluster RCT involving 1,752 adolescent girls, reported no statistically significant differences in device-measured MVPA compared with usual practice at 14-month follow-up, despite high levels of initial enthusiasm and acceptability.^{29,33} Similarly, a UK-based cluster RCT of the GoActive intervention, involving 2,862 adolescents across 16 secondary schools, found no sustained improvement in accelerometer-measured MVPA at post-intervention or 10-month follow-up when peer leadership and choice-based activities were implemented with variable uptake across schools.²⁶ Process evaluations accompanying these trials highlighted challenges related to inconsistent

engagement, peer leader turnover, and competing curriculum demands, particularly in larger and more diverse school settings.

Community and sport-based interventions

The community and sport-based interventions (n = 7 studies) were less commonly evaluated as stand-alone strategies and typically involved smaller samples or voluntary participation, often delivered outside core school hours. For example, a Luxembourg-based community and home-delivered after-school physical activity intervention evaluated using a within-subject quasi-experimental design (n = 18 adolescents) reported modest short-term reductions in sedentary time and transient activity increases immediately following prompts, but no statistically significant improvements in overall daily MVPA.³⁴ Similarly, a Canadian community-linked wearable-based program using a quasi-experimental crossover design (n = 46 adolescents) showed short-term within-group increases in MVPA among some participants, but no consistent between-group effects or sustained population-level changes in device-measured MVPA.³⁵ Together, these studies suggest that limited reach, voluntary uptake, and challenges with sustained attendance constrain the effectiveness of community and sport-based approaches when implemented at scale.

Family/home and hybrid home–school interventions

Overall, family/home and hybrid home–school interventions showed limited impact on habitual MVPA. While many interventions achieved high engagement and acceptability and produced short-term or light-intensity physical activity gains, sustained increases in device-measured MVPA were uncommon. This pattern suggests that home-based components alone are unlikely to shift MVPA unless they deliver a clear, repeated activity dose and are reinforced over time. Hybrid home–school interventions included a wide range of sample sizes in individual studies, from small pilot studies (n = 20 participants) to large cluster trials (n = 1,020 participants) and aimed to extend school-based delivery to the home through challenges, monitoring, or parent involvement. For example, an Australian school–home intervention evaluated in a pilot cluster RCT involving 20 adolescent girls reported increases in weekday physical activity counts and light-intensity activity, but no significant improvements in MVPA, with outcomes closely tied to attendance and engagement in optional after-school components.³⁶ A UK- and Ireland-based girls-focused digitally delivered program (n = 42 adolescents) similarly reported no significant changes in habitual MVPA, despite high adherence to prescribed sessions and strong engagement with mentor support.³⁷

Purely home-based interventions, including remotely delivered mentoring or digital programs, were more often small-scale pilot or feasibility studies. A UK–Ireland multi-arm pilot RCT of a remotely delivered mentoring and online exercise intervention (n = 153 adolescent girls) demonstrated no significant effects on device-measured or self-reported MVPA at post-intervention or follow-up, despite high acceptability and engagement across intervention arms.³⁸ A Luxembourg-based smartphone- and wearable-supported home intervention (n = 18

adolescents) reported short-term reductions in sedentary time and transient activity increases following prompts, but no significant improvements in overall daily MVPA.³⁴

Digital, eHealth, mHealth, and wearable-supported approaches

Digital interventions ranged from small, tightly controlled trials to larger pragmatic deployments. A New Zealand individual RCT of a smartphone app-based intervention (n = 51 adolescents) demonstrated no significant short-term increases in device-measured MVPA when delivered as a stand-alone commercial fitness app without additional behavioural support.³⁹ In contrast, a small pragmatic Luxembourg-based study evaluating a smartphone- and wearable-supported intervention (n = 18 adolescents) reported short-term reductions in sedentary time and transient activity increases following personalised prompts, but no significant improvements in overall daily MVPA.³⁴ This contrast highlights the challenge of achieving sustained increases in MVPA through digital interventions without ongoing behavioural scaffolding and sufficient activity dose.

What works best across settings

Interventions that combined physical activity durations and intensities aligned with national recommendations, structured delivery, and ongoing reinforcement, most often delivered through multi-component, school-based cluster RCTs at scale, were most likely to achieve policy-relevant improvements in adolescent physical activity. These effects were typically seen as slowing the usual age-related decline in MVPA, rather than producing large increases in overall activity levels.²⁴⁻²⁶ Digital tools were most effective when used to support engagement, monitoring, or implementation of structured activity opportunities, rather than as stand-alone alternatives to supervised or curriculum-based physical activity.

Implementation and equity considerations

Larger, real-world studies conducted within UK and Australian school systems consistently highlighted challenges related to reach, implementation fidelity, and sustained engagement, particularly among girls and older adolescents.^{37,40} Although several interventions were specifically designed to engage girls or less active adolescents, improvements in acceptability and participation did not consistently translate into gains in MVPA in the absence of sufficient activity dose and structured delivery support.

Interpretation and limitations of the evidence

The evidence base is characterised by substantial heterogeneity in intervention intensity, study design, outcome measurement, and follow-up duration, with effects generally small to modest, particularly in large-scale cluster RCTs. Larger pragmatic evaluations tended to show smaller effects than tightly controlled pilots, underscoring the importance of implementation quality and sustained delivery. Some studies included overlapping or broader age ranges; however, this

represents the best available evidence to inform physical activity policy and programming for adolescents aged 13–17 years.

Question 2: *In adolescents aged 13–17 years participating in physical activity initiatives, how do individual, socio-cultural, environmental, and policy-related factors (e.g., gender, socioeconomic status, cultural background, geographical location [rural/regional vs urban], family support, access to recreational spaces, active transport infrastructure/walkability, school physical activity policies/programs), compared to their absence or variation, influence the success or failure of these initiatives?*

Key Points

- How well programs were delivered often mattered more than the program design itself: initiatives were more likely to succeed when schools had protected time, clear staff roles, and strong leadership support, and less likely to succeed when delivery was inconsistent.
- Environmental factors strongly determined feasibility and impact: interventions that did not address persistent barriers (e.g., transport systems, seasonal conditions, incomplete access to facilities) were unlikely to produce sustained improvements in habitual physical activity, even when in-program delivery was strong.
- Programs that relied on self-directed digital components (e.g. mobile apps or websites) tended to have lower engagement among adolescents from lower socioeconomic backgrounds, which risks widening participation gaps unless access and support barriers are actively addressed.
- Family support helped sustain physical activity beyond the school setting, while programs delivered only at school, with little or no family involvement, generally produced small and short-lived changes.
- Individual-level skills (e.g., self-regulation, motivation, confidence, autonomy support) helped adolescents to initiate and maintain physical activity, especially when programs relied on self-directed participation outside school (e.g., leisure time or community settings) where there was a lower level of structure and supervision.
- Equity effects were inconsistent: some programs appeared to benefit girls or less active adolescents under certain delivery conditions, but these effects were not reliable and often depended on high-quality implementation and sustained engagement.
- Interventions that depended on voluntary participation, self-managed digital tools, or peer-led delivery were unlikely to produce sustained, population-level gains unless backed by strong staff support, family involvement, and supportive structures and environments.

The individual, socio-cultural, environmental, and policy-related factors influencing the success or failure of physical activity initiatives for adolescents aged 13–17 years are summarised here, with more detailed information provided in Appendix 8.

Individual-level factors

Across adolescent physical activity initiatives, individual-level factors most strongly influenced outcomes when programs relied on adolescents' capacity to self-direct behaviour outside structured settings, including goal-setting, self-monitoring, motivation, and self-regulation. Baseline behavioural patterns, psychological readiness, and ability to sustain engagement beyond supervised contexts shaped adherence and responsiveness to interventions.

Evidence from a school-based self-regulation intervention in Ireland illustrates these dynamics. In a randomised feasibility trial (n = 49), Matthews et al.⁴¹ delivered six classroom sessions targeting goal-setting, self-monitoring, mental imagery, and adaptive causal attributions, with students applying these skills to leisure-time physical activity outside school. The program achieved high attendance (mean 87%) and strong fidelity, and significantly improved self-regulation skills; however, changes in leisure-time MVPA were small and not statistically significant, and objective outcomes could not be analysed due to incomplete pedometer data. This indicates that psychological capacity can be improved through classroom delivery, but behaviour change remains uncertain without sustained monitoring and reinforcement.

Comparable patterns were observed in non-school, home-based interventions where autonomy and motivation were central. In the HERizon Project³⁷, a fully home-based, mentor-supported intervention for adolescent girls (n = 42) improved cardiorespiratory fitness, muscular endurance, intrinsic motivation, and body confidence, with high adherence and acceptability; however, habitual MVPA did not significantly improve over six weeks. A larger follow-up trial (n = 153)³⁸ similarly improved psychological engagement when autonomy and competence were supported, but these gains did not translate into sustained physical activity increases without greater dose, duration, or environmental reinforcement.

Overall, individual-level skills such as self-regulation, motivation, and autonomy support engagement, particularly as activity shifts to non-school contexts. However, interventions relying primarily on individual behaviour change, without sufficient structure, objective monitoring, or environmental and social reinforcement, tend to produce modest and uncertain changes in overall physical activity, indicating that skill development must be embedded within broader, multi-component systems beyond the classroom or home.

Socio-cultural factors

Socio-cultural determinants influenced intervention success through family support, peer norms, and socioeconomic resources that shaped participation, engagement, and sustainability beyond structured delivery of programs.

Family norms and parental rule-setting were key levers for maintaining effects outside school. In Finland, a curriculum-based Health Education intervention with minimal parental involvement (cluster RCT, n = 1,550) produced small but statistically significant short-term improvements in self-reported brisk physical activity and guideline compliance, alongside a modest increase in families setting screen-time limits.²⁴ However, effects were not sustained at 7-month follow-up, indicating that limited family engagement constrains longer-term maintenance.

Socioeconomic status (SES) shaped engagement and equity of reach, particularly where interventions relied on self-directed or digital components. In a UK post-hoc analysis of the GoActive cluster RCT (n = 2,838), adolescents from lower-SES backgrounds were significantly less likely to engage with the intervention website than those from higher-SES backgrounds.⁴² While no short-term subgroup differences in MVPA were observed, longer-term follow-up suggested that structured, school-based delivery may still benefit lower-SES adolescents when engagement barriers are addressed.

Peer and social dynamics were influential but insufficient alone. In the GoActive whole-school intervention (cluster RCT, n = 2,862), peer leadership achieved high reach but low fidelity, with only ~39% receiving core sessions as intended, aligning with no overall MVPA improvement despite subgroup variation by gender and SES.⁴³

Evidence from non-school, home-based interventions reinforces the importance of socio-cultural support. In the HERizon Project, a fully home-based, mentor-supported intervention for adolescent girls (n = 42) achieved high adherence and acceptability and improved fitness, intrinsic motivation, and body confidence; however, habitual MVPA did not significantly increase, indicating that strong social support alone may be insufficient without longer duration or integration with school and community systems.³⁷

Overall, socio-cultural factors, particularly family engagement, peer norms, and socioeconomic context, are critical for engagement, equity, and sustainability. Interventions relying on voluntary uptake, digital self-management, or peer leadership without adequate family integration, staff support, or structural reinforcement are unlikely to achieve sustained, population-level impacts.

Environmental factors

Environmental context influenced intervention effectiveness through the availability, accessibility, and convenience of physical activity opportunities, and alignment with structural constraints such as transport patterns, seasonal conditions, and facility access. Behaviour change was limited when interventions did not address these environmental determinants.

Active transport illustrates these constraints. In Norway, a cluster RCT embedded within the School in Motion program (n = 1,370 adolescents with valid pre–post travel data) assessed whether increasing scheduled school-based physical activity (+120 minutes/week) influenced travel mode.⁴⁴ Findings showed that 91% of students maintained their original travel mode, with no significant effects on switching between active and motorised transport across seasons, indicating that commuting behaviours are highly habitual and unlikely to change without transport and built-environment investment.

Within-school environmental modifications improved context-specific opportunities but rarely increased overall habitual physical activity when implementation was incomplete. In Denmark, the SPACE Study⁴⁵ (cluster RCT; n = 1,348) delivered playground upgrades, improved access to sports equipment, after-school fitness activities, and cycling infrastructure, yet showed no meaningful effect on total MVPA. Process evaluation findings indicated that partial implementation, particularly limited staffing for after-school fitness and incomplete delivery of cycling infrastructure, constrained system-level impact.

Non-school evidence reinforces these findings. The HERizon Project³⁷, a fully home-based intervention for adolescent girls (n = 42), reduced environmental barriers through flexible, remote delivery during COVID-19 lockdowns and achieved high adherence with significant fitness and psychosocial improvements; however, habitual MVPA did not significantly increase, indicating that minimising access barriers alone is insufficient without longer duration or reinforcement through school and community environments.

Overall, environmental factors strongly shaped feasibility and impact. Interventions that do not address entrenched structural constraints, such as transport systems, seasonal conditions, or incomplete facility access, are unlikely to achieve sustained changes in habitual physical activity, underscoring the need for coordinated environmental, transport, and education policy responses.

Policy and organisational factors

Policy and organisational conditions were among the most consistent determinants of intervention success, particularly protected time, clear roles and accountability, staff capability, and sustained leadership support. Interventions were more likely to increase physical activity exposure when responsibilities were clearly defined and embedded within existing school systems, rather than relying on discretionary or volunteer-led delivery. Teacher capability and lesson structure were decisive in PE-focused strategies. In Australia, the AMPED intervention⁴⁶ showed that structured professional learning for PE teachers in low-SES secondary schools increased in-lesson MVPA, with effects sustained at maintenance (cluster RCT; n = 1,421 students across 14 schools). These gains were driven by changes in teacher instructional practices and lesson design, rather than student motivation or out-of-class behaviour, highlighting pedagogy and delivery quality as scalable levers for improving school-time physical activity.

By contrast, interventions reliant on complex or diffuse implementation chains (e.g., mentors, peer leaders, digital tracking systems, or unclear staff roles) were more vulnerable to organisational failure. In the UK GoActive program, a large whole-school cluster RCT⁴³ achieved high reach and acceptability but no overall MVPA benefit. Process data showed low and variable fidelity, with only ~39% of students receiving core components as intended, alongside unclear mentor and teacher roles and inconsistent leadership engagement, aligning with null behavioural effects despite strong theoretical design. Similar constraints were evident in peer-led models targeting girls. In the WISH (Walking In Schools) project⁴⁷, a cluster RCT with embedded process evaluation involving 589 girls across 18 schools, delivery was constrained by timetabling, staff workload, weather, facilities, and competing priorities. Intervention dose was reduced, many students attended few or no walks, and there were no significant device-measured effects on total PA or MVPA, despite high acceptability and some improvements in self-reported wellbeing.

Cost and resourcing influenced feasibility but not effectiveness. In Girls Active⁴⁰, a large UK cluster RCT with embedded economic evaluation (n = 1,752 girls; economic sample n = 997), curriculum-only integration was a low-cost intervention costly but did not produce meaningful MVPA increases, indicating that affordability must be paired with accountability and delivery infrastructure. Non-school evidence reinforced these findings. In the HERizon Project^{37,38}, fully

remote, mentor-supported interventions for adolescent girls achieved high feasibility and adherence with significant fitness and psychosocial improvements, but no sustained MVPA increases, suggesting that even well-organised home-based delivery requires integration with broader systems to achieve population-level impact.

Overall, strong policy and organisational foundations, clear leadership, protected delivery time, workforce capability, and accountability are critical for translating intervention design into meaningful physical activity exposure. Interventions framed as “low-cost” or “light-touch” are unlikely to succeed without sufficient organisational support, regardless of acceptability or theoretical quality.

Cross-cutting patterns and interactions

Across the evidence, success most often required alignment across levels (individual capability + socio-cultural reinforcement + organisational delivery + environmental opportunity). For example, school-based programs that improved in-class activity levels or scheduled PA opportunities did not reliably produce secondary benefit to active travel without transport infrastructure and family routine changes. Similarly, peer-led models depended on organisational conditions (mentor recruitment, protected time, staff support) to translate social influence into sustained participation and dose.

Digital and self-directed components tended to amplify the importance of SES and home supports: where engagement required adolescents to “opt in” to web/app use, lower engagement in disadvantaged groups risked reducing reach and diluting effects.

Implications for program success versus failure

Overall, the evidence synthesis from Question 2 indicates that the factors most consistently supporting success were:

- (1) Protected delivery time and clear accountability within schools;
- (2) Increasing staff capability and structured delivery (including teacher professional learning where relevant); and
- (3) Reinforcement beyond school through family/home norms or supportive environments.

Factors commonly linked to weaker effects or failure included: low/variable fidelity, voluntary or poorly integrated delivery that reduced dose/reach, digital components with low uptake (particularly among lower-SES adolescents), and structural environmental constraints not addressed by the initiative (e.g., transport infrastructure for active travel).

For NSW, these findings suggest that the strongest and most immediately actionable levers sit at the system level, particularly where NSW Health can influence or convene cross-sector action. While many school-based delivery mechanisms (e.g. timetabled activity, staff training, simplified delivery systems) sit primarily within the education system, the evidence indicates that population-level gains are most likely when health, education, transport, and community sport policies are aligned. Where outcomes beyond the school day are sought, such as

increases in active transport or leisure-time physical activity, program and policy design should extend beyond school delivery alone to incorporate transport and built-environment planning, community sport pathways, and family-system supports. This points to the value of cross-department initiatives, similar to joint ministerial approaches in other jurisdictions, that position active schools as anchors within broader active community systems rather than stand-alone intervention sites.

Interpretation and limitations of the evidence

Determinant evidence was frequently derived from process indicators, subgroup analyses, and implementation observations, which can identify plausible enablers/barriers but do not always establish causality. Reporting and measurement of determinants varied substantially across studies (e.g., different engagement metrics, differing definitions of fidelity, and mixed use of device-measured versus self-reported outcomes), limiting direct comparability.

Several insights about failure mechanisms relate to partial implementation of components (e.g., staffing and infrastructure constraints), meaning conclusions may reflect both the intervention concept and real-world delivery feasibility. Some included studies involved overlapping or broader age ranges, but this represents the best available evidence for Questions 1–2 to inform determinants of success/failure for interventions for adolescents aged 13–17 years.

Findings – Question 3

Search findings

Following database searching and removal of duplicates, 1,562 titles and abstracts and 371 full-text articles were independently screened by two reviewers. Four studies were included in the scoping review (see PRISMA diagram in Appendix 9).

Evidence synthesis

Question 3: *In Aboriginal and Torres Strait Islander adolescents aged 13–17 years, how effective are culturally responsive physical activity interventions, particularly those developed in partnership with Aboriginal communities, compared to standard or non-tailored approaches in increasing physical activity levels or program engagement?*

Key Points

- Culturally responsive programs developed with Aboriginal leadership and community partnership consistently achieved very high engagement and retention, even when increasing PA was not the primary program aim.
- Direct evidence that these programs increased PA levels is limited, as most evaluations did not include device-assessed or self-reported PA outcomes, making effectiveness on behaviour change challenging to determine.
- Compared with non-tailored or mainstream programs, culturally adapted approaches demonstrated clearly superior engagement, acceptability, and trust, which are critical prerequisites for effective PA promotion among Aboriginal and Torres Strait Islander adolescents.
- Sport, culture, and country-based activities were effective engagement mechanisms, supporting participation, confidence, and willingness to be active, even where PA outcomes were not formally measured.
- Conclusions about PA effectiveness must be interpreted with caution, as the current evidence base is small, heterogeneous, and focused primarily on engagement and feasibility rather than measured changes in physical activity.

Overview of the evidence base

Characteristics of the four included studies is shown in Appendix 10. The evidence is drawn from four culturally focused program evaluations involving approximately 1,200 Aboriginal and Torres Strait Islander children and adolescents, with substantial overlap with the 13–17-year

age group. The evidence base comprises program evaluations, mixed-methods feasibility studies, and qualitative and process evaluations, rather than trials powered to detect changes in PA behaviours. Most programs were co-designed or led by Aboriginal and Torres Strait Islander organisations, Elders, or community members, and were delivered in school, community, and culturally significant settings.

Effectiveness for physical activity outcomes

The direct evidence for increased physical activity is limited, as none of the programs were designed primarily as PA behaviour-change interventions with device-measured PA outcomes. For example, the Deadly Sista Girlz program⁴⁸, delivered to approximately 732 Aboriginal and Torres Strait Islander girls aged 11–18 years across 15 schools in WA and Victoria, did not measure PA outcomes and did not include structured PA sessions. Similarly, the Strong Culture, Healthy Lifestyles program⁴⁹, involving 111 Aboriginal children across three regional NSW communities, collected accelerometry only to assess feasibility, not effectiveness.

The evaluation of the Go4Fun Aboriginal Program⁵⁰, delivered across multiple NSW Aboriginal communities to children and adolescents primarily aged 7–13 years (with some older adolescents), included weekly structured PA sessions but did not collect device-measured or self-reported PA minutes. Qualitative findings indicated increased participation in active play and improved confidence with movement, but behavioural PA change could not be quantified.

Overall, current evidence is insufficient to conclude that culturally responsive programs increase PA levels relative to non-tailored approaches, largely due to the absence of PA outcome measurement, rather than evidence of ineffectiveness.

Program engagement and acceptability

In contrast, evidence for engagement and acceptability is strong and consistent. Programs grounded in Aboriginal leadership, co-design, and cultural safety demonstrated very high attendance, retention, and participant satisfaction. For example, the Deadly Sista Girlz program⁴⁸ reported consistently high participation and strong relational bonds with mentors, with dedicated culturally safe spaces viewed as essential for ongoing engagement. The Strong Culture, Healthy Lifestyles program⁴⁹ reported 92.5% retention and 89% of participants reporting they “liked or loved” the program, with cultural connection cited as the primary driver of attendance.

The Go4Fun Aboriginal Program⁵⁰ showed higher retention and session completion compared with the mainstream Go4Fun program, with families reporting greater trust, cultural safety, and willingness to participate in PA when programs were delivered by Aboriginal facilitators in familiar community settings. These findings indicate that cultural responsiveness substantially improves engagement compared with non-tailored models.

Comparison with non-tailored approaches and policy implications

Compared with standard or non-tailored programs, culturally responsive initiatives consistently achieved greater reach, trust, and sustained participation, even when PA was not the central focus. Programs such as the Indigenous Youth Sports Program⁵¹ (n = 254 Indigenous adolescents aged 10–15 years in regional Queensland) demonstrated near-universal attendance (98%) using sport as an engagement tool, but lacked cultural governance and PA outcome measurement, limiting conclusions about PA effectiveness.

The evidence collectively suggests that cultural responsiveness is a critical determinant of program success for Aboriginal and Torres Strait Islander adolescents, particularly for engagement and sustainability. While evidence of PA behaviour change is limited, the findings strongly indicate that future PA interventions are unlikely to be effective (i.e., to achieve sustained reach/engagement and, ultimately, change in PA behaviour) without Aboriginal leadership, community partnership, culturally safe spaces, and family-centred delivery.

Interpretation and limitations

The primary limitation of the evidence is the lack of PA outcome measurement, with most studies prioritising wellbeing, cultural identity, and feasibility outcomes. Determinant evidence is therefore indirect, relying on engagement and qualitative indicators rather than quantified PA change. Age ranges often extended beyond 13–17 years; however, this represents the best available evidence to inform culturally responsive PA programming for Aboriginal and Torres Strait Islander adolescents at present.

Considerations for policy and program approaches

This Evidence Check synthesised evidence on physical activity initiatives for adolescents aged 13–17 years, drawn predominantly from high-income countries with comparable education, health, and community sport systems to Australia, and most often delivered through secondary school settings. As such, the findings are highly applicable to the NSW context, particularly where programs can be embedded within existing school structures such as timetabled physical education, whole-of-school wellbeing or health promotion frameworks and established student support systems.

Across the evidence base, interventions that aligned with routine school delivery and were supported by clear implementation infrastructure, such as teacher professional development, designated staff roles or champions, and visible leadership endorsement (e.g. leadership at the school from the principal), were more likely to achieve consistent reach and modest population-level improvements in physical activity. Conversely, programs that relied on optional participation, external or fragmented delivery chains, or variable implementation conditions were less likely to demonstrate sustained effects at scale.

Importantly, the evidence indicates that program effectiveness cannot be considered in isolation from context. Outcomes were strongly influenced by delivery conditions (such as fidelity, dose, and engagement) and by factors beyond the immediate program setting, including family support, transport and built-environment characteristics, access to safe and appealing recreational spaces, and competing academic or extracurricular demands. These contextual influences help explain why interventions that increased physical activity during the school day did not always translate into sustained behaviour change beyond school hours.

The findings collectively suggest that for NSW, successful adolescent physical activity strategies are most likely when program design is coupled with system-level supports, realistic expectations about where behaviour change can occur, and alignment with broader family, transport, and community environments.

Questions 1 and 2: Programs/interventions and determinants of success/failure

Consideration 1: Scalable, multi-component whole-of-school approaches are most likely to achieve population-level impact when participation is the default. Across the evidence, programs combining:

- (i) Structured opportunities for MVPA during the school day;

-
- (ii) Curriculum or PE integration; and
 - (iii) Implementation supports such as teacher training and clear role accountability, demonstrated more consistent effects than optional or “light-touch” components alone.

Consideration 2: The evidence indicates that consistent implementation conditions are critical for achieving effects at scale. School-based initiatives are more likely to translate into behaviour change when protected delivery time, leadership support, staff capability-building, and simple delivery systems (e.g. clear responsibilities, timetabling, and monitoring) are specified and resourced. Across studies, variation in fidelity and dose commonly explains why otherwise promising designs fail to produce population-level impacts.

Consideration 3: The evidence indicates that school-based delivery alone is insufficient to shift population-level adolescent physical activity. While most evaluated interventions are school-based, out-of-school settings, including community sport, active recreation, and active transport, represent important and underutilised opportunities, particularly where school capacity is constrained. Available trials suggest these approaches can increase physical activity, but effects depend on accessibility, affordability, cultural relevance, safety, and sustained engagement. Implementation capacity in community and local-government settings appears critical for translating these approaches into consistent outcomes, and further rigorous evaluation would strengthen the policy-relevant evidence base.

Consideration 4: Digital, mHealth, and wearable components appear most effective when used to support delivery and engagement rather than replace activity opportunities. Stronger effects are observed when digital tools provide prompting, feedback, and reinforcement alongside structured opportunities to be active. In contrast, stand-alone apps or websites that rely on self-directed uptake tend to show weaker and less reliable effects, particularly as engagement declines over time.

Consideration 5: The evidence indicates that inequities are more likely when programs rely on self-direction or opt-in digital engagement. Initiatives requiring voluntary participation or access to digital tools (e.g. websites, apps, or self-monitoring outside school) tend to show lower engagement among adolescents from lower socioeconomic backgrounds unless access barriers and support needs are actively addressed, raising the risk of uneven reach and participation.

Consideration 6: Extending physical activity outcomes beyond the school day appears to require alignment with family and environmental factors. Where policy aims include increasing active travel or leisure-time physical activity (not just in-school MVPA), programs are more likely to be effective when paired with supports that address family routines and environmental constraints such as safety, distance, and infrastructure. Evidence indicates that increases in school-day activity alone do not reliably translate into changes in out-of-school behaviour.

Consideration 7: Routine reporting on reach, fidelity, engagement, and subgroup outcomes is critical for interpreting effectiveness and equity impacts. Given mixed and implementation-dependent effects across subgroups (e.g. by gender or baseline activity), evaluations that include minimum reporting on reach, adherence or dose delivered, and

outcomes by key subgroups (where feasible) are better able to identify who benefits, under what conditions, and where program adaptations may be required.

Question 3: Culturally responsive interventions for Aboriginal and Torres Strait Islander adolescents

Consideration 1: The available evidence indicates that Aboriginal leadership, cultural safety, and co-design are foundational to effective and culturally safe physical activity initiatives for Aboriginal and Torres Strait Islander adolescents. Although the evidence base is limited, evaluations consistently show that culturally responsive approaches developed with Aboriginal organisations, Elders, and communities foster higher trust, acceptability, and sustained engagement. These features appear to be critical preconditions for participation and thus for any subsequent impact on physical activity.

Consideration 2: The current evidence base is constrained by limited measurement of physical activity outcomes. While existing studies provide important insights into feasibility, acceptability, and engagement, most do not include direct measures of physical activity change. Culturally led evaluations that incorporate appropriate physical activity outcome measures alongside engagement metrics are needed to strengthen evidence on behavioural effectiveness and to better understand how culturally responsive approaches compare with non-tailored models.

Consideration 3: Strong participation and retention are most consistently associated with locally tailored delivery and Aboriginal and Torres Strait Islander workforce involvement. Across the small number of evaluated programs, higher engagement is linked to delivery by Aboriginal and Torres Strait Islander facilitators, community-driven design, locally meaningful settings (including school, community, and Country), and culturally safe spaces. These findings suggest that flexible, place-based delivery and support for Indigenous workforce capacity are important enabling conditions for effective implementation.

Limitations

This Evidence Check review has several limitations that should be considered when interpreting findings across Questions 1, 2 and 3. For Questions 1 and 2, although many studies were randomised or cluster-randomised trials, there was substantial variation in intervention content, intensity, duration, settings and outcome measures, limiting comparability and making it difficult to attribute effects to specific components. Many large, pragmatic school trials reported small or modest effects, which may reflect real-world delivery constraints (e.g., variable fidelity, reach and engagement) that were not consistently measured or reported. Evidence for Question 2 relied largely on process evaluations, observational moderators and subgroup analyses, which can identify plausible enablers and barriers but do not establish causality; subgroup analyses were often underpowered, limiting confidence in equity conclusions. For Question 3, the evidence base was small and diverse, and most culturally responsive programs focused on

engagement and cultural outcomes rather than measured PA, so conclusions about behavioural effectiveness require caution. Some studies included broader/overlapping age ranges, but this represents the best available evidence for adolescents aged 13–17 years in NSW.

Declaration of conflict of interest

The authors declare no conflicts of interest.

Appendices

Appendix 1 – Full search terms for the systematic review (Questions 1 and 2)

	Key words	Search terms	Search strings
Population	Adolescents, youth, teenagers, students	Adolescent, Students, adolescent, teen, youth, young people, secondary school, high school, school student	(Adolescent/ OR Students/ OR adolescen*.ti,ab. OR teen*.ti,ab. OR youth*.ti,ab. OR "young people".ti,ab. OR "secondary school*".ti,ab. OR "high school*".ti,ab. OR "school student".ti,ab.)
Intervention	Physical activity, exercise, sport, policy, program, intervention	Motor activity, Exercise, Sports, Physical education and training, Health promotion, Health policy, Public policy, School health services, Program evaluation, Intervention, Physical activity, Exercise, Sport, Activity program, Health promotion, Policy intervention, School program, Community program, Initiative, Campaign, Strategy	(Motor Activity/ OR Exercise/ OR Sports/ OR Physical Education and Training/ OR Health Promotion/ OR Health Policy/ OR Public Policy/ OR School Health Services/ OR Program Evaluation/ OR intervention/ OR "physical activit*".ti,ab. OR exercis*.ti,ab. OR sport*.ti,ab. OR "activity program*".ti,ab. OR "health promotion".ti,ab. OR "policy intervention*".ti,ab. OR "school program*".ti,ab. OR "community program*".ti,ab. OR initiative*.ti,ab. OR campaign*.ti,ab. OR strategy.ti,ab.)
Setting	School, community, family, home, policy, environment	Schools, Education (secondary), Community health services, Family, Parents, Environment design, Urban health, Parks and recreation, Transportation, School, Secondary school, High school, Classroom, School policy, Sport club, Family, Families, Parents, Caregiver, Home, Community, Built environment, Neighbourhood, Recreation facility, Park, Playground, Active transport, Active Travel, Walkability, Walking paths, Trails, Sidewalks, Footpaths, Bicycle, Cycling, Rural, Regional, Urban	(Schools/ OR Education, Secondary/ OR Community Health Services/ OR Family/ OR Parents/OR Environment Design/ OR Urban Health/ OR Parks, Recreational/ OR Transportation/ OR "school*".ti,ab. OR "secondary school*".ti,ab. OR "high school*".ti,ab. OR classroom.ti,ab. OR "school policy*".ti,ab. OR "sport club*".ti,ab. OR family.ti,ab. OR families.ti,ab. OR parent*.ti,ab. OR caregiver*.ti,ab. OR home.ti,ab. OR community.ti,ab. OR "built environment".ti,ab. OR neighbo?rhood*.ti,ab. OR "recreation facilit*".ti,ab. OR park*.ti,ab. OR playground*.ti,ab. OR "active transport*".ti,ab. OR "active travel*".ti,ab. OR walkab*.ti,ab. OR (walk* adj3 (path* OR trail* OR sidewalk* OR footpath*)).ti,ab. OR bicycl*.ti,ab. OR cycl*.ti,ab. OR rural.ti,ab. OR regional.ti,ab. OR urban.ti,ab.)
Outcome	Physical activity, participation, engagement, success, Active transport/travel	Program evaluation, Treatment outcome, Physical activity, MVPA, Activity level, Exercise participation, Sport participation, Program effectiveness, Policy impact, Participation, Engagement, Uptake, Adherence, Success, Barriers, Facilitators, Determinants, Outcomes, Sustainability, Active transport/travel-related (e.g., change or increase in walking or cycling rates, frequency of walking or cycling to school; minutes or distance of active travel per day/week; number of active travel trips per week)	(Program Evaluation/ OR Treatment Outcome/ OR "physical activit*".ti,ab. OR MVPA.ti,ab. OR "activity level*".ti,ab. OR "exercise participation".ti,ab. OR "sport participation".ti,ab. OR "program effectiveness".ti,ab. OR "policy impact".ti,ab. OR participation.ti,ab. OR engagement.ti,ab. OR uptake.ti,ab. OR adheren*.ti,ab. OR success.ti,ab. OR barrier*.ti,ab. OR facilitator*.ti,ab. OR determinant*.ti,ab. OR outcome*.ti,ab. OR sustain*.ti,ab.)
Year and Language	2015–2025; English	Limit by publication year	

Appendix 2 – Full search terms for the scoping review (Question 3)

	Key words	Search terms	Search strings
Population	Aboriginal and Torres Strait Islander adolescents, Indigenous youth	Aboriginal Australians, adolescents, youth, Aboriginal, Torres Strait Islander, First Nations, Indigenous	(Aboriginal Australians/ OR adolescen*.ti,ab. OR youth*.ti,ab. OR Aboriginal.ti,ab. OR "Torres Strait Islander".ti,ab. OR "First Nations".ti,ab. OR Indigenous.ti,ab.)
Intervention	Physical activity, exercise, sport, community-led programs, interventions	Exercise, motor activity, sports, health promotion, physical activity, exercise, sport, community-led, culturally adapted, intervention	(Exercise/ OR Motor Activity/ OR Sports/ OR Health Promotion/ OR "physical activit*".ti,ab. OR exercis*.ti,ab. OR sport*.ti,ab. OR "community-led".ti,ab. OR "culturally adapted".ti,ab. OR intervention*.ti,ab.)
Setting	Community, Aboriginal organisation, school, rural	Community health services, rural health services, schools, Aboriginal community, community-controlled, rural, regional	(Community Health Services/ OR Rural Health Services/ OR school*.ti,ab. OR "Aboriginal community".ti,ab. OR "community-controlled".ti,ab. OR rural.ti,ab. OR regional.ti,ab.)
Outcome	Physical activity, engagement, participation, program effectiveness	Physical fitness, health behaviour, physical activity, participation, engagement, effectiveness, success	(Physical Fitness/ OR Health Behaviour/ OR "physical activit*".ti,ab. OR participation.ti,ab. OR engagement.ti,ab. OR effectiveness.ti,ab. OR success.ti,ab.)
Year and Language	2015–2025; English	Limit by publication year	

Appendix 3 – Database search findings for the systematic review (Questions 1 and 2)

TOTAL YIELD AFTER DE DUPLICATION (ACROSS THE 3 DATABASES: 15,854

DATABASE 1: MEDLINE (via Ovid)

SEARCH DATE: 14/11/2025

SEARCH INPUTS

#	Query	Results
1	(Adolescent/ OR Students/ OR adolescen*.ti,ab. OR teen*.ti,ab. OR youth*.ti,ab. OR "young people".ti,ab. OR "secondary school*".ti,ab. OR "high school*".ti,ab. OR "school student*".ti,ab.) AND (Motor Activity/ OR Exercise/ OR Sports/ OR Physical Education and Training/ OR Health Promotion/ OR Health Policy/ OR Public Policy/ OR School Health Services/ OR Program Evaluation/ OR intervention/ OR "physical activit*".ti,ab. OR exercis*.ti,ab. OR sport*.ti,ab. OR "activity program*".ti,ab. OR "health promotion".ti,ab. OR "policy intervention*".ti,ab. OR "school program*".ti,ab. OR "community program*".ti,ab. OR initiative*.ti,ab. OR campaign*.ti,ab. OR strategy.ti,ab.) AND (Schools/ OR Education, Secondary/ OR Community Health Services/ OR Family/ OR Parents/ OR Environment Design/ OR Urban Health/ OR Parks, Recreational/ OR Transportation/ OR "school*".ti,ab. OR "secondary school*".ti,ab. OR "high school*".ti,ab. OR classroom.ti,ab. OR "school policy*".ti,ab. OR "sport club*".ti,ab. OR family.ti,ab. OR families.ti,ab. OR parent*.ti,ab. OR caregiver*.ti,ab. OR home.ti,ab. OR community.ti,ab. OR "built environment".ti,ab. OR neighbo?rhood*.ti,ab. OR "recreation facilit*".ti,ab. OR park*.ti,ab. OR playground*.ti,ab. OR "active transport*".ti,ab. OR "active travel*".ti,ab. OR walkab*.ti,ab. OR (walk* adj3 (path* OR trail* OR sidewalk* OR footpath*)).ti,ab. OR bicycl*.ti,ab. OR cycl*.ti,ab. OR rural.ti,ab. OR regional.ti,ab. OR urban.ti,ab.) AND (Program Evaluation/ OR Treatment Outcome/ OR "physical activit*".ti,ab. OR MVPA.ti,ab. OR "activity level*".ti,ab. OR "exercise participation".ti,ab. OR "sport participation".ti,ab. OR "program effectiveness".ti,ab. OR "policy impact".ti,ab. OR participation.ti,ab. OR engagement.ti,ab. OR uptake.ti,ab. OR adheren*.ti,ab. OR success.ti,ab. OR barrier*.ti,ab. OR facilitator*.ti,ab. OR determinant*.ti,ab. OR outcome*.ti,ab. OR sustain*.ti,ab.)	
2	Limit to (English language and yr="2015 - 2025")	N = 12,564

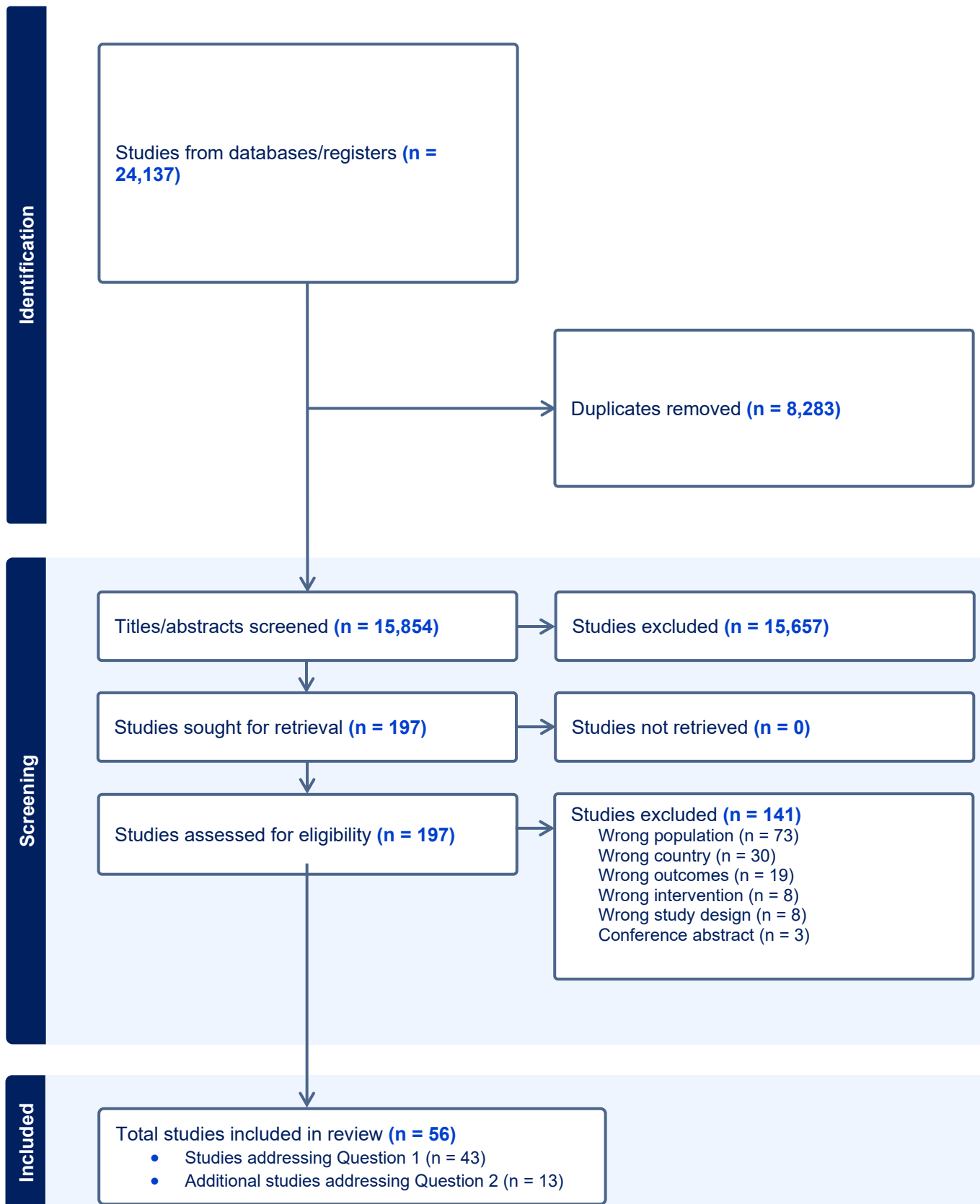
DATABASE 2: Scopus**SEARCH DATE:** 14/11/2025**SEARCH INPUTS**

#	Query	Results
1	TITLE-ABS-KEY(adolescen* OR teen* OR youth* OR "young people" OR "secondary school*" OR "high school*" OR "school student*") AND TITLE-ABS-KEY("physical activit*" OR exercis* OR sport* OR "activity program*" OR "health promotion" OR "policy intervention*" OR "school program*" OR "community program*" OR initiative* OR campaign* OR strategy) AND TITLE-ABS-KEY("school*" OR "secondary school*" OR "high school*" OR classroom OR "school policy*" OR "sport club*" OR family OR families OR parent* OR caregiver* OR home OR community OR "built environment" OR neighbo?rhood* OR "recreation facilit*" OR park* OR playground* OR "active transport*" OR "active travel*" OR walkab* OR (walk* W/3 (path* OR trail* OR sidewalk* OR footpath*)) OR bicycl* OR cycl* OR rural OR regional OR urban) AND TITLE-ABS-KEY("physical activit*" OR MVPA OR "activity level*" OR "exercise participation" OR "sport participation" OR "program effectiveness" OR "policy impact" OR participation OR engagement OR uptake OR adheren* OR success OR barrier* OR facilitator* OR determinant* OR outcome* OR sustain*)	
2	Limit to (English language and yr="2015 - 2025")	N = 8,627

DATABASE 3: SPORTDiscus**SEARCH DATE:** 14/11/2025**SEARCH INPUTS**

#	Query	Results
1	TX(adolescen* OR teen* OR youth* OR "young people" OR "secondary school*" OR "high school*" OR "school student*") AND TX("physical activit*" OR exercis* OR sport* OR "activity program*" OR "health promotion" OR "policy intervention*" OR "school program*" OR "community program*" OR initiative* OR campaign* OR strategy) AND TX("school*" OR "secondary school*" OR "high school*" OR classroom OR "school policy*" OR "sport club*" OR family OR families OR parent* OR caregiver* OR home OR community OR "built environment" OR neighbo?rhood* OR "recreation facilit*" OR park* OR playground* OR "active transport*" OR "active travel*" OR walkab* OR (walk* N3 (path* OR trail* OR sidewalk* OR footpath*)) OR bicycl* OR cycl* OR rural OR regional OR urban) AND TX("physical activit*" OR MVPA OR "activity level*" OR "exercise participation" OR "sport participation" OR "program effectiveness" OR "policy impact" OR participation OR engagement OR uptake OR adheren* OR success OR barrier* OR facilitator* OR determinant* OR outcome* OR sustain*)	
2	Limit to (English language and yr="2015 - 2025")	N = 3,682

Appendix 4 – PRISMA flow diagram for studies included in the systematic review (Questions 1 and 2)



Appendix 5 – List of full-text exclusions with reasons (n=141)

Study title	Journal	First author and year	Reason for exclusion
mHealth or eHealth? Efficacy, use, and appreciation of a web-based computer-tailored physical activity intervention for Dutch adults: a randomized controlled trial	Journal Of Medical Internet Research	Gomez 2016	Wrong patient population
Effectiveness of an 8-week physical activity intervention involving wearable activity trackers and an eHealth app: mixed methods study	JMIR Formative Research	McCormack 2022	Wrong patient population
Effects of wearable fitness trackers and activity adequacy mindsets on affect, behavior, and health: Longitudinal randomized controlled trial	Journal Of Medical Internet Research	Zahrt 2023	Wrong patient population
Effectiveness of the Let's Move It multi-level vocational school-based intervention on physical activity and sedentary behavior: a cluster randomized trial	Ann Behav Med	Hankonen 2025	Wrong patient population
Examining reach, dose, and fidelity of the "Girls on the Move" after-school physical activity club: a process evaluation	BMC Public Health	Robbins 2016	Wrong patient population
'Physical Activity 4 Everyone' school-based intervention to prevent decline in adolescent physical activity levels: 12 month (mid-intervention) report on a cluster randomised trial	British Journal Of Sports Medicine	Sutherland 2016	Wrong patient population
Clustered randomised controlled trial of two education interventions designed to increase physical activity and well-being of secondary school students: the MOVE Project	BMJ Open	Tymms 2016	Wrong patient population
Sources and Types of Social Support for Physical Activity Perceived by Fifth to Eighth Grade Girls	Journal Of Nursing Scholarship	Robbins 2018	Wrong patient population
An Intervention to Increase Students' Physical Activity: A 2-Year Pilot Study	Am J Prev Med	Weaver 2018	Wrong patient population
The development and feasibility of a randomised family-based physical activity promotion intervention: the Families Reporting Every Step to Health (FRESH) study	Pilot Feasibility Stud	Guagliano 2019	Wrong patient population
Testing a Social Network Intervention Using Vlogs to Promote Physical Activity Among Adolescents : A Randomized Controlled Trial	Frontiers In Psychology	Van Woudenberg 2019	Wrong patient population
The FLEX study school-based physical activity programs - measurement and evaluation of implementation	BMC Public Health	Wright 2019	Wrong patient population

Study title	Journal	First author and year	Reason for exclusion
A whole family-based physical activity promotion intervention: findings from the families reporting every step to health (FRESH) pilot randomised controlled trial	Int J Behav Nutr Phys Act	Guagliano 2020	Wrong patient population
Implementation of a School Physical Activity Policy Improves Student Physical Activity Levels: Outcomes of a Cluster-Randomized Controlled Trial	Journal Of Physical Activity & Health	Nathan 2020	Wrong patient population
Feasibility and Provisional Efficacy of Embedding High-Intensity Interval Training Into Physical Education Lessons: A Pilot Cluster-Randomized Controlled Trial	Pediatr Exerc Sci	Harris 2021	Wrong patient population
iEngage: A digital health education program designed to enhance physical activity in young adolescents	Plos One	Caillaud 2022	Wrong patient population
Establishing effectiveness of a community-based, physical activity program for fathers and daughters: a randomized controlled trial	Annals Of Behavioral Medicine	Morgan 2022	Wrong patient population
Multi-strategy intervention increases school implementation and maintenance of a mandatory physical activity policy: outcomes of a cluster randomised controlled trial	British Journal Of Sports Medicine	Nathan 2022	Wrong patient population
Efficacy of education outside the classroom to increase adolescent physical activity	Scientific Reports	Elsborg 2024	Wrong patient population
School Poverty Level Moderates the Effectiveness of a Physical Activity Intervention	Am J Health Promot	Quader 2024	Wrong patient population
Findings from a cluster randomised feasibility study of a school-based physical activity role model intervention (CHARMING) for 9-10-year-old girls	Pilot Feasibility Stud	Morgan 2025	Wrong patient population
Parent-Child Coparticipation in Physical Activity and Its Associations With Daily Physical Activity and Key Correlates: Findings From the Families Reporting Every Step to Health Study	J Phys Act Health	Paudel 2025	Wrong patient population
Effects of a peer-led Walking In ScHools intervention (the WISH study) on physical activity levels of adolescent girls: a cluster randomised pilot study	Trials	Carlin 2018	Wrong patient population
Physical activity and skills intervention: SCORES cluster randomized controlled trial	Med Sci Sports Exerc	Cohen 2015	Wrong patient population
Optimising a multi-strategy implementation intervention to improve the delivery of a school physical activity policy at scale: findings from a randomised noninferiority trial	The International Journal Of Behavioral Nutrition And Physical Activity	Lane 2022	Wrong patient population
Moderators in a physical activity intervention for adolescent girls	Pediatric Research	Robbins 2020	Wrong patient population

Study title	Journal	First author and year	Reason for exclusion
A pilot cluster-randomized controlled trial of an audit, feedback, and coaching intervention on compliance with elementary physical education laws and student physical activity during lesson time	Prev Med Rep	Thompson 2025	Wrong patient population
Connect through PLAY: a randomized-controlled trial in afterschool programs to increase adolescents' physical activity	Journal Of Behavioral Medicine	Zarrett 2021	Wrong patient population
Mediators of Physical Activity Behavior Change in the "Girls on the Move" Intervention	Nursing Research	Robbins 2019	Wrong patient population
Cost effectiveness of a multi-component school-based physical activity intervention targeting adolescents: the "Physical Activity 4 Everyone" cluster randomized trial	International Journal Of Behavioral Nutrition And Physical Activity	Sutherland 2016	Wrong patient population
The impact of playworks on boys' and girls' physical activity during recess	J Sch Health	Bleeker 2015	Wrong patient population
Impact of a personalized versus moderate-intensity exercise prescription: a randomized controlled trial	Journal Of Behavioral Medicine	Schneider 2017	Wrong patient population
Use of in-home stationary cycling equipment among parents in a family-based randomized trial intervention	J Sci Med Sport	Rhodes 2018	Wrong patient population
Randomized Controlled Trial to Increase Physical Activity Among Hispanic-American Middle School Students	J Sch Health	Arlinghaus 2021	Wrong patient population
Evaluating Mailed Motivational, Individually Tailored Postcard Boosters for Promoting Girls' Postintervention Moderate-to-Vigorous Physical Activity	Nursing Research	Bakhoya 2016	Wrong patient population
Cost-effectiveness of Community-Based Minigrants to Increase Physical Activity in Youth	Journal Of Public Health Management And Practice	Moore 2017	Wrong patient population
Scaling up Action Schools! BC: How Does Voltage Drop at Scale Affect Student Level Outcomes? A Cluster Randomized Controlled Trial	International Journal Of Environmental Research And Public Health	Nettlefold 2021	Wrong patient population
Evaluation of the peer leadership for physical literacy intervention: A cluster randomized controlled trial	Plos One	Hulteen 2023	Wrong patient population
Identifying essential implementation strategies: a mixed methods process evaluation of a multi-strategy policy implementation intervention for schools	The International Journal Of Behavioral Nutrition And Physical Activity	Lane 2022	Wrong patient population
Web-based intervention program to foster need-supportive behaviors in physical education teachers and parents: a cluster-randomized controlled study to increase students' intention and effort to engage in physical activity	BMC Public Health	Meerits 2025	Wrong patient population
A randomized controlled trial testing a social network intervention to promote physical activity among adolescents	BMC Public Health	Van Woudenberg 2018	Wrong patient population

Study title	Journal	First author and year	Reason for exclusion
Increasing girls' physical activity during a short-term organized youth sport basketball program: A randomized controlled trial	Journal Of Science And Medicine In Sport	Guagliano 2015	Wrong patient population
Outcomes of the Rope Skipping 'STAR' Programme for Schoolchildren	Journal Of Human Kinetics	Ha 2015	Wrong patient population
Effect and cost of an after-school dance programme on the physical activity of 11-12 year old girls: The Bristol Girls Dance Project, a school-based cluster randomised controlled trial	International J Behav Nutri Phys Act	Jago 2015	Wrong patient population
The PLUNGE randomized controlled trial: evaluation of a games-based physical activity professional learning program in primary school physical education	Prev Med	Miller 2015	Wrong patient population
A classroom-based physical activity intervention for urban kindergarten and first-grade students: a feasibility study	Child Obes	Reznik 2015	Wrong patient population
Lessons learnt from the Bristol Girls Dance Project cluster RCT: implications for designing and implementing after-school physical activity interventions	BMJ Open	Edwards 2016	Wrong patient population
Effects of a 'school-based' physical activity intervention on adiposity in adolescents from economically disadvantaged communities: secondary outcomes of the 'Physical Activity 4 Everyone' RCT	International Journal Of Obesity	Hollis 2016	Wrong patient population
The Impact of Playworks on Students' Physical Activity by Race/Ethnicity: Findings from a Randomized Controlled Trial	J Phys Act Health	James-Burdumy 2016	Wrong patient population
Effects of physical activity on schoolchildren's academic performance: The Active Smarter Kids (ASK) cluster-randomized controlled trial	Prev Med	Resaland 2016	Wrong patient population
Findings From the EASY Minds Cluster Randomized Controlled Trial: Evaluation of a Physical Activity Integration Program for Mathematics in Primary Schools	J Phys Act Health	Riley 2016	Wrong patient population
Improving the well-being of children and youths: a randomized multicomponent, school-based, physical activity intervention	BMC Public Health	Smedegaard 2016	Wrong patient population
Outcomes of a four-year specialist-taught physical education program on physical activity: a cluster randomized controlled trial, the LOOK study	Int J Behav Nutr Phys Act	Telford 2016	Wrong patient population
Physical activity and academic achievement across the curriculum: Results from a 3-year cluster-randomized trial	Prev Med	Donnelly 2017	Wrong patient population
Feasibility of Gamified Mobile Service Aimed at Physical Activation in Young Men: Population-Based Randomized Controlled Study (MOPO)	Jmir Mhealth Uhealth	Leinonen 2017	Wrong patient population
Effect of tailored, gamified, mobile physical activity intervention on life satisfaction and self-rated health in young adolescent men: A population-based, randomized controlled trial (MOPO study)	Computers In Human Behavior	Pyky 2017	Wrong patient population

Study title	Journal	First author and year	Reason for exclusion
An RCT to Facilitate Implementation of School Practices Known to Increase Physical Activity	American Journal Of Preventive Medicine	Sutherland 2017	Wrong patient population
Increasing physical activity through an Internet-based motivational intervention supported by pedometers in a sample of sedentary students: A randomised controlled trial	Psychol Health	Miragall 2018	Wrong patient population
Physically Active Lessons Improve Lesson Activity and On-Task Behavior: A Cluster-Randomized Controlled Trial of the "Virtual Traveller" Intervention	Health Educ Behav	Norris 2018	Wrong patient population
Adding Family Digital Supports to Classroom-Based Physical Activity Interventions to Target In- and Out-of-School Activity: An Evaluation of the Stay Active Intervention during the COVID-19 Pandemic	Journal Of Healthy Eating And Active Living	Forseth 2021	Wrong patient population
Feasibility of a school-based physical activity intervention for adolescents with disability	Pilot And Feasibility Studies	Leahy 2021	Wrong patient population
The impact of school uniforms on primary school student's physical activity at school: outcomes of a cluster randomized controlled trial	Int J Behav Nutr Phys Act	Nathan 2021	Wrong patient population
The impact of an implementation intervention that increased school's delivery of a mandatory physical activity policy on student outcomes: A cluster-randomised controlled trial	Journal Of Science And Medicine In Sport	Hall 2022	Wrong patient population
Economic evaluation of a multi-strategy intervention that improves school-based physical activity policy implementation	Implementation Science	Lane 2022	Wrong patient population
Effectiveness of an adapted physical activity intervention for weight management in adolescents with intellectual disability: A randomized controlled trial	Pediatr Obes	Yu 2022	Wrong patient population
Scalable physical activity intervention for youth with disability: Burn 2 Learn adapted cluster randomized controlled trial	Int J Behav Nutr Phys Act	Lubans 2025	Wrong patient population
A community-based physical activity intervention (FitSkills) can improve participation attendance of young people with disability: a stepped wedge cluster randomised trial	British Journal Of Sports Medicine	Shields 2025	Wrong patient population
Effect of a gamified-based intermittent teaching unit in Physical Education on schoolchildren's accelerometer-measured weekly physical activity: a cluster-randomized controlled trial. School-fit study	Revista De Psicodidã;ctica (English Ed.)	Guijarro-Romero 2025	Wrong patient population
Feasibility and acceptability of at-home play kits for middle school physical activity promotion during the COVID-19 pandemic	BMC Public Health	Kroshus 2023	Wrong patient population
Evaluation of a walking school bus program: a cluster randomized controlled trial	Int J Behav Nutr Phys Act	Johnson 2024	Wrong patient population
Intervention Effects of "Girls on the Move" on Increasing Physical Activity: A Group Randomized Trial	Annals Of Behavioral Medicine	Robbins 2019	Wrong patient population

Study title	Journal	First author and year	Reason for exclusion
Environment modification at school to promote physical activity among adolescents: a cluster randomized controlled trial	Rev Bras Epidemiol	Benthroldo 2022	Wrong patient population
Impact of the ActTeens Program on physical activity and fitness in adolescents: a cluster randomized controlled trial	Bmc Pediatr	Castilho Dos Santos 2024	Wrong patient population
Adolescents physical activity and sedentary behavior: A pathway in reducing overweight and obesity: The PRALIMAP 2-year cluster randomized controlled trial	Journal Of Physical Activity And Health	Omorou 2015	Wrong country
A Physical Activity Intervention for Brazilian Students From Low Human Development Index Areas: A Cluster-Randomized Controlled Trial	J Phys Act Health	Filho 2016	Wrong country
Effect of theory-based intervention to promote physical activity among adolescent girls: a randomized control trial	Electronic Physician	Darabi 2017	Wrong country
A school-based rope skipping program for adolescents: Results of a randomized trial	Prev Med	Ha 2017	Wrong country
Randomised controlled feasibility study of a school-based multi-level intervention to increase physical activity and decrease sedentary behaviour among vocational school students	Int J Behav Nutr Phys Act	Hankonen 2017	Wrong country
A cluster-randomised controlled trial to promote physical activity in adolescents: the Raising Awareness of Physical Activity (RAW-PA) Study	BMC Public Health	Ridgers 2017	Wrong country
Increasing Students' Activity in Physical Education: Results of the Self-determined Exercise and Learning For FITness Trial	Medicine And Science In Sports And Exercise	Ha 2020	Wrong country
A community-based lifestyle-integrated physical activity intervention to enhance physical activity, positive family communication, and perceived health in deprived families: a cluster randomized controlled trial	Frontiers In Public Health	Lai 2020	Wrong country
The effect of social norm-based intervention with observable behaviour on physical activity among adolescents: A randomized controlled trial	BMC Sports Science, Medicine And Rehabilitation	Lee 2020	Wrong country
Effects of Physical Activity and Psychological Modification-Based Intervention on Physical Fitness, Physical Activity and Its Related Psychological Variables in Female Adolescents	International Journal Of Environmental Research And Public Health	Kim 2021	Wrong country
Effects of school-based high-intensity interval training on body composition, cardiorespiratory fitness and cardiometabolic markers in adolescent boys with obesity: a randomized controlled trial	BMC Pediatrics	Meng 2022	Wrong country
Effect of an activity wristband-based intermittent teaching unit in Physical Education on students' physical activity and its psychological mediators: a cluster-randomized controlled trial. School-fit study	Frontiers In Psychology	Guijarro-Romero 2023	Wrong country

Study title	Journal	First author and year	Reason for exclusion
Physical Activity, Body Composition, and Fitness Variables in Adolescents After Periods of Mandatory, Promoted or Nonmandatory, Nonpromoted Use of Step Tracker Mobile Apps: Randomized Controlled Trial	JMIR Mhealth And Uhealth	Mateo-Orcajada 2024	Wrong country
Time to Move: A 4-Week Gamified Mobile Application Intervention to Promote Physical Activity in Secondary School Students	European Journal Of Sport Science	HasilKorkmaz 2025	Wrong country
Implementing High-Intensity Interval Training in Physical Education: Effects on Adolescents' Exercise Motivation	Behav Sci (Basel)	Mital 2025	Wrong country
The Effects of a Web-Based Need-Supportive Intervention for Physical Education Teachers on Students' Physical Activity and Related Outcomes: A Randomized Controlled Trial	Children (Basel)	Paap 2025	Wrong country
Gender and academic year as moderators of the efficacy of mobile app interventions to promote physical activity in adolescents: a randomized controlled trial	Humanities And Social Sciences Communications	Mateo-Orcajada 2023	Wrong country
The Avengers in action: A gamified-based intermittent teaching unit in the Physical Education setting to promote physical activity and its psychological mediators in secondary education students	Psychology Of Sport And Exercise	Becerra-Fernandez 2025	Wrong country
Do You Want to Increase Physical Activity in Adolescents? A School-Based Physical Activity Program Could Be an Efficient Way	Children (Basel, Switzerland)	Polo-Recuero 2023	Wrong country
Web-based need-supportive parenting program to promote physical activity in secondary school students: a randomized controlled pilot trial	BMC Public Health	Meerits 2023	Wrong country
Effectiveness of a school-based intervention on physical activity and screen time among adolescents	Journal Of Science And Medicine In Sport	Ahmed 2022	Wrong country
Effects of a School-Based Intervention on Motivation for Out-of-School Physical Activity Participation	Res Q Exerc Sport	Barkoukis 2021	Wrong country
Environment modification at school to promote physical activity among adolescents: a cluster randomized controlled trial	Rev Bras Epidemiol	Benthroldo 2022	Wrong country
Impact of the ActTeens Program on physical activity and fitness in adolescents: a cluster randomized controlled trial	Bmc Pediatr	Castilho Dos Santos 2024	Wrong country
Adding Family Digital Supports to Classroom-Based Physical Activity Interventions to Target In- and Out-of-School Activity: An Evaluation of the Stay Active Intervention during the COVID-19 Pandemic	Journal Of Healthy Eating And Active Living	Forseth 2021	Wrong country
Feasibility of a school-based physical activity intervention for adolescents with disability	Pilot And Feasibility Studies	Leahy 2021	Wrong country
The impact of an implementation intervention that increased school's delivery of a mandatory physical activity policy on student outcomes: A cluster-randomised controlled trial	Journal Of Science And Medicine In Sport	Hall 2022	Wrong country

Study title	Journal	First author and year	Reason for exclusion
The Impact of Playworks on Students' Physical Activity by Race/Ethnicity: Findings from a Randomized Controlled Trial	J Phys Act Health	James-Burdumy 2016	Wrong country
Effects of physical activity on schoolchildren's academic performance: The Active Smarter Kids (ASK) cluster-randomized controlled trial	Prev Med	Resaland 2016	Wrong country
Improving the well-being of children and youths: a randomized multicomponent, school-based, physical activity intervention	BMC Public Health	Smedegaard 2016	Wrong country
Preliminary efficacy and feasibility of embedding high intensity interval training into the school day: A pilot randomized controlled trial	Prev Med Rep	Costigan 2015	Wrong outcomes
School Physical Activity Intervention Effect on Adolescents' Performance in Mathematics	Med Sci Sports Exerc	Lubans 2018	Wrong outcomes
Outcomes of the Y-PATH Randomized Controlled Trial: Can a School-Based Intervention Improve Fundamental Movement Skill Proficiency in Adolescent Youth?	Journal Of Physical Activity & Health	McGrane 2018	Wrong outcomes
Evaluation of an intervention to reduce adolescent sitting time during the school day: The 'Stand Up for Health' randomised controlled trial	J Sci Med Sport	Parrish 2018	Wrong outcomes
Intervention effects and mediators of well-being in a school-based physical activity program for adolescents: The 'Resistance Training for Teens' cluster RCT	Mental Health And Physical Activity	Smith 2018	Wrong outcomes
Feasibility and Preliminary Efficacy of a Teacher-Facilitated High-Intensity Interval Training Intervention for Older Adolescents	Pediatric Exercise Science	Leahy 2019	Wrong outcomes
Effects of the Girls on the Move randomized trial on adiposity and aerobic performance (secondary outcomes) in low-income adolescent girls	Pediatr Obes	Pfeiffer 2019	Wrong outcomes
Effects of school-based physical activity interventions on mental health in adolescents: The School in Motion cluster randomized controlled trial	Mental Health And Physical Activity	Åvitsland 2020	Wrong outcomes
Effects of a Physical Education Intervention on Academic Performance: A Cluster Randomised Controlled Trial	Int J Environ Res Public Health	Lima 2020	Wrong outcomes
Effects of a school-based physical activity intervention on academic performance in 14-year old adolescents: a cluster randomized controlled trial - the School in Motion study	BMC Public Health	Solberg 2021	Wrong outcomes
Aerobic fitness mediates the intervention effects of a school-based physical activity intervention on academic performance. The school in Motion study - A cluster randomized controlled trial	Prev Med Rep	Solberg 2021	Wrong outcomes
The effect of a one-year vigorous physical activity intervention on fitness, cognitive performance and mental health in young adolescents: the Fit to Study cluster randomised controlled trial	Int J Behav Nutr Phys Act	Wassenaar 2021	Wrong outcomes

Study title	Journal	First author and year	Reason for exclusion
Effects of a School-Based Physical Activity Intervention on Adolescents' Mental Health: A Cluster Randomized Controlled Trial	J Phys Act Health	Ahmed 2023	Wrong outcomes
Effects of school-based high-intensity interval training on health-related fitness in adolescents	Frontiers In Physiology	Jovanovial 2024	Wrong outcomes
The use of physical activity mobile apps improves the psychological state of adolescents: a randomized controlled trial	Human Behavior And Emerging Technologies	Mateo-Orcajada 2024	Wrong outcomes
Enhancing adolescent physical fitness and well-being: A school-based high-intensity interval training program	Journal Of Functional Morphology And Kinesiology	Mitall 2024	Wrong outcomes
A cluster-randomized controlled trial to improve student experiences in physical education: Results of a student-centered learning intervention with high school teachers	Psychology Of Sport And Exercise	Bechter 2019	Wrong outcomes
Exploring the effect of a school-based cluster-randomised controlled trial to increase the scheduling of physical activity for primary school students on teachers' physical activity	Health Promot J Austr	Murawski 2022	Wrong outcomes
Potential Mediators of a School-Based Digital Intervention Targeting Six Lifestyle Risk Behaviours in a Cluster Randomised Controlled Trial of Australian Adolescents	Prev Sci	O'Dean 2024	Wrong outcomes
Effect of the Shaping Healthy Choices Program, a Multicomponent, School-Based Nutrition Intervention, on Physical Activity Intensity	J Am Coll Nutr	Fetter 2018	Wrong intervention
Does the Healthy Body Image program improve lifestyle habits among high school students? A randomized controlled trial with 12-month follow-up	J Int Med Res	Sundgot-Borgen 2020	Wrong intervention
Feasibility and preliminary efficacy of a school-based health and well-being program for adolescent girls	Pilot Feasibility Stud	White 2022	Wrong intervention
A mobile app-based intervention improves anthropometry, body composition and fitness, regardless of previous active-inactive status: a randomized controlled trial	Frontiers In Public Health	Gomez-Cuesta 2024	Wrong intervention
Mediated effects of LIFE4YOUth-a mobile health intervention for multiple lifestyle behavior change among high school students in Sweden: findings from a randomized controlled trial	BMC Public Health	Hedin 2025	Wrong intervention
Development and implementation of a smartphone application to promote physical activity and reduce screen-time in adolescent boys	Frontiers In Public Health	Lubans 2014	Wrong intervention
Adolescent behavioural intentions: Secondary outcomes from a cluster randomized controlled trial of the Health4Life school-based lifestyle modification intervention	Can J Public Health	O'Dean 2025	Wrong intervention

Study title	Journal	First author and year	Reason for exclusion
Effects of a School-Based Intervention on Motivation for Out-of-School Physical Activity Participation	Res Q Exerc Sport	Barkoukis 2021	Wrong intervention
Design and methods for "Commit to Get Fit" - a pilot study of a school-based mindfulness intervention to promote healthy diet and physical activity among adolescents	Contemp Clin Trials	Salmoirago-Blotcher 2015	Wrong intervention
School-based systems change for obesity prevention in adolescents: outcomes of the Australian Capital Territory 'It's Your Move!'	Aust N Z J Public Health	Malakellis 2017	Wrong study design
Implementing Resistance Training in Secondary Schools: A Cluster Randomized Controlled Trial	Med Sci Sports Exerc	Kennedy 2018	Wrong study design
Initial Outcomes of a Participatory-Based, Competency-Building Approach to Increasing Physical Education Teachers' Physical Activity Promotion and Students' Physical Activity: A Pilot Study	Health Educ Behav	Weaver 2018	Wrong study design
The reimagination of school-based physical activity research in the COVID-19 era	Plos Med	Harrington 2020	Wrong study design
Effects of an activity tracker and app intervention to increase physical activity in whole families – the Step It Up Family Feasibility Study	Int J Environ Res Public Health	Schoeppe 2020	Wrong study design
School-level intra-cluster correlation coefficients and autocorrelations for children's accelerometer-measured physical activity in England by age and gender	BMC Medical Research Methodology	Salway 2024	Wrong study design
Evaluating the reach, effectiveness, adoption, implementation and maintenance of the Resistance Training for Teens program	Int J Behav Nutr Phys Act	Kennedy 2021	Wrong study design
Implementing a school-based physical activity program: process evaluation and impact on teachers' confidence, perceived barriers and self-perceptions	Physical Education And Sport Pedagogy	Kennedy 2019	Wrong study design
A peer-led walking intervention for adolescent girls (the WISH study): a cluster-randomised controlled trial	Lancet (London, England)	Murphy 2023	Conference abstract
Effectiveness of the GoActive intervention to increase physical activity in adolescents aged 13-14 years: a cluster randomised controlled trial	The Lancet	Corder 2019	Conference abstract

Appendix 6 Study quality ratings for the systematic review (Questions 1 and 2), based on the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool (n = 43 studies)

Citation	A) Selection Bias	B) Study Design	C) Confounders	D) Blinding	E) Data Collection	F) Withdrawals & Drop-outs	G) Intervention Integrity	H) Analyses	Global Rating
Aittasalo 2019²⁵	Strong	Strong	Strong	Moderate	Strong	Strong	Strong	Strong	Strong
Andruschko 2018³⁷	Weak	Strong	Moderate	Moderate	Strong	Strong	Strong	Moderate	Moderate
Belton 2019²⁶	Strong	Strong	Strong	Moderate	Strong	Moderate	Strong	Moderate	Strong
Christiansen 2021²⁸	Moderate	Moderate	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Coimbra 2021³³	Strong	Strong	Strong	Moderate	Strong	Strong	Strong	Strong	Strong
Corder 2016²⁹	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Corder 2020²⁷	Strong	Strong	Strong	Moderate	Strong	Weak	Weak	Moderate	Moderate
Corepal 2019⁵³	Moderate	Strong	Moderate	Moderate	Strong	Weak	Moderate	Moderate	Moderate
Costigan 2018³²	Moderate	Strong	Strong	Moderate	Strong	Moderate	Strong	Strong	Strong
Cowley 2021³⁸	Moderate	Strong	Moderate	Moderate	Strong	Strong	Strong	Moderate	Strong
Cowley 2024³⁹	Moderate	Strong	Strong	Moderate	Strong	Weak	Strong	Moderate	Moderate
Cushing 2021⁵⁴	Moderate	Moderate	Moderate	Moderate	Strong	Strong	Strong	Moderate	Strong
Direito 2015⁴⁰	Moderate	Strong	Strong	Moderate	Strong	Strong	Moderate	Strong	Strong
Domin 2022³⁵	Weak	Moderate	Moderate	Moderate	Moderate	Strong	Strong	Moderate	Moderate
Gammon 2019⁵⁵	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Gaudet 2017⁵⁶	Moderate	Moderate	Moderate	Moderate	Strong	Strong	Weak	Moderate	Strong
Gómez-Cuesta 2024⁵⁷	Strong	Strong	Strong	Moderate	Moderate	Strong	Strong	Strong	Strong
Gråstén 2017³¹	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Strong
Gråstén 2015⁵⁸	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Strong
Guthrie 2015⁵⁹	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Strong	Moderate	Strong
Harrington 2018³⁰	Moderate	Strong	Strong	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Isensee 2018⁶⁰	Moderate	Strong	Moderate	Moderate	Strong	Strong	Strong	Strong	Strong
Jago 2021⁶¹	Moderate	Strong	Strong	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Kolle 2020⁶²	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Kwon 2025⁶³	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Lee 2020⁶⁴	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Lonsdale 2019⁴⁷	Moderate	Strong	Strong	Moderate	Strong	Moderate	Strong	Strong	Strong
Mateo-Orcajada 2023⁶⁵	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Matthews 2018⁴²	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Strong
Murphy 2024⁴⁸	Moderate	Strong	Strong	Moderate	Strong	Moderate	Moderate	Moderate	Strong

Okely 2017¹⁶	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Ridgers 2021⁶⁶	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Schmidt 2020⁶⁷	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Sebire 2019⁶⁸	Moderate	Strong	Strong	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Sebire 2018⁶⁹	Moderate	Strong	Strong	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Suchert 2015⁷⁰	Moderate	Strong	Moderate	Moderate	Strong	Strong	Strong	Strong	Strong
Sutherland 2020⁷¹	Moderate	Strong	Strong	Moderate	Strong	Strong	Strong	Strong	Strong
Sutherland 2016¹⁵	Moderate	Strong	Strong	Moderate	Strong	Moderate	Strong	Strong	Strong
Ten Hoor 2018⁷²	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Tessier 2022⁷³	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Thompson 2016⁷⁴	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
Toftager 2015⁴⁶	Moderate	Strong	Moderate	Moderate	Strong	Moderate	Moderate	Moderate	Strong
van de Kop 2023⁷⁵	Moderate	Strong	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Strong

Study quality was assessed using the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool, which evaluates methodological quality across six core domains. Each domain is rated as Strong, Moderate, or Weak, based on standard EPHPP criteria. A) Selection bias: Representativeness of the sample and likelihood that participants are representative of the target population. B) Study design: Appropriateness and rigour of the study design (e.g. randomised controlled trial, controlled or quasi-experimental design). C) Confounders: Extent to which important confounding variables were balanced or controlled for in the design and/or analysis. D) Blinding: Whether outcome assessors and/or participants were aware of intervention status, where relevant. E) Data collection methods: Validity and reliability of outcome measures, including use of objective or validated instruments. F) Withdrawals and drop-outs: Completeness of follow-up, reporting of attrition, and handling of missing data. G) Intervention integrity: Fidelity of intervention delivery, including consistency, dose delivered/received, and contamination between groups. Global rating: The overall study quality rating (Strong, Moderate, or Weak) reflects a composite judgement based on the six core EPHPP domains (A–F), in accordance with EPHPP guidance. Intervention integrity (G) is reported to inform interpretation of findings but does not contribute to the calculation of the global rating.

Appendix 7 – Study overview for Question 1 (systematic review): Summary of included studies examining the effectiveness of physical activity interventions for adolescents aged 13–17 years (n = 43 studies)

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
Aittasalo et al., 2019²⁴ Finland	School-based: (Health Education) School curriculum-based behaviour change program	Cluster RCT (Level II) 3 lessons + follow-ups at 4 weeks 7 months	n=1,476 Mean age: 13.9 y 48% girls, 52% boys	Three-lesson, multimodal intervention based on the Health Action Process Approach. Components included: • SoftGIS online self-assessment mapping (students map PA/sedentary locations, commuting routes). • Classroom PA feedback based on aggregated school-level maps. • FeetEnergy homework leaflet with PA recommendations, self-monitoring, and action planning. • Goal-setting and action-planning activities during HE lessons. • FeetEnergy PA video viewed in class and at home. • Optional parent leaflet. Delivered by Health Education teachers after brief training; no external staff or equipment needed.	Days with ≥1 hour of brisk PA (self-report): Small but statistically significant increase of ~0.3 extra days/week in the intervention group compared with control ($p < 0.05$). Proportion meeting PA guidelines (self-report): Intervention group had ~4% more students meeting daily PA guidelines than controls ($p < 0.05$). All other PA outcomes (non-significant): • No significant differences between groups for active commuting, organised sport participation, self-reported sedentary behaviour, accelerometer-measured MVPA (~1 min/day difference), steps/day (~50-step difference), total accelerometer counts, sitting breaks, or activity diary outcomes (school PA, commuting PA, organised sport, sedentary time) (all $p > 0.05$). • Initial short-term improvements were not maintained at 7 months.	Reach: Very high; 96% attended ≥2 lessons. Adoption: All 14 schools participated (100%). Fidelity: Delivered as planned in 35/36 classes. Teacher acceptability: Moderate (ratings 2.4–3.2/5); technical issues reported. Parent engagement: Very low (~2% meaningful exposure).	One-sentence summary: The SoftGIS + Health Education program produced small short-term improvements in self-reported activity (~0.3 extra active days/week and +4% meeting PA guidelines), but showed no objective PA changes and no sustained effects at 7 months. Policy implication: Best used as a light-touch universal HE strategy, combined with environmental changes, whole-school initiatives, or family engagement to strengthen and sustain PA outcomes.
Andruschko, Okely & Pearson, 2018 (Sport4Fun)³⁶ Australia	School- and home-based: School Sport (compulsory), Homeroom (roll call), and After-school program	Pilot RCT (Level II) 6-month intervention	n=20 Mean age: 13.2 100% girls	Three-component program grounded in Social Cognitive Theory: 1. School Sport Sessions (17 × 90 min): Weekly practical sessions focused on developing 5 fundamental movement skills (sprint run, catch, overarm throw, two-handed strike, kick) through modified games and fun, age-appropriate activities. Supported by peer helpers from senior grades. 2. Behaviour Modification Lessons (up to 47 × 15 min): Short theory sessions during homeroom focused on goal setting, time management, self-monitoring (pedometer challenge), motivation, identifying barriers/supports, and decision-making for PA. 3. After-school PA Sessions (20 × 60 min): Optional weekly sport/fitness activities including aerobics, fitness circuits, tennis, boxing, powerwalking, skipping, and modified games. Comparison group: Regular school sport (90 min/week) plus normal homeroom; no after-school PA.	Total weekday PA (accelerometer counts/min): Significant increase of ~70–80 counts/min in intervention girls, while control girls declined ($p = 0.03$). Light-intensity PA (minutes/day): Intervention girls spent ~15–20 more minutes/day in light movement than control girls ($p = 0.02$). All other PA outcomes: No significant differences for MVPA (~1 minute/day difference), fundamental movement skills (run, throw, catch, kick, strike), or weekend accelerometer outcomes (all $p > 0.05$).	Feasibility: Strong; 19/20 participants completed post-testing (95% retention). Program is feasible within the school timetable and well received by participants. However, after-school component faces structural barriers (transport). Session delivery: • School sport: 100% delivered (17/17). • Behaviour modification: 98% delivered (46/47). • After-school sessions: 75% delivered (15/20). Attendance: • School sport: 91%. • After-school PA: 44% (limited by transport access). • Behaviour lessons: 79%. Participant enjoyment: High (4.0/5 school sport; 4.7/5 after-school). Recruitment: Low (29% consent rate among eligible girls).	One-sentence summary: The Sport4Fun program increased girls' weekday activity, reduced sitting time by ~20–25 minutes/day, and increased light activity by ~15–20 minutes/day, but did not improve MVPA or fundamental movement skills. Policy implication: A promising approach for low-fit adolescent girls, particularly when incorporating motor skill development and behaviour-skills training. However, the program requires larger trials, improved recruitment strategies, and solutions to after-school attendance barriers before broader implementation.
Belton et al., 2019	School-based: whole-	Cluster RCT (Level II)	n=490 Mean age: 12.8	A structured, multi-level intervention targeting students, teachers, and parents. Included:	Average daily MVPA (minutes/day): At 24 months, intervention students performed ~10 more minutes/day of	Fidelity: Delivered with high fidelity: teachers completed CPD	One-sentence summary: The Y-PATH program led to ~10 extra minutes/day of MVPA overall, ~12 extra minutes/day in girls, and significantly

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
(Y-PATH) ²⁵ Ireland	school, multi-component PA intervention delivered via PE classes, whole-school policies, teacher training, and parent engagement	24-month duration	48% girls, 52% boys	• PE Component: Focus on physical literacy, motivational climate, FMS practice, and maintaining MVPA. PE teachers received 4 hours CPD and delivered 6 Y-PATH lessons in Year 1 + 6 lessons in Year 2. Integrated PA journals and local activity directories. • Whole-School Component: PA promotion workshops for all teachers; development of a schoolwide PA charter; reinforcement of teachers as active role models. • Parent Component: PA information evening + periodic newsletters emphasising strategies for supporting PA outside school. Implemented for 1–2 academic years depending on school retention.	MVPA compared with control students ($p = 0.03$). Change in MVPA over time (time × intervention): The intervention significantly slowed the usual age-related decline in MVPA over the two-year period ($p = 0.011$). Female MVPA (minutes/day): • Intervention girls accumulated ~12 more minutes/day of MVPA than control girls at 24 months ($p = 0.014$). • Intervention girls showed a much smaller decline in MVPA across adolescence compared with girls in the control group. Male MVPA (minutes/day): • No significant differences between intervention and control boys ($p = 0.143$). • Both groups showed an age-related decline in MVPA.	and delivered required lesson blocks. Cost: Low cost: primary resource requirement was teacher CPD and printed materials. Uptake: Whole-school adoption feasible because components fit existing Irish PE curriculum. Attrition: Some attrition at 24-month follow-up (10 schools retained)	slowed the usual adolescent decline in MVPA, with no significant effects for boys. Policy implication Findings support statewide/national dissemination of programs embedding physical literacy, motivational climate, and whole-school engagement. Particularly relevant for addressing gender inequities in adolescent PA.
Christian sen et al., 2021 ²⁷ Sweden	School-based: classroom PA intervention (English + Math lessons + PE reflections)	Non-randomised pragmatic trial (Level III-2) 12-month intervention	n=57 Aged 16-18 years 70% girls, 30% boys	Multi-component classroom PA intervention across two semesters (14 weeks + 14 weeks). Components included: 1. Activity Breaks: Two 5-min low-intensity PA breaks during each English and Math lecture (total ~50 min/week) to interrupt prolonged sitting. 2. Classroom Adjustments: Standing desks, desk bikes, balance pads, exercise balls, and resistance bands rotated among students every 2 weeks to promote unstructured movement and reduce sedentary time. 3. PE Reflection Sessions: Weekly PE classes included 15-min podcasts and guided reflections on PA, motivation, and wellbeing to enhance engagement. Exposure frequency: English 2×/week, Math 3×/week; PE 1×/week. Delivered entirely by school staff within normal curriculum; no external providers.	MVPA (min/day): • No significant between-group differences at any timepoint ($p > 0.05$). • At 12 months, intervention group performed ~6 minutes/day more MVPA than controls ($p = 0.255$, not significant). Light physical activity – LPA (min/day): No significant between-group differences at 6 or 12 months ($p > 0.05$). Sedentary time – ST (min/day): No significant between-group differences at follow-up ($p > 0.05$). Within-group changes (Intervention group): • Small, non-significant increases in MVPA (+3.3 min/day, $p = 0.367$). • Small, non-significant increase in LPA (+6.8 min/day, $p = 0.228$). • Small, non-significant decrease in ST (–10 min/day, $p = 0.203$). Within-group changes (Control group): • Significant decline in LPA (–9.9 min/day, $p = 0.044$). • Significant increase in sedentary time (+16.3 min/day, $p = 0.028$). All other PA outcomes (non-significant): No significant differences for weekend activity, total counts, or steps/day (all $p > 0.05$).	Delivery: Delivered entirely by teachers as part of normal curriculum. Feasibility: High feasibility: Classrooms adapted with standing tables, desk bikes, and movement equipment. Fidelity: Some fidelity issues: students sometimes chose preferred stations rather than rotating strictly per protocol. Limitations: Small sample and non-random allocation noted as implementation limitations.	One-sentence summary: The classroom-based intervention did not significantly increase MVPA, low-intensity physical activity, or reduce sedentary time, but may have helped prevent the decline in PA typically seen in late adolescence, as the control group showed significant increases in sedentary time and reductions in light activity. Policy implication: This low-cost, curriculum-integrated classroom movement model may help maintain PA levels in older adolescents but is unlikely to meaningfully increase MVPA without stronger intensity components or whole-school reinforcement.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
Coimbra et al., 2021 ³² Switzerland	School-based: PE; Behavioural skill training embedded into PE, delivered during compulsory PE lessons	Cluster RCT (Level II) 7-8 week intervention	n=143 Mean age: 16.2 50% girls, 50% boys	Adapted MoVo-Lisa (Motivation–Volition–Lifestyle PA) behavioural skill training grounded in Theory of Planned Behaviour, Social Cognitive Theory, Self-Determination Theory, and Goal Achievement Theory. Delivered by a trained research assistant during PE lessons. Four 20-min sessions: (1) SMART health and PA goal setting; (2) Implementation intentions (when, where, how, with whom); (3) Peer discussion, feasibility checking, and PA journaling for 2 weeks; (4) Barrier identification and coping planning with counter-strategy development. Followed by 3-week independent implementation phase. Each session followed by 70 min of regular PE. Control group completed usual PE only.	Moderate-intensity PA (min/day): Intervention group increased from 24.6 to 34.9 min/day (+10.3 min/day), while the control group showed no improvement (25.4 to 23.9 min/day). Between-group effect: $p < .001$ (large effect). Vigorous-intensity PA (min/day): Intervention group increased from 22.9 to 29.6 min/day (+6.7 min/day), while the control group decreased from 36.4 to 24.3 min/day. Between-group effect: $p < .01$ (moderate effect). Total MVPA (moderate + vigorous, min/day): Intervention group increased from 47.4 to 64.4 min/day (+17.0 min/day), while the control group decreased from 61.8 to 48.3 min/day. Between-group effect: $p < .001$ (very large effect). Meeting general PA guidelines (≥ 150 min/week): At post-intervention, significantly more intervention students met adult PA guidelines than control students ($\chi^2 = 16.0$, $p < .001$). Meeting youth PA guidelines (≥ 420 min/week): At post-intervention, a significantly greater proportion of intervention students met youth-specific PA guidelines than control students ($\chi^2 = 5.3$, $p < .05$), reversing the baseline pattern.	Retention: 143/160 (89%). Delivery: 100% embedded in existing PE curriculum. Fidelity: Delivered as planned by trained research assistant. Resources: No specialist equipment. Scalability: High due to short session length and PE integration.	One-sentence summary: A 7-week PE-integrated behavioural skills program increased adolescent MVPA by ~17 min/day and improved volitional self-regulation. Policy implication: A low-cost, scalable PE-based strategy that can be embedded into national curricula to meaningfully increase adolescent PA through self-regulation and barrier-management training.
Corder et al., 2016 (GoActive) ²⁸ United Kingdom	School-based: whole-school, peer-led PA promotion program delivered during tutor time using a tiered leadership and competition model	Feasibility study + Pilot Cluster RCT (Level II) 8-week intervention	n=460 Mean age: 13.2 53% girls, 47% boys	GoActive is a school-wide PA promotion program designed to increase participation through choice, novelty, peer mentorship, rewards, and competition. Tutor groups selected two different activities each week from a bank of ~20 activities requiring minimal equipment. Older student mentors and rotating peer leaders encouraged participation. Students accumulated points for trying activities, contributing to inter-class competition, with small rewards for milestones. Activities could be completed during tutor time and outside school. Teachers supported delivery and points recording.	Accelerometer-assessed MVPA (min/day): The intervention group showed a statistically significant improvement relative to control, with an adjusted between-group difference of +5.1 min/day in favour of the intervention ($p = 0.014$), despite both groups showing overall declines in MVPA across the 8 weeks. Participation in activity types: Intervention students reported participation in more activity types than controls, approaching statistical significance (difference = +2.3 activities; $p = 0.07$). Peer support for PA: The intervention group showed a statistically significant increase in peer support compared with control ($p = 0.03$).	Reach: 77% of eligible students were measured. Acceptability (students): 71% of boys and 74% of girls reported the program was fun; 56–69% said it encouraged them to be more active; 61% indicated they would continue an activity after the program. Mentors: 88% found mentoring fun; 94% reported leadership skill improvements. Teachers: 91% enjoyed the program; 73% felt students were more active; 100% said classes found it fun. Fidelity issues: Variable mentor recruitment across schools; need for improved training, simplified points system, and better upfront communication identified for scale-up.	One-sentence summary: The GoActive peer-led, school-wide intervention produced a statistically significant +5 min/day improvement in MVPA relative to control, alongside gains in peer support and well-being, but required refinements to mentoring and delivery systems. Policy implication: GoActive represents a feasible, scalable, low-cost whole-school PA promotion model that leverages peer leadership and student choice. Findings support progression to a fully powered effectiveness and cost-effectiveness trial before wider policy adoption.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
Corder et al., 2020 (GoActive – Effective & Cost-effective)²⁶ United Kingdom	School-based: Whole-school, peer-led PA promotion program delivered during tutor/form time, supported by mentors, teachers, and local-authority facilitators	Cluster RCT (Level II) with embedded mixed-methods process and economic evaluation 12-week intervention with 10-month follow-up	n=2,862 Mean age: 13.2 48% girls, 52% boys	GoActive is a co-designed, theory-informed, population-wide PA promotion program aligned with Self-Determination Theory. Each tutor group selected two new activities per week from ~20 low-equipment activities. Older adolescent mentors and in-class peer leaders encouraged participation. Students earned points for activity completed in and out of school, logged via a website to unlock inter-class competition and rewards. For the first 6 weeks, a local-authority-funded facilitator supported mentors and teachers; support was reduced in weeks 7–12 to promote school-led sustainability. Control schools received usual curriculum only.	Accelerometer-assessed MVPA (min/day) at 10 months: The intervention group did not show a statistically significant improvement compared with control (baseline-adjusted difference –1.91 min/day, $p = 0.316$); MVPA declined in both groups. Post-intervention MVPA: No statistically significant between-group differences ($p > 0.05$). Sedentary time & Light PA: No significant between-group effects at the daily level; weekday patterns favoured control, while weekend patterns favoured intervention. Self-reported PA: Declined over time in both groups; no significant intervention effects. Cost-effectiveness: Mean delivery cost £13.06 per student; not cost-effective vs control (QALYs difference –0.006; intervention dominated).	Reach: 84.1% of eligible students consented; 75.7% attended 10-month follow-up. Engagement: Only 37.9% of intervention students attended ≥1 GoActive session in the last fortnight post-intervention; 46.5% ever logged points online. Acceptability: 62.9% of students, 70% of teachers, and 87.3% of mentors reported the program was fun. Fidelity: Low and highly variable between schools; mentor and teacher roles often unclear.	One-sentence summary: The 12-week GoActive peer-led, whole-school intervention did not produce a statistically significant improvement in accelerometer-assessed MVPA at 10 months, despite strong theoretical development and pilot promise, due to low implementation fidelity. Policy implication: This rigorously evaluated whole-school, peer-led PA model should not be scaled in its current form. Future school-based PA policy should prioritise simpler program designs, clearer staff accountability, stronger delivery infrastructure, and realistic expectations of effect size at scale.
Corepal et al., 2019 (StepSmart Challenge)⁵² United Kingdom	School and home-based: gamified pedometer competition combining individual, team, and inter-school challenges using Fitbit Zip devices, delivered across the school day and outside school via pedometer-based competitions	Cluster RCT (Level II) 22-week intervention with measurements at baseline, 22 weeks, and 52 weeks	n=224 Aged 12–14 years 53% girls, 47% boys	The StepSmart Challenge is a gamified PA intervention grounded in Self-Determination Theory and behavioural economics. Participants wore Fitbit Zip pedometers for the full 22 weeks. Phase 1 (8 weeks): Inter-school, within-school team, and within-school individual step-count competitions with weekly material (e.g., vouchers, prizes) and social incentives (certificates, trophies, leaderboards). A £1000 prize was awarded to the highest-performing school. Teams were formed using friendship network data and baseline PA levels. Phase 2 (14 weeks): Transition to individual challenges only, including weekly missions and virtual badge rewards via the StepSmart website and a closed Facebook group. Participants received workbooks, motivational messaging, and weekly challenges to encourage PA with friends and family. Control schools received no intervention and no pedometers.	MVPA (accelerometer): No statistically significant intervention effects were tested, as this was a feasibility trial. Intervention group MVPA remained stable from baseline to 52 weeks (≈33 min/day), while the control group showed a small temporary increase at 22 weeks followed by a decline at 52 weeks (≈37 min/day). Moderate-, Vigorous-, Light PA, and Sedentary Time: No clear intervention-related changes were observed across time points; patterns were broadly stable in intervention schools. Steps/day: Median daily steps declined slightly in the intervention group from ~8300 to ~7100 steps/day by 52 weeks, while control group steps also fluctuated with no consistent advantage.	Recruitment: 5/14 schools recruited (36%); student recruitment 94.9%. Retention: 95.5% returned accelerometers at baseline; 57.4% provided valid MVPA at 52 weeks. Acceptability: High among students and teachers; competition and incentives were strongly motivating for many participants. Engagement: Strong engagement with Fitbit devices; lower engagement with website and workbook. Fidelity challenges: Team composition issues, variable website use, summer attrition.	One-sentence summary: The StepSmart Challenge was a highly feasible and acceptable gamified school-based PA intervention, but no conclusions about effectiveness on MVPA could be drawn due to its feasibility design. Policy implication: Gamified pedometer-based school PA programs using competition, incentives, and peer networks are highly acceptable and scalable, but require full-scale effectiveness trials before policy translation, with improved long-term engagement strategies beyond initial competition phases.
Costigan et al., 2018 (HIIT RCT)³¹ Australia	School-based: High-Intensity Interval Training (HIIT) embedded within PE	RCT (Level II) 8-week intervention; assessments at baseline	n=65 Mean age: 15.8 31% girls, 69% boys	Students were randomised to two HIIT conditions (Aerobic Exercise Program [AEP] or Resistance & Aerobic Program [RAP]) or control. Both HIIT groups completed 24 sessions over 8 weeks (3 sessions/week). Each HIIT session consisted of a short warm-up, 8–10 minutes of HIIT (progressing from 8 to 10 minutes across the program), and	Moderate PA (min/day): The intervention showed a trivial and non-significant effect compared with control (adjusted difference +0.53 min/day, $p = 0.853$). Vigorous PA (min/day): The intervention showed a moderate but non-statistically significant effect	Accelerometer compliance: Valid wear time achieved by 62% at baseline and 78% during intervention week. Enjoyment & fatigue: 87% disagreed that HIIT made them too tired for PE; 87% disagreed that HIIT reduced activity during school breaks; 81% disagreed	One-sentence summary: Embedding short HIIT sessions into the school day produced a moderate increase in vigorous activity on HIIT days, but did not significantly increase overall daily MVPA across the week. Policy implication: Brief HIIT embedded into PE is safe, acceptable, and effective for boosting vigorous activity during the school day, but alone is unlikely to shift total daily PA. HIIT is

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
	lessons and lunchtime sessions	and during intervention (week 1)		brief cool-down, targeting ≥85% maximum heart rate using live heart-rate feedback (Polar Team system). Two HIIT sessions occurred at the start of PE lessons, and one at lunchtime each week. AEP involved continuous aerobic activities (e.g., shuttle runs, skipping), while RAP combined aerobic and body-weight resistance exercises (e.g., lunges + sprints). After HIIT, students completed normal PE. Control group undertook usual PE and lunchtime activities only.	compared with control (adjusted difference +1.70 min/day, $p = 0.354$). Daily PA on HIIT days (compensation analysis): Adolescents accumulated significantly more moderate PA (+10.8 to +11.6 min/day) and vigorous PA (+7.4 to +8.4 min/day) on HIIT days compared with usual school or PE days (all $p < 0.05$), indicating no compensatory reduction.	that HIIT reduced after-school activity. Fidelity: Sessions delivered by trained staff with real-time heart-rate monitoring to ensure intensity.	best positioned as a supplementary strategy within broader whole-school PA approaches.
Cowley et al., 2021 (HERizon Project)³⁷ United Kingdom & Ireland	Home-based: digitally delivered multi-component PA + behaviour change intervention; delivered remotely during national COVID-19 lockdown	RCT (Level II – formative feasibility trial); 6-week intervention with baseline and immediate post-intervention assessment	n=42 Aged 13-16 years 100% girls	HERizon is a home-based, SDT-informed multi-component intervention designed to increase PA and fitness in adolescent girls. Components included: (1) Exercise sessions: Participants completed 3 × 30-min PA sessions/week, choosing from YouTube workouts, self-designed workouts, or researcher-led live Zoom group workouts. (2) Behaviour change support calls: Weekly one-to-one video calls with an Activity Mentor (1 × 30 min introduction + 6 × 10 min calls) using autonomy-supportive behaviour change techniques (goal setting, planning, problem solving, social support). (3) Text messaging: 3 motivational SMS per week with reminders, encouragement, and live workout schedules. (4) PA logbook: Weekly self-monitoring of completed sessions. Control group continued usual activity and received no intervention contact.	Habitual PA (self-reported MVPA): The intervention group did not show a statistically significant change in habitual PA compared with the control group (group × time $p = 0.767$). Daily step count: No statistically significant between-group difference (group × time $p = 0.868$). Vigorous PA (days/week and hours/week): No statistically significant between-group differences ($p > 0.05$). Sedentary behaviour (TV viewing, gaming, internet use): No statistically significant intervention effects ($p > 0.05$).	Reach: 42/62 invited girls participated (68% recruitment rate). Retention: 100% retention (all 42 completed post-intervention testing). Adherence: Participants completed 18 ± 2 PA sessions on average (high compliance). Delivery: 154 mentor video calls delivered as planned; 18/18 live group workouts delivered; 396/396 SMS messages delivered. Acceptability: High - girls reported enjoying live workouts, mentor support, autonomy of activity choice, and social connection.	One-sentence summary: The HERizon home-based, mentor-supported digital intervention did not significantly increase habitual PA, but significantly improved fitness, intrinsic motivation, and body appreciation in adolescent girls. Policy implication: Home-based, digitally supported PA programs with female-only delivery, autonomy-supportive mentoring, and live social exercise options are highly feasible and acceptable, particularly for reaching inactive adolescent girls. However, larger, fully powered effectiveness trials with objective PA outcomes are required before broader policy implementation.
Cowley et al., 2024 (HERizon – multi-arm remote pilot RCT)³⁸ United Kingdom & Ireland	Home-based: digital PA + behaviour change intervention with four arms: (i) PA Programme, (ii) Behaviour Change Support, (iii) Combined, (iv) Comparison; Home-based, fully remote	Multi-arm Pilot Randomised Controlled Trial (NHMRC Level II – feasibility/effectiveness hybrid); 12-week intervention with post-intervention and 3-month follow-up	n=153 Mean age: 14.8 100% girls	HERizon is a Self-Determination Theory (SDT)–informed remote intervention. PA Programme (PROGRAM): Two live 35-min online group workouts/week (recorded for later viewing), including body-weight circuits and aerobic exercises with regression/progression options; PA logbook for self-monitoring; 3 motivational SMS/week; private moderated Instagram group. Behaviour Change Support (BC): Weekly mentor-led video calls (30 min at baseline & week 12; 15 min at weeks 1–6 & 9) delivered by trained Sport & Exercise Psychology trainees using needs-supportive coaching (goal-setting, action planning, barrier management, reflection). Combined (COMBO): Received all PROGRAM + BC	Device-measured MVPA (min/day): No statistically significant between-group differences at post-intervention ($p = 0.524$) or at 3-month follow-up ($p = 0.948$). Self-reported MVPA (HBSC days/week): No statistically significant between-group differences at post-intervention ($p = 0.548$) or follow-up ($p = 0.158$). Vigorous PA frequency & duration: No statistically significant between-group effects at either timepoint (all $p > 0.17$).	Recruitment: Target achieved (153/160 planned). Accelerometer compliance: 75% at baseline, 52% post-intervention, 37% at 3-month follow-up. Adherence: High engagement with mentor calls and online workouts across intervention arms. Delivery fidelity: Manualised mentor calls, standardised SMS, and live workout delivery achieved as planned. Acceptability: High participant satisfaction with mentor support, autonomy of activity choice, and social connection.	One-sentence summary: The multi-arm HERizon remote intervention did not significantly increase device-measured or self-reported MVPA, but significantly improved perceived competence, autonomous motivation, and muscular endurance, particularly in the combined PA + behaviour change arm. Policy implication: Remote, SDT-guided PA interventions with mentor-delivered behaviour change support are feasible, scalable, and psychologically beneficial for adolescent girls, but larger, fully powered trials with stronger PA stimulus and longer follow-up are required before policy-level implementation for MVPA outcomes.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
	intervention delivered outside school hours			components. Comparison: PA logbook only.			
Cushing et al., 2021⁵³ USA	Home-based: fully digital mHealth behavioural intervention using tailored text messages, community-based, intervention delivered remotely via SMS; participants used study-provided smartphones	Non-randomised controlled trial (Level III-2); 20-day intervention	n=40 Mean age: 15.3 75% girls, 25% boys	NUDGE: Network Underwritten Dynamic Goals Engine—a control theory-based adaptive text messaging system. Components included: • Daily goal-setting prompts (user-selected MVPA goals). • Morning reminders of stored goals. • Self-monitoring of MVPA minutes via SMS each afternoon. • Automated adaptive feedback indicating whether goal was achieved. • Adaptive goal revision: new goals restricted to 75–125% of previous performance; minimum 15 and maximum 120 min/day. • Chatbot adjusted feedback wording based on user input and past performance. Control group: Wore accelerometer and completed surveys only—no intervention content.	Objectively measured MVPA (accelerometer): Intervention group accumulated +20.84 min/day more MVPA than control (statistically significant). Sedentary time (accelerometer): Intervention group averaged 82 min/day less sedentary time, but effect was not statistically significant due to high variability. Patterns: MVPA improvement consistent across days; weekend effects explored but not statistically meaningful.	Feasibility: High. Participants exchanged messages regularly; system functioned as intended. Acceptability: 90% reported being very or mostly satisfied; enjoyment rated above average. Engagement: Participants responded to daily prompts; very few unexpected/out-of-sequence messages. Technical issues: Minimal; occasional “goal-loop” events when participants selected goals outside allowable range.	One-sentence summary: A 20-day adaptive text-message intervention significantly increased adolescent MVPA by ~21 min/day compared with attention control. Policy implication: Shows promise as a low-cost, scalable mHealth approach for boosting adolescent PA. Appropriate for integration into broader youth health programs, but requires longer trials to evaluate sustainability, optimal dosing, and cost-effectiveness.
Direito et al., 2015 (AIMFIT – Apps for IMproving FITness)³⁹ New Zealand	Home-based: mHealth-delivered stand-alone fitness app intervention vs usual behaviour, home use of smartphone apps	3-arm Parallel RCT (NHMRC Level II); 8-week intervention with baseline and post-intervention assessment	n=51 Mean age: 15.7 57% girls, 43% boys	Participants were randomised to: (1) Immersive app (Zombies, Run! 5K Training), (2) Non-immersive app (Get Running – Couch to 5K), or (3) Control (usual behaviour). Both apps delivered a fully automated 8-week progressive running program aiming to achieve a 5 km run, incorporating self-monitoring, feedback, progressive overload, audio coaching, music integration, and performance tracking. The immersive app embedded the program within a gamified narrative (zombie-themed missions). Participants were encouraged (but not prompted) to use the app 3 times/week, ad libitum. No supplementary counselling, reminders, or co-interventions were provided.	Objectively measured MVPA (accelerometry, min/day): The intervention did not produce a statistically significant change in MVPA compared with control (immersive vs control +1.74 min/day, $p = 0.98$; non-immersive vs control –1.82 min/day, $p = 0.99$). Sedentary time, light PA, moderate PA, vigorous PA: No statistically significant between-group differences were observed for any intensity domain (all $p > 0.90$). Self-reported PA (PAQ-A): No statistically significant intervention effects ($p > 0.40$).	Recruitment: 51/143 screened eligible adolescents randomised. Retention: 96% completed post-intervention testing. Accelerometer compliance: 94% at baseline; 90% at follow-up. Adherence: Only 31% reported using the app ≥ 3 times/week. Acceptability: Layout and usability rated positively; immersive app rated more engaging. Engagement: Social networking features were rarely used; progress tracking and workout tasks most valued.	One-sentence summary: Stand-alone commercial fitness apps did not significantly improve adolescent cardiorespiratory fitness or PA compared with usual behaviour over 8 weeks. Policy implication: Commercial PA apps should not be relied upon as stand-alone strategies for increasing adolescent PA. Their greatest value is likely as adjunct tools within supervised, school-based, or multi-component behaviour change programs, where adherence and intensity can be supported.
Domin et al., 2022³⁴ Luxembourg	Home-based: smartphone mHealth intervention with Fitbit activity tracker in community/home setting	Within-subject 4-week trial (NHMRC III-2); baseline week + 3 intervention weeks	n=18 Mean age: 16.3 Girls and boys (% not reported)	Participants used the Mobile App for PA combining a Fitbit Charge 4 tracker, Fitbit app data, personalized daily PA prompts delivered after school (5–7pm), reminders-to-move (4–9pm), weekly personalised goal adjustments (+5%), chat-based interactive assistance, and reward vouchers for meeting consecutive daily goals. Intervention was used independently at home; no school involvement.	Sedentary time: Significant reduction in week 1 vs baseline ($p = .04$; bootstrapped $p = .02$). Trend reduced in weeks 2–3. MVPA (MET-based): No significant changes, though descriptive increases observed. MVPA (heart-rate based): No significant overall change. Step count: No significant overall increase; however, personalised	Feasibility: High feasibility; participants adhered to wearable use and received all prompts. Engagement: Engagement with prompts was good; reward system functioned as intended. Retention and adherence: Minimal dropout. Some variability in daily tracking completeness.	One-sentence summary: The theory-informed personalised app produced modest reductions in sedentary time and short-term increases in activity immediately after prompts but did not increase overall daily MVPA or steps. Policy implication: Personalised prompts and goal-adjusted digital interventions may complement broader youth PA strategies but are unlikely to meaningfully increase PA on their own without structured, supervised, or school-integrated components.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
					prompts produced marginally significant increases in steps/min in week 2 ($p = .09$; bootstrapped $p = .05$).		
Gammon et al., 2019⁵⁴ (Physical Active Lessons – PAL) United Kingdom	School-based: Teacher-delivered classroom movement integration (Physically Active Lessons) delivered within normal classroom lessons (maths, English, and whole-school subjects)	Feasibility Study + Pilot Cluster RCT (NHMRC Level II); Teacher training plus ~8-week implementation period with baseline and follow-up	n=321 Mean age: 13 49% girls, 51% boys	PAL training was delivered to teachers over two after-school sessions (2 hours each). Teachers were trained to integrate movement directly into academic lessons, rather than using activity breaks. Strategies included: students moving around the classroom to collect information, completing wall-based learning tasks, outdoor data collection, and rotating between active learning stations. Training was grounded in Social Cognitive Theory, focusing on barrier identification, coping strategies, and modelling of active pedagogical techniques. In the pilot phase, all subject teachers at the intervention school received training; control schools continued usual classroom teaching.	Sedentary time (school hours): The intervention did not produce a statistically significant reduction in students' sedentary time at follow-up in either the feasibility study or the pilot cluster RCT (all $p > 0.05$). Light-intensity PA: The intervention did not produce a statistically significant increase in light activity at follow-up ($p > 0.05$). Moderate PA: The intervention did not result in a statistically significant change in moderate-intensity activity ($p > 0.05$). Vigorous PA: The intervention did not show a statistically significant effect on vigorous-intensity activity ($p > 0.05$).	Feasibility: Training delivery to teachers was feasible within standard after-school professional development time. Teacher acceptability: Mixed; initial feasibility study showed good acceptability, but acceptability declined in the pilot phase, particularly for outdoor PAL and perceived impact on curriculum time. PAL intervention dose: In the pilot study, ~35% of Year 7 and 9 lessons were delivered as PAL, with teachers delivering ~2.2 PALs per week on average. Student acceptability: High, >90% of students who recalled PAL wanted lessons to continue; students reported PAL as more enjoyable and engaging. Costs: Training delivery cost ~£900 per school; minimal equipment required. Fidelity: PAL delivery increased post-training but declined over time.	One-sentence summary: The PAL teacher-training intervention was feasible and acceptable to students, but did not produce statistically significant reductions in sedentary time or increases in PA in secondary school students. Policy implication: While classroom movement integration is low-cost and highly acceptable to students, this PAL model should not be scaled in its current form for PA outcomes in secondary schools. Future PAL policy should prioritise higher-intensity movement strategies, stronger curriculum alignment, and sustained teacher support to achieve meaningful reductions in sitting time.
Gaudet et al., 2017 (A Bit of Fit – Fitbit Tracker Intervention)⁵⁵ Canada	School and home-based: Minimalist mHealth wearable intervention (Fitbit Charge HR) using self-monitoring and goal-setting only	Quasi-experimental crossover trial (NHMRC Level III-2); 7-week intervention for each arm with measurements at baseline, 7 weeks, and 14 weeks	n=46 Mean age: 13.0 52% girls, 48% boys	Students were allocated by class to immediate or delayed intervention in a crossover design. During the 7-week intervention phase, each participant received a Fitbit Charge HR wrist-worn tracker displaying real-time steps, heart rate, distance, calories, and active minutes. Students created an individual SMART goal following a brief researcher-led presentation. Participants had access to their personal Fitbit web dashboard for reviewing progress. No counselling, reminders, social support, competitions, or behaviour change sessions were provided beyond the initial goal-setting and device provision. During the control phase, students received no intervention. MVPA was measured using Actical accelerometers at baseline and after each intervention period.	Overall MVPA (accelerometer, min/day): The intervention did not produce a statistically significant overall increase in MVPA when all participants were combined (time effect only: $p = 0.008$; no intervention main effect). Within-group change – First intervention group: The first group exposed to Fitbit showed a statistically significant increase of +10.9 min/day over the first 7 weeks ($p = 0.03$). Within-group change – Delayed intervention group: When later exposed, the second group increased MVPA by +13.2 min/day, but this was not statistically significant ($p = 0.49$). Between-group comparisons: No statistically significant differences between groups at baseline, 7 weeks, or 14 weeks.	Recruitment: 46/52 eligible students (88%). Retention: 100% of participants retained, but accelerometer compliance declined over follow-ups (43 at baseline; 27 at 14 weeks). Wear time: Valid Fitbit wear peaked in the first 2 weeks, then dropped sharply from week 3 onward ($p < 0.001$). Engagement: Mean valid Fitbit wear 30 days (range 6–49). Acceptability: High initial novelty effect; rapid decline in sustained engagement.	One-sentence summary: A minimalist Fitbit-only intervention did not significantly increase MVPA overall, but produced a >15 min/day statistically significant MVPA increase in adolescents already in the action/maintenance stages of behaviour change. Policy implication: Wearables should not be deployed as stand-alone population strategies for adolescent PA promotion. Their greatest policy value lies as adjunct tools within multi-component, behaviourally supported school or community programs, especially when targeted to adolescents with demonstrated readiness to change.
Gómez-Cuesta et al., 2024⁵⁶	School and, home-based:	Randomised controlled trial	n=462 Mean age: 13.8	Four step-tracking apps (Strava®, Pacer®, MapMyWalk®, Pokémon Go®) assigned by class. Adolescents required to complete ≥3 walking sessions/week	Self-reported PA (PAQ-A): Only inactive EG adolescents reported significant increases in perceived PA (p	Feasibility: High feasibility; minimal attrition (6.9%). High adherence to app use; average	One-sentence summary: A 10-week after-school mobile app walking program improved body composition and fitness and increased PA

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
Spain	mobile app walking program promoted through PE but performed after school	(Level II); 10-week intervention	48% girls, 52% boys	after school, with progressive weekly targets (7,100 steps/session in week 1 → 12,500 steps/session in week 10). Distance guidance provided in km (4.57 km → 8.00 km). PE teachers promoted and explained app use; completion contributed up to 1 extra PE grade point. CG continued normal PE only.	< 0.05). No significant PAQ-A change in active adolescents or controls.	distance ≈147 km across 10 weeks. Engagement and acceptability: Engagement similar across apps. Good fidelity; teachers promoted program as intended. Acceptability high.	only among adolescents who were initially inactive. Policy implication: PE-promoted mobile app walking programs are feasible and scalable and may particularly benefit inactive youth, but require integration with broader strategies (e.g., structured MVPA opportunities) to meaningfully increase PA for all adolescents.
Gråstén et al., 2017 (Physical Activity as Civil Skill Program) ³⁰ Finland	School-based: PE + whole-day activity environment intervention targeting motivational climate and school break activity	Non-randomised controlled longitudinal intervention (NHMRC Level III-2); 12-month intervention with baseline (T0) and 1-year follow-up (T1)	n=240 Mean age: 14.5 Girls and boys (% not reported)	The Physical Activity as Civil Skill Program was grounded in Achievement Goal Theory (AGT) and the Social Ecological Model (SEM). Two core components: \n1) Task-involving climate support in PE: PE teachers completed 4 × 90-min workshops focused on autonomy-supportive, mastery-oriented teaching, cooperative learning, individualised progress, effort-based feedback, and positive encouragement. \n2) Additional daily PA opportunities: Introduction of a daily 30-min extended active break, supervised access to fitness halls, ball games (e.g., floorball, soccer, basketball, badminton), and free access to PA equipment during breaks. Students were responsible for setting up equipment and games. Teacher training extended across 2011–2013; the evaluated intervention ran across one full school year (2012–2013). Control schools continued usual PE and break-time practices.	Self-reported MVPA (days/week ≥60 min/day): The intervention group did not show a statistically significant change in MVPA across the 12-month period, and MVPA remained stable in both intervention and control groups (all $p > 0.05$).	Fidelity: PE climate, Students in the intervention schools reported a statistically significant increase in task-involving climate and a decrease in ego-involving climate ($p < 0.05$). Teacher training: Most teachers (61%) attended at least one supplementary training session. Break-time delivery: Teachers supervised daily extended breaks and PA access; students actively managed equipment. Acceptability: High engagement with supervised break-time games and facility access. Monitoring: Program staff observed school breaks twice per month.	One-sentence summary: The Physical Activity as Civil Skill Program significantly improved students' perceptions of physical competence, but did not produce a statistically significant change in total MVPA over 12 months. Policy implication: School-based strategies that combine mastery-focused PE climates with structural break-time PA opportunities are effective for improving perceived competence, a key driver of lifelong PA. However, additional community and family-based strategies are required if the policy goal is to shift total daily MVPA at scale.
Gråstén et al., 2015 (School-Initiated Physical Activity as Civil Skill Program) ⁵⁷ Finland	School-based: Whole-school, multi-level school-day PA intervention targeting PE climate + break-time activity opportunities	Non-randomised controlled longitudinal study (NHMRC Level III-2); 1 academic year (Grade 7 → Grade 8) with baseline (2011) and follow-up (2012)	n=847 Aged 12–14 years; 50% girls, 50% boys	The Sotkamo Physical Activity as Civil Skill Program was grounded in Achievement Goal Theory and the Social Ecological Model and included two integrated components: 1) Task-involving motivational climate in PE: Four PE teachers completed 4 × 90-min workshops focused on cooperative learning, student autonomy, individualized goal progression, mastery-oriented feedback, and effort-based evaluation. 2) Physical school environment enhancement: Introduction of a daily 30-min extended active break, open access to a fitness hall, teacher-supervised student-led ball games during breaks, and school-wide PA equipment provision (e.g., floor hockey, table tennis, basketball, dance pads, disc golf). Students were responsible for setting up and managing activities under supervision. Control schools continued usual PE and break-time practice.	Self-reported MVPA (days/week ≥60 min): The intervention group showed a statistically significant relative improvement compared with control across one school year, with the increase in MVPA being 13.4% higher than in control students ($p < 0.001$).	Recruitment: 75% of eligible students consented in the intervention school; 73% in control schools. Delivery: PE climate training delivered as scheduled; extended breaks and fitness hall access implemented daily. Monitoring: School breaks monitored by project leaders twice per month. Fidelity: High for environmental modifications; teacher participation in PE workshops varied (61% attended ≥1 supplementary session). Acceptability: Strong student engagement with supervised ball games and open equipment access during breaks.	One-sentence summary: The school-initiated multi-level PA program significantly attenuated the age-related decline in adolescent MVPA, producing a 13.4% higher MVPA change than control across one school year. Policy implication: Whole-school strategies that combine PE motivational reform with structural break-time PA opportunities are effective for preserving adolescent MVPA at scale. This model is particularly suited to population-level prevention of PA decline, though additional out-of-school strategies would be required to drive large absolute MVPA increases.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
Guthrie et al., 2015 (Zamzee) ⁵⁸ United States	School and home-based: mHealth + incentive-based digital intervention using accelerometer + online rewards platform	Multi-site Randomised Controlled Trial (NHMRC Level II); 6-week intervention with weekly MVPA assessment	n=182 Mean age: 12.7 48% girls, 52% boys	Zamzee is an accelerometer-linked online feedback and incentive system. All students wore a Zamzee 3-axis accelerometer. Randomised to: (1) Zamzee Intervention – access to personalised real-time MVPA feedback, daily and weekly graphical summaries, points-based rewards (ZAMs) redeemable for gift cards/charity, goal-achievement “levels”, avatars, and social comparison leaderboards; (2) Active Control – received Dance Dance Revolution (DDR) active videogame with free play; (3) Passive Control – wore accelerometer only, no feedback or rewards. Students used platforms ad libitum.	Daily MVPA (min/day): The Zamzee group accumulated 15.26 min/day of MVPA compared with 10.27 min/day in passive controls and 9.12 min/day in DDR controls, representing a 49% increase vs passive control and 67% increase vs active control ($p < .0001$ for both). Stability over time: The MVPA benefit did not diminish across the 6-week period (no significant Group $\times$ Week interaction, $p = 0.605$). • Sex-specific effects: Girls increased MVPA by 39% ($p = .0049$) and boys by 76% ($p < .0001$) in the Zamzee group.	Adherence: 96% provided valid activity data; mean 26.4 valid days of wear over 6 weeks; average 8.9 hours/day wear time. Engagement: 82% of Zamzee participants accessed the website at least once; median incentive earnings US\$5/week. DDR engagement: Only 51% used DDR at least once. Acceptability: High initial engagement driven by rewards and feedback.	One-sentence summary: The Zamzee accelerometer-linked incentive platform produced a ~50–70% statistically significant increase in daily MVPA over 6 weeks, outperforming both passive monitoring and an active videogame control. Policy implication: Incentive-based wearable + digital feedback systems show strong short-term effectiveness for increasing adolescent PA, but long-term sustainability, cost-effectiveness, and equity impacts must be established before widescale policy adoption. Best positioned as a complement to school-based or community PA programs, not a stand-alone population strategy.
Harrington et al., 2018 (Girls Active) ²⁹ United Kingdom	School-based: whole-school, peer-led school-based intervention targeting girls' PA culture and opportunities	Cluster RCT; 14-month intervention with follow-ups at 7 months and 14 months	n = 1,752 Mean age: 12.8 100% girls	Girls Active is a whole-school, peer-led PA program developed by the Youth Sport Trust. Teachers completed a school self-review and action planning, attended centralised training, received marketing resources, and were provided £1,000 total capacity funding. Schools established peer leadership groups of girls to promote PA, influence PE/sport provision, and act as role models. Ongoing hub-school and development coach support were provided. Control schools continued usual PE and sport provision.	Moderate-to-vigorous physical activity (MVPA; min/day): • At 14 months, the intervention group showed no statistically significant improvement in MVPA compared with control (mean difference 1.7 min/day, $p = .178$). • At 7 months, the intervention group showed a statistically significant increase in MVPA compared with control (2.4 min/day, $p = .039$). Overall PA (average acceleration): • At 7 months, the intervention group showed a statistically significant increase in overall PA compared with control (1.39 mg, $p = .030$). • No significant difference at 14 months. Light PA (min/day): • At 7 months, the intervention group showed a statistically significant increase in total light PA (5.7 min/day, $p = .018$) and school-day light PA (4.5 min/day, $p = .038$). • No significant differences at 14 months. After-school sedentary time (min/day): • At 7 months, the intervention group showed a statistically significant reduction in after-school sedentary time (−4.7 min/day, $p = .026$). • No significant difference at 14 months. Meeting youth PA guidelines (≥60 min/day): The intervention group showed no statistically significant difference in the proportion meeting PA	Recruitment: 20 schools (10 intervention, 10 control); 1,752 girls recruited. Accelerometer compliance: ~69% provided valid primary outcome data at 14 months. Implementation dose: All schools implemented at least some elements, but fewer strategies were delivered than originally planned. Acceptability: High among teachers and peer leaders; girls reported enjoying leadership roles and new activity opportunities. Barriers: Competing curriculum priorities, time constraints, variable senior leadership support. Costs: Estimated £23–£95 per pupil.	One-sentence summary: Girls Active produced small short-term increases in MVPA and light PA at 7 months, but no sustained improvements in MVPA at 14 months. Overall policy implication: Whole-school, peer-led PA promotion models like Girls Active require stronger structural PA dose requirements and sustained leadership enforcement to achieve long-term population-level changes in adolescent girls' PA.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
					guidelines at either 7 or 14 months ($p > .05$).		
Isensee et al., 2018 (Lauff)⁵⁹ Germany	School-based: whole-school pedometer-based PA competition with behaviour change strategies	Cluster RCT (NHMRC Level II); 12-week intervention with 1-year follow-up	n=1,020 Mean age: 13.7 48% girls, 52% boys	The “lauff.” program is a 12-week school-based pedometer intervention targeting daily PA across school and leisure time. All students received Omron Walking Style pedometers to self-monitor daily steps. Students uploaded steps to a secure online platform using personal accounts. Core components included: (1) Class-level step competitions during weeks 1, 5, and 11 with cash prizes for highest mean steps and greatest improvement; (2) Creative PA school-life challenges where classes designed and logged ideas to integrate PA into daily routines; (3) Four educational PA lessons focused on goal-setting, strategies for daily PA integration, and reflection; (4) Peer-driven motivation and social norm reinforcement via class-level competition and recognition. Control schools continued usual curriculum with no pedometers.	Moderate-to-vigorous physical activity (MVPA): At 1-year follow-up, the intervention group showed a statistically significantly greater increase in MVPA than the control group (group $\times$ time interaction $p < .05$). Active commuting (minutes/day): The intervention group showed a statistically significant increase in active commuting compared with control ($p < .001$). Out-of-school sports participation: The intervention group showed a statistically significant increase compared with control ($p < .05$).	Reach: 29 schools participated; high student participation across schools. Retention: 1-year follow-up achieved with high school-level retention. Adherence: Pedometer wear and online step logging were maintained throughout intervention. Fidelity: All competition and lesson components delivered as planned. Acceptability: High student engagement due to competition, prizes, and peer motivation.	One-sentence summary: The pedometer-based intervention produced statistically significant long-term increases in adolescent MVPA, active commuting, and leisure-time sports participation at 1-year follow-up. Policy implication: Low-cost, school-based pedometer competitions integrated with behaviour change lessons are highly scalable and effective for sustaining adolescent PA, particularly for promoting daily movement beyond the school setting.
Jago et al., 2021 (PLAN-A – Peer-Led Physical Activity Intervention for Adolescent Girls)⁶⁰ United Kingdom	School-based: whole-school, peer-led school-based PA promotion intervention	Cluster RCT (NHMRC Level II); 10-week intervention with follow-up at 5–6 months post-intervention (~12 months post-baseline)	n=1,558 Mean age: 13.8 100% girls	PLAN-A is a peer-led diffusion-based intervention grounded in Diffusion of Innovation Theory and Self-Determination Theory. All girls completed a peer nomination process, with the top 18% nominated as peer supporters. Peer supporters received 2 days of off-site training plus a booster day, delivered by trained female facilitators, covering: (1) benefits of PA, (2) autonomy-supportive encouragement, (3) confidence building, (4) strategies for informal peer support. Peer supporters then informally promoted PA to their friends for 10 weeks through everyday conversations and encouragement. Control schools continued usual PE provision only.	Weekday MVPA (min/day): At follow-up, the intervention group showed a slightly greater decline in MVPA than the control group, with an adjusted between-group difference of -2.84 min/day, which was not statistically significant ($p = 0.071$). Weekend MVPA (min/day): The intervention group showed no statistically significant difference compared with control ($p = 0.857$). Weekday sedentary time (min/day): The intervention group showed no statistically significant difference compared with control ($p = 0.741$). Weekend sedentary time (min/day): The intervention group showed no statistically significant difference compared with control ($p = 0.791$).	Recruitment: 20 schools recruited; 1,558 girls consented. Accelerometer compliance: 78% provided valid data at both baseline and follow-up. Peer supporter participation: Only 3 peer supporters declined training. Delivery fidelity: All peer training and booster sessions delivered as planned. Acceptability: Peer supporters and staff reported training was engaging; informal peer delivery varied widely between schools. Reach of peer influence: Peer support exposure declined over time in both arms. Costs: Mean cost £2,817 per school (~£31 per girl).	One-sentence summary: The PLAN-A peer-led intervention did not increase weekday or weekend MVPA and showed a small non-significant decline in MVPA compared with control. Policy implication: Peer-led diffusion-only models should not be implemented as stand-alone school PA strategies. Future policy should prioritise structural, curriculum-embedded, and environment-based PA approaches over informal peer encouragement alone.
Kolle et al., 2020 (School in Motion – SciM)⁶¹ Norway	School-based: whole-school, timetable-embedded PA intervention with two active arms	Three-arm Cluster RCT (NHMRC Level II); 9-month intervention (Sept 2017–	n=2,084 Mean age: 14.0 50% girls, 50% boys	Schools were randomised to: (1) Physically Active Learning (PAL): (a) +60 min/week additional PE, (b) 30 min/week physically active learning integrated into academic subjects (e.g., maths, languages), and (c) 30 min/week PA session of at least moderate intensity. (2) Don’t Worry–Be Happy (DWBH): (a) 60 min/week “Be Happy” student-chosen group activities (e.g.,	Daily PA (accelerometer cpm): The PAL group showed a statistically significantly smaller decline in daily PA than controls (between-group difference $+34.7$ cpm, $p < .05$). The DWBH group showed no statistically significant difference vs control. Moderate-to-vigorous physical activity (MVPA, min/day): The PAL group showed a statistically significantly	Reach: 30/103 eligible schools participated; 76% student consent rate. Retention: 1,579 students provided valid PA data at follow-up. Dose delivered: PAL schools delivered ~83% of intended PA dose (~100 min/week); DWBH	One-sentence summary: The School in Motion PAL intervention significantly reduced the typical adolescent decline in daily PA and MVPA and significantly improved cardiorespiratory fitness, while the student-led DWBH model showed no PA benefit and a negative fitness effect. Policy implication: Mandated, teacher-led increases to weekly PE and physically active learning are effective and scalable strategies for protecting adolescent PA and fitness at the

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
		June 2018) with baseline and 12-month follow-up		dance, parkour, outdoor recreation), and (b) 60 min/week “Don’t Worry” PE-style skill sessions linked to those activities. Both intervention arms aimed to add 120 min/week of PA beyond compulsory PE. Control schools continued usual curriculum and standard PE only.	smaller decline in MVPA than controls (+4.7 min/day, $p < .05$). The DWBH group showed no statistically significant effect. School-day MVPA (min/day): The PAL group showed a statistically significant increase during school hours vs control (+5.6 min/day, $p < .001$). School-day sedentary time (min/day): The PAL group showed a statistically significant reduction vs control (–4.0 min/day, $p < .05$). The DWBH group showed a statistically significant increase in sedentary time vs control (+10.0 min/day, $p < .001$).	schools delivered ~78% (~94 min/week). Fidelity: All components delivered as scheduled; weekly teacher logs completed. Funding: ~AUD \$90 per student to support staffing and timetable changes. Acceptability: PAL well accepted by teachers; DWBH student-led format showed variable engagement.	population level. In contrast, student-led, self-organised PA models without structured intensity control should not be relied upon as primary policy levers.
Kwon et al., 2025 (Family & Peer Wearable Challenge) ⁶² United States	School and home-based: wearable technology intervention with family or peer challenges	Three-arm Cluster RCT – Pilot Trial (NHMRC Level II); 6-week intervention with pre–post assessment	n=75 Mean age: 13.0 51% girls; 49% boys	A 6-week multi-component wearable-based PA intervention grounded in Social Cognitive Theory. All groups received: (1) Fitbit Inspire 2 for self-monitoring & goal-setting, (2) 7-min PA education session, and (3) weekly motivational videos. Intervention arms added group-based challenges: Family Challenge Group (FCG): Youth paired with a parent using Fitbit family dashboard; parents received PA summaries and prompts to discuss PA. Peer Challenge Group (PCG): Youth competed with classmates via Fitbit leaderboards with researcher-facilitated goal setting and feedback. Control: Fitbit self-monitoring only. \nAll participants wore ActiGraph accelerometers pre- and post-intervention.	Sedentary time (min/day): The intervention did not produce a statistically significant reduction in sedentary time in either the family challenge group (–18.7 min/day, $p = 0.31$) or peer challenge group (–4.2 min/day, $p = 0.81$) relative to control. Light PA (min/day): The intervention did not produce a statistically significant increase in light PA in the family challenge group (+7.5 min/day, $p > 0.05$) or peer challenge group (+4.3 min/day, $p > 0.05$) compared with control. Moderate-to-vigorous physical activity (MVPA, min/day): The intervention did not produce a statistically significant increase in MVPA in either the family challenge group (+11.0 min/day, $p > 0.05$) or peer challenge group (–0.1 min/day, $p > 0.05$) compared with control. Between-group PA effects: No statistically significant group × time effects were observed for sedentary behaviour, light PA, or MVPA (all $p > 0.05$).	Recruitment: 75 students recruited across 3 classes. Retention: 68% completed post-intervention accelerometry. Adherence: Fitbit wear: ~60% used the device often or almost always. App engagement: Low - only 38% used the mobile app frequently. Challenge engagement: Only 39% frequently checked group challenges (PCG: 56%, FCG: 22%). Acceptability: High satisfaction with Fitbit (74%) and app (81%); lower satisfaction with group challenge feature (42%).	One-sentence summary: A 6-week family- and peer-supported wearable intervention did not significantly improve adolescent MVPA, light PA, or sedentary time compared with self-monitoring alone. Policy implication: Wearable-only and socially networked wearable interventions should not be relied upon as stand-alone school PA strategies. Parental involvement may hold promise, but stronger behaviour change scaffolding, longer duration, and adolescent-tailored digital platforms are required before policy-scale implementation.
Lee et al., 2020 ⁶³ Singapore	Home-based: digital social norms intervention using Fitbit Flex pedometer + automated weekly	RCT (Level II); 16-week intervention + 2-week baseline monitoring	n=311 Mean age: 14.6 68% girls, 32% boys	Participants wore Fitbit devices for 16 weeks. Once/week, each adolescent received an SMS ranking their weekly step count within their 12-person group. Two study arms: Anonymous arm: ranks shown with step counts only; Onymous arm: ranks shown with full names attached to each step count. Aim: test whether observable behaviour (names attached) increases PA relative to anonymous descriptive norms. No	Steps/week (Fitbit): No statistically significant differences between Onymous and Anonymous arms at any weekly timepoint (all $p > 0.05$).	Reach: 311 adolescents randomised; high completion (282 completed end-of-study). Adherence: ~65% wore pedometer nearly every day; ~66% read weekly ranking SMS every week. Acceptability: ~64% somewhat satisfied; similar across arms. Engagement with group identity: Onymous participants were significantly more likely to	One-sentence summary: Weekly descriptive norm messages with personal identification (names) did not increase adolescents’ step counts relative to anonymous rankings. Policy implication: Social-norm SMS ranking alone - whether anonymous or identifiable - is insufficient to increase adolescent PA. Norm-based strategies should be combined with stronger behavioural support (e.g., goal-setting, prompts, coaching, incentives) and delivered within meaningful peer or school-based contexts to maximise relevance.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
	SMS, community-based, entirely home/independent use with remote weekly SMS			coaching, reminders, or structured PA content provided.		know a group member (50.7% vs 21.7%).	
Lonsdale et al., 2019 (AMPED – Activity and Motivation in Physical Education)⁴⁶ Australia	School-based: Curriculum-embedded PE intervention via teacher professional learning in government secondary schools in low socioeconomic areas of Western Sydney, NSW	Cluster RCT (NHMRC Level II); Teacher training delivered across 7–8 months, with post-intervention and 14–15 month maintenance follow-up	n=1,421 Mean age: 12.9 45% girls, 55% boys	AMPED is a blended face-to-face + online teacher professional learning program grounded in Self-Determination Theory. Teachers were trained to: (1) Maximise movement & skill development, (2) Reduce transition time, (3) Build student competence, and (4) Support student autonomy and relatedness. Professional learning included: face-to-face workshops, structured online modules, implementation tasks, video exemplars of good and poor practice, mobile app-based teaching prompts, mentoring sessions, and discussion forums. Intervention was delivered entirely through regular PE lessons by classroom PE teachers. Control schools continued usual PE practice.	PE lesson MVPA (% lesson time): At post-intervention, the intervention group spent a statistically significantly greater proportion of lesson time in MVPA than control (+5.58%, $p < .001$; $\approx +4$ min/lesson). At maintenance, this effect remained statistically significant (+2.64%, $p < .001$; $\approx +2$ min/lesson). PE lesson sedentary time: The intervention group showed a statistically significant reduction in sedentary time compared with control at post-intervention ($p < .001$) and maintenance ($p \leq .001$). PE lesson light PA: The intervention group showed a statistically significant increase in light PA at post-intervention and maintenance ($p < .01$). PE lesson moderate PA: The intervention group showed a statistically significant increase in moderate PA at post-intervention and maintenance ($p < .01$). PE lesson vigorous PA: The intervention group showed a statistically significant increase in vigorous PA at post-intervention and maintenance ($p < .01$). Leisure-time MVPA: At post-intervention, the intervention group showed a statistically significant lower leisure-time MVPA than control (-1.09 min/day, $p = .006$). At maintenance, no statistically significant difference was observed ($p > .05$). Leisure-time sedentary behaviour, light PA, moderate PA, vigorous PA: No statistically significant between-group effects at any timepoint (all $p > .05$).	Recruitment: 23/64 eligible schools expressed interest; 14 selected. Teacher participation: 93% of PE teachers consented; 100% of Grade 8 PE teachers participated. Student retention: 78.7% of enrolled Grade 8 students provided baseline data. Fidelity: Observed teacher behaviours showed large, statistically significant improvements across all four AMPED teaching domains (all $p < .001$, $d > 1.6$). Acceptability: Teachers rated training as highly useful (4.82/5) and the platform as user-friendly (4.60/5). Dose delivered: Integrated into all regular PE lessons.	One-sentence summary: The AMPED teacher training program produced statistically significant and sustained increases in MVPA and reductions in sedentary time during PE lessons, but did not increase whole-day leisure-time PA. Policy implication: Mandating autonomy-supportive PE teacher professional development is a scalable, low-cost, and effective policy lever for increasing MVPA during school PE, particularly in low-SES settings. However, additional whole-school and out-of-school strategies are required to impact total daily adolescent PA.
Mateo-Orcajada et al., 2023⁶⁴	School and home-based: mobile app	Cluster RCT (Level II); 10-week	n=400 Mean age: 14.0	Students in intervention classes were assigned to one of four apps (Strava®, Pacer®, MapMyWalk®, Pokémon Go®). Required to use the app $\geq 3\times/\text{week}$	PAQ-A physical activity: No statistically significant between-group differences; intervention prevented	Retention: High (400 $\rightarrow$ 390 analysed). App adherence higher in girls (71%) and older	One-sentence summary: The mobile app program maintained PA levels and improved adiposity and fitness indicators but did not significantly increase PA.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
Spain	PA program promoted through PE but completed outside school hours	intervention with pre–post assessments	47.5% girls, 52.5% boys	outside school. Weekly step-distance targets increased from 7000 steps (week 1) to 12,520 steps (week 10). PE teachers provided instructions and monitored weekly adherence. Academic rewards were provided for completing targets. Control group continued usual routine.	expected declines but did not increase PA overall.	adolescents. PE teachers delivered instructions as planned. Engagement: Varied by app; no adverse events. Feasibility and cost: Feasible, low-cost, and easily integrated into PE.	Policy implication: School-facilitated mobile app use is feasible and acceptable; however, apps alone are unlikely to produce meaningful PA increases without additional structured school or social components.
Matthews et al., 2018 ⁴¹ Ireland	School-based: classroom behavioural intervention targeting leisure-time PA (LTPA)	School-level randomised feasibility trial (NHMRC Level III-2); 6-week intervention with 8-week post-intervention follow-up	n=49 Mean age: 15.8 31% girls, 69% boys	A theory-based self-regulation intervention grounded in Zimmerman’s Self-Regulation Model. Delivered as six weekly 30-minute classroom sessions during standard school hours across one school term. Techniques mapped to the three self-regulation phases: Forethought: SMART goal-setting for LTPA. Performance: Self-monitoring and mental imagery. Self-reflection: Strategic causal attributions (focusing on controllable causes such as effort and strategy). Sessions used group discussions, case studies, quizzes, guided imagery, and personal reflection tasks. Students applied techniques to their own chosen leisure-time PA outside school. Delivered primarily by the lead researcher, supported by a school teacher. Control group received six non-PA classroom sessions and continued usual PE.	Leisure-time MVPA (self-report, MET-minutes/week): The intervention group showed a small, non-statistically significant increase in leisure-time MVPA compared with the control group at 8-week follow-up (group × time $p = 0.27$). Within-group change (Intervention): The intervention group showed a small positive within-group increase in MVPA from baseline to follow-up, which did not reach statistical significance. Objective PA (pedometer steps/day): Outcome could not be analysed due to insufficient valid pedometer data at both timepoints (only 16% provided usable paired data).	Recruitment: 49/60 invited students consented (82%). Attendance: Mean session attendance 87% (range 79%–96%). Fidelity: All sessions delivered as intended; one case study delayed due to time constraints. Technique adoption: Goal-setting: 90% reported use; Self-monitoring: 53% reported regular tracking; Mental imagery: 84% reported use; Strategic attribution: 79% reported shifting toward controllable explanations. Acceptability: High engagement with interactive activities.	One-sentence summary: A 6-week theory-based self-regulation program was feasible, well-attended, and increased adolescents’ use of self-regulation techniques, but did not produce a statistically significant increase in leisure-time MVPA. Policy implication: Short, skills-based classroom self-regulation programs are feasible and low-cost for older adolescents, but are unlikely to meaningfully increase MVPA without stronger PA dose, environmental opportunities, or supervised activity components. These programs are best positioned as adjuncts within broader whole-school or community PA strategies.
Murphy et al., 2024 (WISH – Walking in Schools) ⁴⁷ Ireland	School-based: peer-led walking intervention delivered outside curriculum time (before school + break + lunch)	Cluster RCT (NHMRC Level II); ~20-week intervention (mean 19.9 weeks) with baseline, mid-intervention, post-intervention, and 12-month follow-up	n=589 Aged: 12–14 100% girls	WISH is a low-cost, peer-led school walking program underpinned by Self-Determination Theory and a socio-ecological framework. Older female students (aged 15–18 years) were trained as walk leaders to lead younger girls on 10–15 minute brisk walks before school, at break, and at lunch. Walk leaders received structured training in: (1) health walking principles, (2) pacing at brisk intensity, (3) motivation and social support, and (4) safe group leadership. Leaders used heart-rate monitors (~≥135 bpm target) as feedback for brisk intensity. Walks occurred entirely within school grounds, with girls encouraged to participate in multiple walks per day if desired. Walk leaders received ongoing social media support and a mid-intervention booster session. Control schools continued usual practice.	Total PA (accelerometer counts/min): At post-intervention, the intervention group showed no statistically significant difference compared with control (adjusted mean difference –33.5 cpm, $p = 0.213$). Moderate-to-vigorous physical activity (MVPA, min/day): The intervention group showed no statistically significant improvement compared with control ($p > 0.05$). Sedentary time (min/day): The intervention group showed no statistically significant reduction compared with control ($p > 0.05$). Proportion meeting PA guidelines (≥60 min/day): The intervention group showed no statistically significant increase compared with control ($p > 0.05$). School-day MVPA (exploratory analysis): The intervention group	Recruitment: 18 schools; 589 girls recruited. Walk leaders: 149 trained (mean 17 per school). Retention: High pupil retention to post-intervention and follow-up. Intervention dose: Schools scheduled 2–3 walks/day; actual attendance was low-to-moderate across schools. Fidelity: Walk leader training delivered as planned; variability in walk frequency and attendance between schools. Acceptability: Pupils reported enjoying the program. Barriers: Competing school demands, weather, exam pressures, variable student attendance.	One-sentence summary: A ~20-week peer-led school walking intervention did not significantly increase total PA, MVPA, or the proportion of girls meeting activity guidelines. Policy implication: Peer-led school walking programs alone should not be relied upon to increase adolescent girls’ MVPA at scale. Future policy should prioritise timetable-protected PA opportunities, structured intensity targets, and stronger incentives or curriculum integration to ensure sufficient participation and dose.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
					showed no statistically significant difference compared with control at post-intervention ($p > 0.05$).		
Okely et al., 2017 (Girls in Sport) ¹⁶ Australia	School-based: whole-school, health-promoting schools intervention targeting school sport, school environment, and community links in secondary schools across urban, regional, and rural New South Wales.	Group Cluster RCT (NHMRC Level II); 18-month intervention with baseline (2009) and follow-up (2010–2011)	n=1,518 Mean age: 13.6 100% girls	Girls in Sport was a multi-component whole-school intervention embedded within the Premier's Sporting Challenge (NSW) and guided by Health Promoting Schools and Action Learning frameworks. Each intervention school formed a Girls in Sport Committee (executive staff, teachers, and female students) and developed a school-specific 18-month action plan across three domains: (1) Formal curriculum (school sport & PE) – increasing MVPA during sport sessions and introducing non-traditional activities preferred by girls (e.g., yoga, Zumba®, boxing-style fitness, skipping); (2) School environment – lunchtime and after-school programs, policy changes for uniform use, PA promotion through school awards and culture; (3) Community links – partnerships with local sports clubs, PCYCs, fitness centres, and community providers. Schools received two-day professional development workshops, a mid-intervention symposium, ongoing critical friend support, and implementation funding. Control schools continued usual sport and PE provision.	Accelerometer-derived total physical activity (TPA): From baseline to 18 months, there was a statistically significant decline in TPA in both intervention and control groups, with no statistically significant between-group difference (group $\times$ time $p = 0.89$). Sedentary time (min/day and % of wear time): Both groups showed statistically significant increases in sedentary time over 18 months, with no statistically significant intervention effect (group $\times$ time $p > 0.73$). Light-intensity PA (min/day and % time): Both groups showed statistically significant declines, with no statistically significant between-group difference (group $\times$ time $p > 0.51$). Moderate PA (min/day and % time): Both groups showed statistically significant declines, with no statistically significant intervention effect (group $\times$ time $p > 0.83$). Vigorous PA (min/day): Both groups showed very low baseline levels and further statistically significant declines, with no statistically significant between-group difference.	Recruitment: 24 schools recruited from 500 expressions of interest. Baseline participation: 86% of eligible girls assessed at baseline. Accelerometer validity: ~80% valid data at baseline; 43% at follow-up. Implementation fidelity: Only 4 of 12 intervention schools implemented the program as intended; 5 schools met <50% of implementation criteria. Support: Monthly critical-friend meetings with research staff. Acceptability: Schools valued choice-based activities and non-traditional sports.	One-sentence summary: The Girls in Sport whole-school intervention did not significantly reduce the age-related decline in objectively measured PA among adolescent girls, except in a small per-protocol subgroup of high-implementation schools. Policy implication: Whole-school PA programs without strong accountability, delivery enforcement, and protected activity time are unlikely to produce population-level PA change. Policy should focus on mandated curriculum-embedded PA and structured intensity targets, alongside whole-school cultural strategies.
Ridgers et al., 2021 (RAW-PA – Raising Awareness of Physical Activity) ⁶⁵ Australia	School and home-based: wearable and social media digital behaviour change intervention secondary schools in socio-economically disadvantaged areas of Melbourne, Victoria	Cluster RCT (NHMRC Level II); 12-week intervention with assessments at baseline, 12 weeks (post), and 6-month follow-up	n=275 Mean age: 13.7 52.3% girls, 47.7% boys	RAW-PA was a 12-week multicomponent digital intervention grounded in Behavioural Choice Theory and Social Cognitive Theory, co-designed with adolescents. Components included: (1) Fitbit Flex wearable tracker with app-based self-monitoring of steps and activity intensity; (2) Private researcher-moderated Facebook group delivering weekly behaviour-change "missions" (e.g., goal setting, pair-up activity, stair challenges, step challenges); (3) Matched digital behaviour-change resources (short videos, infographics); (4) 2–3 weekly alerts/reminders to prompt engagement with online content. Missions targeted goal setting, self-monitoring, self-efficacy, and social support. Participants retained the Fitbit after the intervention. Wait-list control schools received the intervention after the 6-month follow-up.	Device-measured MVPA (min/day, immediately post-intervention): The intervention group showed no statistically significant difference compared with control (+0.5 min/day, $p = 0.81$). Device-measured MVPA (min/day, 6-month follow-up): The intervention group showed a statistically significant reduction in MVPA compared with control (–5.0 min/day, $p = 0.02$). Male MVPA at 6 months: Intervention males accumulated statistically significantly less MVPA than control males (–11.0 min/day, $p = 0.001$). Female MVPA at 6 months: No statistically significant difference between groups ($p > 0.05$). Self-reported PA (days/week meeting 60 min MVPA): The intervention group showed no statistically significant differences compared with control at	Recruitment: 18 schools; ~20% of Year 8 students met eligibility and enrolled. Retention: 198 provided valid accelerometer data post-intervention; 193 at 6 months. Accelerometer compliance: ~72% at post-test; ~70% at follow-up. Digital engagement: Low engagement with Facebook missions and challenges reported. Wearable acceptability: Fitbit perceived as easy to use, but charging/syncing reduced engagement. Equity reach: Successfully recruited adolescents from low-SES areas.	One-sentence summary: The RAW-PA wearable-plus-digital intervention did not increase adolescent MVPA at 12 weeks and was associated with a statistically significant reduction in MVPA at 6-month follow-up, particularly among boys. Policy implication: Wearable-only or wearable-plus-social-media interventions should not be implemented as stand-alone strategies for adolescent PA promotion, particularly in low-SES settings. Future policy should prioritise timetable-embedded, supervised activity opportunities supported by digital tools rather than relying on self-directed engagement alone.

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
					post-intervention or 6-month follow-up (all $p > 0.05$).		
Schmidt et al., 2020⁶⁶ Norway	School-based: whole-of-school health promotion program with physically active learning (PAL), active breaks, and PE	Quasi-experimental pre-post controlled study (NHMRC Level III-2); 7-month intervention (Sept 2017–Apr/May 2018)	n=644 Mean age: 13.2 49% girls, 51% boys	Active and Healthy Kids is a multi-component, socio-ecological, school-based health promotion program led by the Telemark County Council and grounded in salutogenic theory and Self-Determination Theory. The PA component included: (1) Physically Active Learning (PAL): 135 min/week using movement during English, Mathematics, and Norwegian lessons; (2) Physically active classroom breaks: 25 min/week (5-min activity breaks); and (3) PE as usual: 135 min/week. Combined dose aimed to provide ~59 min/day of school-based PA. Teachers completed mandatory PAL training workshops and follow-up planning sessions. Each school appointed a PAL resource teacher, and implementation involved collaboration between school leaders, teachers, nurses, and municipal public health staff. Control schools continued usual curriculum and PE only.	School-time MVPA (min/day): At follow-up, the intervention group showed a statistically significant increase in school-time MVPA compared with the control group (group $\times$ time $p < .001$). School-time sedentary time (min/day): The intervention group showed a statistically significant reduction in sedentary time compared with the control group ($p = .001$). School-time total PA (cpm): The intervention group showed a statistically significant increase in total PA compared with the control group ($p < .001$). Full-day MVPA (min/day): There was no statistically significant between-group difference in full-day MVPA at follow-up ($p = .446$). Proportion meeting PA guidelines (≥ 60 min/day): No statistically significant change in the proportion meeting guidelines across groups.	Recruitment: 644/813 eligible students consented (79% response). Accelerometer compliance: 484 valid datasets at baseline; 329 at follow-up (full day); higher compliance during school hours. Training: All intervention schools received formal teacher PAL training; participation in planning meetings varied. Fidelity: All intervention schools implemented PAL and active breaks; teacher adherence varied. Equity reach: Delivered in a region with documented poor public health profile.	One-sentence summary: A 7-month multi-component whole-school PAL intervention significantly increased school-time PA and reduced school-time sedentary behaviour, but did not increase adolescents' total daily MVPA. Policy implication: PAL and active breaks should be embedded as core education policy to improve in-school activity exposure, but additional before- and after-school strategies are required to shift total daily PA at the population level.
Sebire et al., 2019 (PLAN-A – Peer-Led physical Activity iNtervention for Adolescent girls)⁶⁷ United Kingdom	School-based: whole-school, peer-led social diffusion intervention delivered through friendship networks	Feasibility Cluster RCT (NHMRC Level II); 10-week peer-diffusion intervention with assessments at baseline (T0), end of Year 8 (T1), and start of Year 9 (T2 $\approx$ 12-month follow-up)	n=427 Aged 12–13 100% girls	PLAN-A is an informal peer-led PA diffusion intervention adapted from the ASSIST smoking prevention model and grounded in Self-Determination Theory. All Year 8 girls completed peer nomination, with the top 18% most influential girls invited to become Peer Supporters (PSs). PSs attended: (1) 2 consecutive full training days off-site, and (2) a mid-intervention top-up training day at 5 weeks. Training covered: PA benefits, being active with friends, sedentary behaviour, confidence in communication, empathy, supporting autonomy, and developing an active identity. Training was delivered by external female trainers with youth-work and health-promotion experience. Following training, PSs engaged in 10 weeks of informal, unstructured peer encouragement within their friendship groups (e.g., co-participation, subtle encouragement, sharing ideas). Control schools continued usual practice.	Weekday MVPA (min/day, accelerometer, T1): At immediate post-intervention, the intervention group showed no statistically significant difference compared with control (+1.1 min/day). Weekday MVPA (min/day, accelerometer, T2 $\approx$ 12 months): At 12-month follow-up, the intervention group showed a statistically significant improvement compared with control (+6.1 min/day), indicating prevention of the usual age-related decline in MVPA.	Recruitment: 95% of all eligible Year 8 girls participated. Peer supporter uptake: 55 PSs trained (17–24% per school). Training attendance: 91–100% attendance across the 3 training days. Accelerometer compliance: >85% returned at each wave; valid wear time 83% (T0), 71% (T1), 62% (T2). Fidelity: High fidelity to peer-nomination and PS training delivery. Acceptability: High among PSs, students, trainers, parents, and teachers. Cost: £2,685 per school or £37 per Year 8 girl.	One-sentence summary: PLAN-A is a feasible, acceptable peer-led school intervention that produced a statistically significant +6 min/day increase in weekday MVPA at 12-month follow-up, indicating prevention of the typical adolescent decline in PA. Policy implication: Informal peer-led diffusion models show strong promise for increasing adolescent girls' PA at low cost and with high acceptability, but require confirmation in a definitive cluster RCT before widescale policy adoption.
Sebire et al., 2018 – PLAN-A (Peer-Led physical	School-based: whole-school, peer-led social	Feasibility Cluster RCT (NHMRC Level II); 10-week	n=427 Aged 12–13 100% girls	PLAN-A is a peer-led, theory-driven PA diffusion intervention adapted from the ASSIST smoking prevention model and grounded in Diffusion of Innovations Theory and Self-Determination Theory. All Year 8 girls completed peer	Weekday MVPA (min/day) – 12-month follow-up: At 12 months, the intervention group showed a statistically significant increase in weekday MVPA compared with the control group (+6.09	Recruitment: 427/451 eligible girls participated (94.7%). Peer supporter uptake: 57 invited; 55 consented (96.5%).	One-sentence summary: The PLAN-A peer-led diffusion intervention significantly increased weekday MVPA by ~6 minutes per day at 12-month follow-up, demonstrating prevention of the typical adolescent decline in PA.

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Activity iNtervention ⁶⁸ United Kingdom	diffusion PA intervention	peer diffusion intervention with assessments at baseline (T0), post-intervention (T1), and 12-month follow-up (T2)		nomination (respect, leadership, trust, admiration), with the top 18% most influential girls invited as Peer Supporters (PSs). PSs attended two consecutive full off-site training days, plus a 1-day top-up at 5 weeks, delivered by trained female youth facilitators. Training focused on: PA benefits, autonomy-supportive communication, confidence, empathy, co-participation, norm-shifting, and informal encouragement strategies. Over 10 weeks, PSs provided informal, real-world peer encouragement within friendship networks (e.g., walking at break, active travel, co-participation). Control schools continued usual PE and health education only.	min/day), indicating prevention of the expected adolescent decline in PA. Weekday MVPA (min/day) – immediate post-intervention: At post-intervention, the intervention group showed no statistically significant difference compared with the control group.	Training attendance: 97% completed the full training program. Accelerometer compliance: >85% returned devices at each time point; valid wear time was 83% (T0), 71% (T1), 62% (T2). Questionnaire completion: >91% at all time points. Cost: £2,685 per school (~£37 per Year 8 girl). Fidelity: High fidelity to peer-nomination, training delivery, and diffusion model.	Policy implication: Low-cost, peer-led diffusion models are highly scalable and show strong promise for population-level girls' PA promotion, justifying a fully powered effectiveness trial and potential education-system scale-up.
Suchert et al., 2015 (läuft.) ⁶⁹ Germany	School-based: whole-school pedometer-based PA competition with behavioural strategies (school + out-of-school leisure focus)	Cluster RCT (NHMRC Level II); 12-week intervention with pre- and immediate post-intervention assessment	n=1,162 Mean age: 13.7 48% girls, 52% boys	The “läuft.” program is a 12-week multi-component school-based pedometer intervention targeting leisure-time and daily PA. All students received Omron Walking Style One 2.1 pedometers to self-monitor steps and uploaded data via a personal online account. Core components included: (1) Class-level step competitions during weeks 1, 5, and 11 with cash prizes (€3,250 total) for highest mean steps and greatest improvement; (2) Creative PA challenges, where classes developed and logged ideas to increase PA in daily school life with additional prizes (€2,750 total); and (3) Four educational classroom lessons introducing competitions, goal-setting, PA integration strategies, and reflection. Teachers and principals supported delivery and parents received PA information material. Control schools continued usual education with no pedometers.	Out-of-school sports activity (hours/week): The intervention group showed a statistically significant greater increase in leisure-time sports participation than the control group ($p = 0.008$). MVPA (days/week ≥ 60 min): The intervention group demonstrated a statistically significant greater increase in MVPA frequency compared with control ($p = 0.002$). Active commuting (minutes/day): The intervention group showed a statistically significant increase in active commuting compared with the control group ($p = 0.001$). Sedentary behaviour (hours/day): The intervention did not produce a statistically significant reduction in sedentary time compared with control ($p = 0.881$).	Recruitment: 29 schools successfully recruited. Retention: High student retention across pre- and post-intervention measurement Adherence: High pedometer wear and step logging compliance. Fidelity: All class competitions and educational lessons delivered as planned. Acceptability: Very high student engagement due to competition, prizes, and peer-based motivation. School support: Strong headmaster, teacher, and parent support noted.	One-sentence summary: A 12-week whole-school pedometer and class competition intervention produced statistically significant increases in out-of-school sports participation, MVPA frequency, and active commuting among adolescents. Policy implication: This low-cost, scalable pedometer-plus-competition model is an effective school-based strategy for increasing adolescent leisure-time PA, particularly when combined with incentives, peer competition, and behavioural education.
Sutherland et al., 2020 (PA4E1 – Scale-up Trial) ⁷⁰ Australia	School-based: whole-school, policy-driven physical activity practice implementation with external + internal	Cluster RCT – Type III Hybrid Implementation–Effectiveness Trial (NHMRC Level II); 12-month implementation phase	49 schools, ~6,476 students Aged 12–15 Girls and boys (% not reported)	PA4E1 is a multi-component, whole-school PA systems intervention based on the Health Promoting Schools Framework and Social Ecological Theory. Schools were supported to implement seven evidence-based PA practices: (1) high-quality PE (SAAFE principles), (2) student personal PA plans, (3) enhanced school sport (e.g., Resistance Training for Teens), (4) supervised recess/lunchtime PA + equipment access, (5) school PA policy targeting ≥ 150 min/week MVPA, (6) community PA provider links, and (7)	School practice outcomes (primary effectiveness outcome): • Adoption of ≥ 4 of 7 PA practices: At 12 months, 66.7% of program schools (16/24) met the adoption threshold compared with 4% of control schools (1/25), representing a statistically significant difference (OR = 33.0, $p < .001$). • Mean number of PA practices implemented: At 12 months, program schools implemented an average of 3.2 more practices than controls (mean 3.9 vs 0.7 practices; $p < .001$).	Recruitment: 49/184 eligible schools randomised. Retention: 100% of schools retained at 12 months (no school lost to follow-up). Fidelity of implementation support: >80% across all seven support strategies. Reach: High uptake of implementation strategies (e.g., In-School Champions appointed in 100% of intervention schools; $\geq 90\%$ completed training activities).	One-sentence summary: A 12-month system-level implementation strategy produced a statistically significant large improvement in school adoption of evidence-based PA practices, with two-thirds of intervention schools implementing ≥ 4 of 7 practices. Policy implication: Sustained school PA change requires funded in-school champions, external implementation support, leadership engagement, and system accountability. PA4E1 represents one of the strongest real-world examples of scalable PA policy and practice implementation in secondary schools and is

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
	implementation support	(with planned 24-month follow-up)		regular PA communication to parents. Implementation was supported using seven Behaviour Change Wheel–informed strategies, including: funded in-School Champions (0.5 day/week), external Health Promotion Support Officers, leadership engagement, structured teacher professional learning, resource provision (equipment + online platform), weekly prompts, and term-by-term performance monitoring with automated feedback to schools and principals. Control schools continued usual practice.		Leadership engagement: 15/24 schools formed PA committees; 10/24 met each term. Resourcing: \$100 PA equipment vouchers and Gymsticks provided to nearly all schools.	directly applicable to state-wide and national education-health partnerships.
Sutherland et al., 2016 (PA4E1 – 24-month Effectiveness Trial)¹⁵ Australia	School-based: whole-school, multicomponent curriculum and environment and community PA intervention with embedded implementation support	Cluster RCT (NHMRC Level II); 24-month intervention with baseline (Grade 7), 12-month, and 24-month follow-up	n=1,150 Aged 12-14 51% girls, 49% boys	PA4E1 was a multi-strategy, Health Promoting Schools–based intervention guided by Social Cognitive and Social Ecological Theory, delivered over 7–8 school terms. Seven PA strategies were implemented progressively: (1) Teaching strategies to maximise MVPA in PE including pedometer-based lessons (2 per term); (2) Student personal PA plans with goal setting, monitoring, and rewards; (3) Enhanced school sport program (10-week lifelong activity skills program in Grade 8); (4) School PA policy development/modification; (5) Supervised PA at recess/lunchtime (≥2 days/week with equipment provision); (6) Promotion of community PA providers via school PA expos; and (7) Parent newsletters promoting PA and local opportunities. Six implementation strategies supported delivery: funded in-school PA consultant (1 day/week), leadership committee, teacher training workshops, provision of manuals/equipment, regular prompts, and quarterly performance feedback based on lesson audits. Control schools delivered usual PE and school PA practice only.	Daily MVPA (min/day, accelerometer): At 24-month follow-up, the intervention group showed a statistically significant improvement compared with control, with an adjusted between-group difference of +7.0 min/day ($p < .002$). The intervention group increased MVPA by ~4.4 min/day, while the control group decreased by ~2.6 min/day. Vigorous PA (min/day): The intervention group showed a statistically significant improvement compared with control ($p < .05$). Moderate PA (min/day): The intervention group showed a statistically significant improvement compared with control ($p < .05$). Total accelerometer counts: The intervention group showed a statistically significant increase compared with control ($p < .05$). Sex subgroup effects: Males showed a larger statistically significant intervention effect for MVPA (+10.4 min/day, $p < .01$) than females (+4.0 min/day, $p < .05$).	Recruitment: 10/13 approached schools consented (77%); parental consent obtained for 84% of eligible students. Accelerometer compliance: 84% valid at baseline; 36% valid at 24 months. Fidelity: All six implementation strategies delivered as planned; all 5 intervention schools implemented 6 of 7 PA strategies; 4/5 implemented school PA policy. Teacher uptake: 89% used pedometers in PE; 59% used personal PA plans each term. Student reach: 91% reported using pedometers in PE; 57% participated in organised recess/lunchtime PA. Acceptability: Moderate–high among PE staff and students.	One-sentence summary: Over 24 months, PA4E1 produced a statistically significant +7 min/day improvement in MVPA and successfully slowed the typical adolescent decline in PA, particularly among boys. Policy implication: PA4E1 provides compelling real-world evidence for state-wide and national scale-up of fully supported whole-school PA systems, including funded in-school champions, curriculum-aligned PE reform, school sport reform, supervised break-time activity, and community partnerships—especially in low-SES settings.
Ten Hoor et al., 2018⁷¹ Netherlands	School-based: PE and classroom motivational intervention	Cluster RCT (NHMRC Level II); 12-month intervention with baseline (T0) and post-intervention (T1)	n=695 Mean age: 13.0 49.6% girls, 50.4% boys	A 12-month curriculum-embedded intervention combining: (1) Strength exercise integration into PE; PE teachers spent 15–30 min of every PE lesson (≈30% of lesson time; ≈45 min/week) on absolute strength exercises (free weights, medicine balls, elastic bands), supported by teacher workshops, safety guidelines, and inspirational resources; and (2) Monthly motivational lessons based on Motivational Interviewing, delivered by	Daily PA (accelerometer counts/min): Daily PA decreased in both groups, but the intervention group showed a statistically significantly smaller decline than controls (group × time $p = .049$). MVPA (% of day): At 12 months, the intervention group showed a statistically significant higher proportion of MVPA than controls (+0.4% of the day ≈ ~6 min/day; $p = .046$).	Recruitment: 695 students recruited across 9 schools. Retention: High at school level across 12 months. PE delivery fidelity: Teachers implemented ≥30% of PE lesson time as strength training as instructed. Motivational lesson delivery: Monthly lessons delivered by trained mentors/teachers; early	One-sentence summary: A 12-month school-based program combining PE-embedded strength training and monthly motivational lessons significantly attenuated the typical decline in adolescent PA and produced a small but statistically significant improvement in MVPA (~6 min/day). Policy implication: Embedding structured strength training and motivation-focused lessons into routine PE represents a low-cost, scalable strategy to preserve adolescent PA and improve

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		assessment		trained mentors or PE teachers to promote after-school PA, including self-reflection on PA, social norms, pros/cons of PA, action planning, commitment, implementation intentions, and barrier coping. Control schools continued usual curriculum and PE.	Sedentary time (% of day): No statistically significant between-group difference at 12 months ($p = .715$). Light PA (% of day): No statistically significant between-group difference at 12 months ($p = .833$).	phase included additional online sessions. Resources: Medicine balls, elastic bands, free weights supplied.	metabolic health, particularly in lower vocational education settings.
Tessier, Nicaise & Sarrazin, 2022⁷² France	School-based: classroom health communication and self-regulation planning intervention	Cluster RCT (NHMRC Level II); Single-session intervention + 2-week post-test and 2-week follow-up	n=193 Mean age: 16.9 72% girls, 28% boys	This theory-based behavioural intervention combined goal-framed persuasive messaging and action + coping planning, grounded in Self-Determination Theory (SDT) and the Theory of Planned Behaviour (TPB). Classes were randomised to: (1) Intrinsic Message + Planning (IMC+P) – PA framed around well-being, enjoyment, energy, and mood; (2) Extrinsic Message + Planning (EMC+P) – PA framed around appearance, attractiveness, and body image; or (3) Control (CC) – no intervention. Messages were delivered as a 20-minute standardised PowerPoint by a researcher during normal class time. Planning involved structured action planning (“when, where, how”) and coping planning (barriers and solutions). PA was objectively measured by accelerometer.	Moderate PA (min/day): The intervention groups did not show a statistically significant improvement in moderate PA compared with control ($p > .05$). Light PA (min/day): The intervention groups showed a statistically significant increase in light PA compared with control ($p < .05$). MVPA (min/day): The intervention groups did not demonstrate a statistically significant increase in MVPA compared with control ($p > .05$).	Recruitment: 193 low-active adolescents identified and enrolled from screened classes. Randomisation: 15 classes randomised across 3 conditions. Retention: High short-term retention across post-test and follow-up. Delivery: 100% of sessions delivered as planned by the researcher. Time burden: Single 20-minute session + brief planning activity; no equipment required. Fidelity: Message delivery standardised and rehearsed. Scalability: Very high due to brief, classroom-only delivery and no resource burden.	One-sentence summary: A brief classroom-based goal-framing plus planning intervention significantly increased light PA, intention, and attitudes toward PA, but did not significantly increase MVPA in low-active adolescents. Policy implication: Brief classroom-based motivational and planning interventions may support behaviour initiation and movement substitution (light PA), but should only be used as adjuncts to structurally embedded school PA opportunities (PE, active breaks, sport) if MVPA targets are to be achieved.
Thompson et al., 2016⁷³ United States	Home-based: digital intervention using pedometers + SMS behaviour-change support	Randomised Feasibility Trial (NHMRC Level II – pilot); 12-week intervention with baseline and immediate post-intervention assessment	n=160 Aged 14–17 48% girls, 52% boys	A four-arm randomised feasibility trial grounded in Self-Determination Theory (SDT). After baseline accelerometry, adolescents were randomised to: (1) Control (no intervention); (2) Pedometer only; (3) Pedometer + weekly goal-prompt texts; or (4) Pedometer + weekly goal-prompt texts + daily SDT-informed motivational SMS. All non-control groups received a New-Lifestyle AT-82 pedometer, baseline step feedback, age-appropriate step recommendations, and tips for increasing daily steps. The SDT text library included 84 pre-tested SMS messages: 12 weekly goal prompts and 72 need-supportive messages (autonomy, competence, relatedness), delivered automatically via a secure Administrative Management System (AMS) at 8am daily. Participants could reply to texts and contact staff. Control participants received pedometers only after follow-up.	Daily steps (accelerometer): At post-intervention, the group receiving all components (pedometer + goal prompts + SDT texts) showed the largest increase in daily steps (~+318 steps/day), while the control group showed no improvement; however, no statistically significant group × time interaction was detected ($p > .05$). MVPA (min/day, accelerometer): The combined intervention group showed the greatest increase in MVPA (~+1.7 min/day), with no statistically significant between-group differences observed ($p > .05$).	Recruitment: Target achieved (160/160 recruited in ~6 months). Retention: 98% retained (attrition = 2%). Data completeness: 86% provided complete accelerometer data at both timepoints (≥4 valid days inc. 1 weekend day). Technical delivery: Only one minor SMS delivery error, self-corrected; feasibility criterion met. Program satisfaction: Mean satisfaction 17.5/20, highest in the full intervention group (18.2/20). Acceptability: 85% read texts daily; 75% found them helpful; 55% found them motivational. Adolescent feedback: 90% wanted PA tips included; 75% wanted externally set step goals rather than self-set goals.	One-sentence summary: A 12-week pedometer + SMS intervention was highly feasible and acceptable, producing small increases in steps and MVPA in the full intervention group, but no statistically significant between-group effects. Policy implication: SMS-supported pedometer programs are a scalable and low-cost delivery platform for adolescent PA promotion, but externally structured goals, stronger PA stimulus, and longer follow-up are required before effectiveness or policy translation can be justified.
Toftager et al., 2015⁴⁵	School-based: whole-	Cluster RCT (NHMRC	n=1,348 Aged 13–15	A social-ecological, multicomponent school-environment intervention targeting everyday movement through	Overall PA (counts/min): The intervention group did not show a statistically significant improvement	School recruitment: 14/23 eligible schools randomised.	One-sentence summary: The multicomponent SPACE school-environment intervention did not significantly increase overall daily PA or MVPA,

Citation & Country	Setting	Study Design (NHMRC) & Duration	Sample & Age (% Girls/Boys)	Intervention Description (Expanded)	Physical Activity (PA) Outcomes	Implementation Outcomes	Effectiveness Summary & Policy Implication
Denmark	school, non-curricular, environmental and organisational systems intervention	Level II); 2-year intervention with baseline and follow-up	48% girls, 52% boys	11 components, including: Physical environment changes: (1) Upgraded outdoor PA areas with unfixed equipment; (2) Purpose-built adolescent “play spots”; (3) Improved active-transport safety; (4) After-school fitness programs. Organisational changes: (5) School PA policy; (6) Teacher “kick-starter” training for recess PA; (7) Student play patrol; (8) Mandatory outdoor recess/open gym; (9) School traffic patrol; (10) Safe cycling education; (11) Annual school PA theme week. Control schools continued usual practice.	compared with control at 2-year follow-up (adjusted between-group difference +219 cpm; $p > .05$). MVPA (min/day): The intervention group did not show a statistically significant difference compared with control at follow-up (–3 min/day; $p > .05$). \ Sedentary time (min/day): The intervention did not produce a statistically significant reduction compared with control ($p > .05$). School-time PA (counts/min): The intervention group did not show a statistically significant improvement compared with control (+6 cpm; $p > .05$). \ Recess PA (counts/min): In sensitivity analyses, the intervention group showed a small but statistically significant increase in recess PA compared with control (+95 cpm; $p < .05$).	Retention: 65% of students provided valid accelerometry at both time points. Environment upgrades: All intervention schools upgraded outdoor areas and built play spots. Policy adoption: PA policy implemented in all intervention schools Recess strategies: Kick-starters, play patrols, and mandatory outdoor recess implemented at all intervention schools. After-school fitness programs: Successfully implemented in only 2 of 7 intervention schools (staffing barriers). Active transport infrastructure: Partially implemented due to funding constraints.	but produced a small, statistically significant improvement in recess-time activity only. Policy implication: Large-scale school infrastructure and policy changes without embedded curriculum, behavioural skill training, or structured intensity targets are unlikely to meaningfully increase adolescent MVPA. School PA policy should prioritise curriculum-embedded PE reform, structured MVPA opportunities, and teacher-delivered behaviour-change strategies alongside environmental supports.
van de Kop et al., 2023 (SALVO Study) ⁷⁴ Netherlands	School-based: whole-school, co-designed, multi-component physical activity promotion using participatory action research	Cluster RCT (NHMRC Level II); 2-year intervention with annual follow-ups (baseline, 1-year, 2-year)	n=2,685 Aged 13–14 49% girls, 51% boys	SALVO is a co-created, asset-based school intervention grounded in Salutogenesis and student agency theory. The Triple-I participatory co-design method was used: (1) Structured Interview Matrix + Photovoice to identify student PA assets and preferences; (2) Student–teacher–researcher focus groups to co-design school-specific PA plans; and (3) Implementation of tailored interventions at each of 11 intervention schools. Interventions varied by school and included: daily school-break activities, after-school sport clubs, rooftop playgrounds, boot-camp sessions, PE curriculum modifications with student choice, Run2BeFit lifestyle programs, municipal Topscore programs, dance/fencing/kickboxing clinics, referee and sports assistant training, school PA competitions, energy-bike challenges, and student-led event organisation. Control schools continued usual practice.	Total PA (hours/week, self-report): The intervention group did not show a statistically significant difference compared with control across 2 years ($p > .05$). Time spent in sport (hours/week): The intervention group did not demonstrate a statistically significant improvement compared with control ($p > .05$). Active commuting to school (hours/week): The intervention did not produce a statistically significant increase compared with control ($p > .05$). Screen time (hours/week): The intervention group did not show a statistically significant reduction compared with control ($p > .05$). Moderation by participation level: Schools with higher student participation in co-design showed statistically significantly better shuttle-run performance, but this did not translate into overall PA behaviour change.	Recruitment: 22 schools recruited; 2,685 students measured at baseline (90% of eligible). Retention: 84% retained at 2-year follow-up. Co-design fidelity: Triple-I method successfully implemented in all 11 intervention schools. Delivery variability: Intervention content differed substantially by school (high contextual tailoring). Student participation: Participation level varied; higher engagement associated with better fitness outcomes. Cross-sector partnerships: Strong collaboration with municipal sports services and local clubs.	One-sentence summary: The SALVO co-designed, whole-school intervention did not significantly improve adolescents’ overall PA behaviour, but did significantly improve several indicators of physical fitness, particularly in schools with high student participation. Policy implication: Co-design enhances fitness outcomes, ownership, and intervention relevance, but future school PA policy must combine co-design with structured, dose-controlled MVPA opportunities (PE reform, scheduled MVPA, sport delivery) to achieve behavioural change at population level.

Appendix 8 – Study overview for Question 2 (systematic review): Individual, socio-cultural, environmental, and policy-related factors influencing the effectiveness of adolescent physical activity initiatives (n = 43 primary studies plus n = 13 additional reports)

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
Aittasalo et al., 2019 ²⁴	Finland Cluster RCT with RE-AIM evaluation n = 1,550 adolescents (690 intervention; 860 control), mean age 13.9 yrs, ~48% girls	School curriculum-based PA and sedentary behaviour behaviour-change program, delivered through three compulsory Health Education (HE) lessons using SoftGIS self-assessment, FeetEnergy leaflet & poster, YouTube video, classroom discussion, action planning, and minimal parental leaflet	Socio-cultural → Family norms & parental screen-time regulation	When family norms support PA and screen-time limits, adolescents respond more positively to school programs; when family engagement is minimal, behavioural effects are small and poorly sustained. School-only strategies without meaningful family integration limit long-term success and equity of behaviour change.	PA (self-report): Small but statistically significant improvement in weekly days with ≥1 h of brisk PA (+0.3 days) and proportion meeting PA guidelines (+4.1%) at 4 weeks. Psychosocial/family effects: Increase in families setting screen-time limits (+5.4). Objective PA: No significant effects on accelerometer or diary-based MVPA. Maintenance: Effects diluted by 7 months and disappeared for PA guideline compliance. Policy implication: Universal, curriculum-based school PA programs can achieve high reach and adoption, but sustained behavioural impact requires meaningful family system integration. Education policy should mandate structured parent engagement and home-based reinforcement strategies alongside classroom delivery to support longer-term maintenance of PA.
Alliott et al., 2023 ⁴²	United Kingdom Post-hoc secondary analysis of cluster RCT n = 2,838 adolescents, aged 13–14 yrs, 16 secondary schools	GoActive whole-school, peer-led PA intervention, delivered over 12 weeks with class mentors, rotating peer leaders, weekly activity choices, point-reward system, and web-based activity logging; usual-practice control schools	Socio-economic → Individual-level socioeconomic position (SEP)	When digital engagement, self-directed participation, and individual agency are required, adolescents from lower-SEP groups engage less, which can undermine reach and data completeness. However, structured, in-school universal delivery can still generate greater behavioural benefits for low-SEP adolescents, meaning school-based PA interventions can actively reduce socioeconomic inequities if engagement barriers are addressed.	Engagement: Low-SEP students were significantly less likely to access the intervention website (40.0% vs 45.4% middle-SEP vs 52.0% high-SEP; $\chi^2 = 16.52$, $p < 0.001$). Post-intervention MVPA: No significant subgroup effect at 14–16 weeks (Low-SEP +3.13 min/day; $p = 0.15$). 10-month follow-up: Significant positive effect for low-SEP adolescents (+4.90 min/day MVPA $p = 0.046$), with a significant interaction favouring low-SEP (–7.53 min/day difference vs high-SEP; $p = 0.009$). Policy implication: Universal school-based PA programs can generate meaningful long-term PA gains at the population level, including among adolescents from lower socioeconomic backgrounds. However, digital components require active school-based support and alternative non-digital engagement pathways to prevent participation drop-off and maximise intervention effectiveness.
Andruschko, Okely & Pearson, 2018 ³⁶	Australia (Sydney) Pilot 2-arm parallel RCT (6 months) n = 20 low-fit adolescent girls (10 intervention; 10 control); mean age 13.2 ± 0.9 yrs	Sport4Fun school-based PA and motor skill intervention, comprising: (1) 17 × 90-min compulsory school sport sessions targeting five fundamental movement skills via modified games; (2) 20 × 60-min optional after-school sport sessions (attendance limited by transport); (3) Behaviour-change lessons (3 × 15-min/week) during homeroom covering goal setting, self-monitoring, pedometer challenges, motivation and planning, underpinned by Social Cognitive Theory	Individual → Low fitness status & fundamental movement skill (FMS) competence	When interventions specifically target low-fit girls and prioritise development of object-control movement skills in a supportive, non-competitive environment, PA engagement improves substantially. When participation depends on after-school attendance and transport access, implementation and equity of reach are reduced.	PA: Significant increase in total weekday PA (accelerometer CPM) for intervention vs control (adjusted difference = 77.5 CPM; $p = .03$; Cohen's $d = 1.26$), equating to ~30 min/day less sedentary time and ~20 min/day more light PA. Sedentary time: Significant reduction ($p = .02$; $d = -1.62$). MVPA: Small, non-significant increase ($d = 0.66$; $p = .34$). FMS: Small–medium improvements (overall FMS $d = 0.48$; ns). Perceived competence & enjoyment: Unexpectedly favoured controls (competence $p = .01$; $d = 1.02$). Implementation: School sport delivery 100%, after-school attendance only 44% due to transport barriers. Policy implication: School-day, curriculum-integrated motor skill and PA programs are highly effective for engaging low-fit adolescent girls, while after-school delivery models dependent on transport and family resources substantially undermine uptake. Policy should prioritise in-school delivery during protected curriculum time to optimise participation and scalability.
Belton et al., 2019 (Y-PATH) ²⁵	Ireland Cluster RCT (24 months) n = 490 adolescents, 20 post-primary schools; Mean age = 12.8 yrs; mixed gender	Whole-school, multi-component PA intervention delivered through PE, classroom teachers and parents during school transition	Policy/School Environment → Whole-school PE policy & gender	When high-quality, theory-based PE is embedded within a whole-school policy framework, it can prevent age-related MVPA decline, particularly in girls. Failure to address known gender disparities limits long-term effectiveness.	Accelerometer MVPA: Significant time × intervention effect ($p = 0.011$). Girls in intervention maintained MVPA, while control girls declined. Female post-intervention difference = –11.84 min/day MVPA favouring intervention ($p = 0.014$; $d = 0.74$). No significant effect in boys. Policy implication: Whole-school, policy-aligned, theory-based PE provision can prevent age-related declines in adolescent MVPA, particularly for girls. National education policy should prioritise minimum PE quality standards, teacher training, and whole-school alignment as core components of adolescent PA promotion strategies.
Carlin et al., 2025 (WISH) ⁷⁵	Ireland & Northern Ireland Cluster RCT + RE-AIM process	Peer-led, school-day brisk walking intervention, with trained older student walk leaders delivering 10–15 min	Environmental/Organisational → School support, time,	When schools actively support scheduling, staffing, and promotion, peer-led PA can be implemented successfully. Timetabling constraints, staff workload, poor facilities, weather, and COVID-related	Reach: Only 15% met PA guidelines at baseline. Adoption: 26% never attended a walk; 15% of trained walk leaders led no walks. Dose delivered: Mean 2.1 walks/week per school (range 2–104). Effectiveness: No significant between-group effect on device-measured PA ($p = 0.213$), but self-reported physical health, mental

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
	evaluation (school year) n = 589 girls (12–14 yrs) from 18 post-primary schools; 286 intervention	walks before school, recess, and lunch over one academic year	facilities & staff engagement	restrictions directly suppress participation, fidelity, and sustainability.	well-being & social connection improved. Implementation barriers: Walk leader availability, lack of time, weather, poor indoor facilities, COVID split breaks. Facilitators: Strong teacher support and engaged walk leaders. Policy implication: Low-cost, peer-led school walking programs require protected time in the school day, staff ownership, and basic infrastructure to achieve meaningful delivery at scale. Without formal timetable integration and resourced staff coordination, implementation fidelity and sustainability are unlikely, even for highly acceptable interventions.
Charles et al., 2019 (Girls Active) ⁴⁰	United Kingdom Embedded micro-costing & cost-consequence analysis within cluster RCT (14 months) n = 1,752 girls recruited; complete-case economic sample n = 997 (570 intervention; 427 control); aged 11–14 yrs	Whole-school, peer-led PA and PE culture-change programme. Schools reviewed PA provision, formed girls' leadership & peer-marketing groups, delivered student-informed activity changes, supported by Youth Sport Trust training, hub-school mentoring, and £1,000 capacity funding	Policy/Organisational → Resourcing model, curriculum integration & delivery mode	When programmes are integrated within curriculum time, delivery is low-cost and feasible, but extending delivery to after-school clubs, trips and events rapidly escalates staffing cost and complexity, without corresponding population-level PA gains. Non-prescriptive implementation increases variability and weakens consistency of impact.	Costs: £1,054–£3,498 per school/year (£2–£7 per pupil/year) depending on delivery model. Least-cost model = curriculum-only integration. Primary outcomes: No statistically significant effect on MVPA/day at 14 months ($\Delta=0.53$ min/day), health-related quality of life (CHU-9D), or health-service use/costs. Subgroups: Short-term PA effects at 7 months only; no sustained effect at 14 months. Policy implication: School-based PA culture-change programmes can be delivered at very low cost when embedded within existing curriculum, but cost-efficient delivery alone does not guarantee sustained PA benefit. Policy should prioritise evidence-based programme content, protected curriculum time, and accountability for behavioural outcomes, not just low-cost implementation.
Christian sen et al., 2021 ²⁷	Sweden Pragmatic non-randomised controlled trial (12 months) n = 57 adolescents (31 intervention; 26 control), aged 16–18 yrs; 70% female overall	Classroom-based, multi-component PA intervention: (1) 5-min activity breaks twice per lesson in English & Maths; (2) classroom environmental changes (standing desks, desk bikes, balance pads, exercise balls, resistance bands); (3) PE-based reflection + outdoor walking with podcasts every 2 weeks	Environmental/School Environment → Classroom design, activity breaks & sedentary time disruption	When physical classroom environments are re-designed to interrupt prolonged sitting and embed incidental movement, sedentary accumulation during the school day can be attenuated. However, without sufficient dose, randomisation, and system-level integration, measurable population-level PA gains are unlikely.	Between-group effects: No significant differences in accelerometer-measured MVPA, LPA or ST at 6 or 12 months (12-month MVPA difference +5.9 min/day; $p = 0.255$). Within-group changes: Intervention group showed non-significant increases in MVPA (+3.3 min/day) and reductions in ST (–10.1 min/day), while controls showed a significant decline in LPA (–9.9 min/day; $p = 0.044$) and increase in ST (+16.3 min/day; $p = 0.028$). Interpretation: Suggests potential preventive effect against the typical adolescent shift toward sedentary behaviour, rather than large PA increases. Policy implication: Classroom-based PA and ST-reduction strategies may help offset age-related declines in movement, but require greater intervention dose, randomisation, and whole-school policy integration to achieve scalable, statistically robust PA improvements.
Coimbra et al., 2021 ³²	Switzerland Cluster RCT (7–8 weeks) n = 143 adolescents (76 intervention; 67 control), 50% girls, aged 14–18 yrs	PE-based behavioural skill training (MoVo-Lisa adapted) delivered during four 20-min PE lessons plus reflection phases. Components: goal-setting, implementation intentions, self-monitoring journals, barrier identification, coping planning, followed by 3-week independent practice; control = usual PE	Individual (Psychological) → Behavioural self-regulation skills (goal setting, coping planning, self-efficacy)	When behavioural self-regulation skills are explicitly taught within compulsory PE, adolescents improve their ability to plan, cope with barriers, and sustain exercise behaviour beyond structured lessons. Without these volitional skills, motivation alone is insufficient to translate into sustained PA.	Between-group post-intervention effects: Significant improvements favouring intervention for introjected motivation ($p < .05$), coping planning ($p < .001$), self-efficacy ($p < .01$) and self-reported moderate, vigorous and total exercise/sport activity (all $p < .001$). Total MVPA: Strong time effect in intervention group ($\eta^2 = .439$). Guideline compliance: Significantly more intervention students met adult (≥ 150 min/wk) and youth (≥ 420 min/wk) PA guidelines at post-test (both $p < .05$ –.001). Correlations: Increases in coping planning ($r=.22$) and self-efficacy ($r=.19$) associated with increased PA. Policy implication: Embedding structured behavioural skill training into compulsory PE is an effective, scalable strategy to improve adolescents' PA behaviour, not just motivation. Education policy should mandate self-regulation skill development (planning, coping, barrier management) as core PE outcomes, not optional enhancements.
Corder et al., 2016 ²⁹	United Kingdom Feasibility study + pilot cluster RCT (8 weeks) n = 460 adolescents recruited; pilot analytic sample n = 458; mean age	Whole-school, peer-led PA intervention delivered during tutor time. Weekly choice of activities, older adolescent mentors + rotating peer leaders, school-wide point-reward competition, novelty	Organisational/Social → Mentorship, peer leadership, school readiness & delivery capacity	When mentorship and peer leadership structures are reliably implemented and supported by trained teachers, participation, enjoyment, and behavioural engagement are high. When schools fail to operationalise mentor recruitment, communication, and training, implementation fidelity weakens and delivery becomes inconsistent.	MVPA (pilot): Adjusted between-group difference +5.1 min/day MVPA favouring intervention ($p=0.014$), recognising analysis was not clustered due to limited schools. Self-report outcomes: Greater peer support ($\Delta=0.5$; $p=0.03$) and well-being ($\Delta=1.8$; $p=0.04$). Acceptability: 71–74% reported GoActive was “fun”; 56–69% said it encouraged more PA; 61% intended to continue activities post-intervention. Implementation: Major barriers were mentor recruitment failures, inadequate upfront training, and complex points recording.

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
	13.2 yrs; 46.6% female	activities requiring minimal equipment			Policy implication: Peer-led school PA models are feasible and can produce meaningful short-term MVPA gains, but require mandated mentor recruitment, standardised training, and formal school-level delivery agreements to ensure scalable, high-fidelity implementation.
Corder et al., 2021 (GoActive) ⁴³	United Kingdom Cluster RCT with mixed-methods process & economic evaluation n = 2,862 adolescents, 8 intervention & 8 control schools; aged 13–14 yrs, ~50% girls	Whole-school, peer-led PA programme: older student mentors + in-class peer leaders promoted two new weekly activities during tutor time; weekly points, rewards, website tracking; external facilitator support during initial 6 weeks	Organisational/Socio-cultural → Peer leadership, school support & implementation fidelity	When mentor roles, teacher support, and protected curriculum time are clearly defined and resourced, engagement is high. When leadership expectations, space and time are unclear, delivery fidelity and participation decline sharply, undermining behavioural impact despite strong co-design.	Accelerometer MVPA at 10 months: No significant between-group difference (baseline-adjusted –1.91 min/day; <i>p</i> = 0.316). Subgroups: Favoured lower-SEP adolescents (+4.25 min/day); unfavourable trend for boys (–3.44 min/day). Reach: 84%. Dose/fidelity: Only ~39% received core sessions as intended. Cost: £13.06 per student, not cost-effective. Policy implication: Peer-led school PA programs require mandated delivery structures, protected time, formal mentor training, and staff resourcing. Without system-level accountability for fidelity, even co-designed, low-cost interventions are unlikely to achieve population-level PA impact.
Corder et al., 2020 (GoActive) ²⁶	United Kingdom Cluster RCT with mixed-methods process & economic evaluation (12-week intervention; 10-month follow-up) n = 2,862 adolescents, 8 intervention & 8 control schools; aged 13–14 yrs, 48.9% girls	Whole-school, peer-led PA programme: older student mentors + in-class peer-leaders encouraged classes to complete two new weekly activities; weekly tutor-time delivery; points, rewards and web-based logging; facilitator support reduced after 6 weeks to promote school sustainability	Organisational/System → Implementation fidelity, leadership clarity & school culture	When school leadership provides clear role definition, protected curriculum time and consistent delivery structures, peer-led PA programmes can be implemented with fidelity. When mentor roles, teacher responsibilities and delivery expectations are unclear, fidelity is low and behavioural impact is lost, even in rigorously designed interventions.	Device-measured MVPA at 10 months: No significant between-group difference (–1.91 min/day; <i>p</i> = 0.316). Both groups declined by ~10 min/day over 2 school years. Subgroup signals: Trend towards benefit in low-/medium-SEP adolescents, unfavourable trend in boys (interaction <i>p</i> for SES = 0.005; gender = 0.022). Process evaluation: Only 37.9% attended a session in the previous fortnight; 46.5% logged activity points; mentor and teacher roles frequently unclear. Cost: £13.06 per student, not cost-effective. Policy implication: Large-scale school PA interventions will fail without system-level delivery enforcement. Education policy must mandate protected delivery time, defined leadership roles, implementation accountability and sustained resourcing, rather than relying on voluntary teacher and mentor goodwill.
Corepal et al., 2019 (StepSmart) ⁵³	Northern Ireland (UK) Feasibility cluster RCT (22-week intervention; 52-week follow-up) n = 224 adolescents, Year 9 (12–14 yrs), 53.1% female, 5 schools (3 intervention; 2 control)	Gamified, school-based pedometer competition: Fitbit Zip devices; inter-school, team and individual competitions (Phase 1); transition to individual challenges and intrinsic motivation (Phase 2); incentives, trophies, website feedback, Facebook group for peer support; informed by Self-Determination Theory	Socio-cultural/Behavioural → Gamification, social networks & peer competition	Gamification, incentives and peer/team structures increase short-term engagement and enjoyment, particularly when friendship networks are leveraged. However, competitive formats deter some adolescents, digital platforms show variable uptake, and benefits depend heavily on peer affiliation and perceived fairness of teams, limiting consistent behavioural impact.	Feasibility: School recruitment 5/14; student consent 94.9%. Retention: 57.4% valid MVPA at 52 weeks. MVPA: Intervention group remained stable across time; control showed minor fluctuation (no formal hypothesis testing performed). Steps/day: Declined in both groups by 52 weeks. Psychosocial: Wellbeing, social support and time-preference measures remained largely stable. Acceptability: High for competitions and incentives; website and workbooks were poorly used; Fitbit displays/apps preferred. Equity signal: Device loss and lower accelerometer return were concentrated in high-disadvantage schools. Policy implication: Gamified PA programs are highly acceptable and scalable in schools, but competition-heavy designs and reliance on digital platforms risk uneven engagement. Policy should prioritise inclusive, non-punitive gamification, wrist-worn devices, and school-embedded delivery models to ensure sustained participation across socioeconomic contexts.
Costigan et al., 2018 ³¹	Australia Pilot RCT (8 weeks) n = 65 adolescents from one secondary school (AEP n=21; RAP n=22; control n=22); mean age 15.8 ± 0.6 yrs, 69% boys	School-day High-Intensity Interval Training (HIIT) embedded within PE and lunchtime: 24 HIIT sessions (3/week), 8–10 min/session at ≥85% HRmax using aerobic and resistance formats; heart-rate monitored; control = usual PE	Environmental/Program Design → Time-efficient HIIT embedded in PE	When short, high-intensity sessions are embedded directly into scheduled PE and lunchtime, adolescents can accumulate meaningful volumes of vigorous PA without displacing other activity. Brief, structured HIIT avoids the time and curriculum pressures that often limit traditional PA programs.	MPA: Trivial effect (adjusted Δ = 0.53 min/day; <i>p</i> = .853; <i>d</i> = 0.04). VPA: Moderate effect (adjusted Δ = +1.70 min/day; <i>p</i> = .354; <i>d</i> = 0.55). Compensation analysis: On HIIT days, adolescents accumulated +11.6 min MPA and +8.4 min VPA compared with usual school days (both <i>p</i> < .05), no evidence of activity compensation. Acceptability: >80% reported HIIT did not reduce PE, break-time or after-school activity; no injuries recorded. Policy implication: Embedding brief HIIT within the school day is a scalable, time-efficient strategy for increasing adolescent vigorous PA without compensatory reductions. Education policy should support short, structured high-intensity activity blocks within PE and lunch periods, particularly where curriculum time is constrained.
Cowley et al.,	UK & Ireland 2-arm RCT,	Home-based, multi-component PA intervention including: 3×30	Individual/Psychological → Autonomy,	When adolescent girls are given autonomy over activity choice, supportive mentoring, and a safe,	PA: No significant group × time effect for habitual MVPA (<i>p</i> = 0.767). Fitness: Significant improvements in cardiorespiratory fitness (20mSRT +1.8 stages vs +0.3;

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
2021 (HERizon Project)³⁷	formative evaluation (6 weeks) n = 42 girls (22 intervention; 20 control), aged 13–16 yrs	min PA/week using online exercise menu + live Zoom workouts; weekly mentor video calls; SMS reminders; self-monitoring via PA logbooks; COVID-lockdown context	competence, motivation & body confidence (SDT-based)	non-judgemental home-based environment, adherence, fitness and psychosocial outcomes improve. However, without sufficient intervention duration and environmental reinforcement, habitual MVPA does not significantly change.	$p = 0.001$) and muscular endurance (push-ups +6.9 vs +2.3; $p = 0.022$). Psychosocial: Significant increases in intrinsic motivation ($p = 0.037$) and body appreciation ($p = 0.003$). Adherence: High (median 18 ± 2 sessions); 100% completion. Policy implication: Home-based, mentor-supported PA interventions are highly feasible and beneficial for adolescent girls' fitness and mental wellbeing, particularly when autonomy and psychological safety are prioritised. However, sustained MVPA improvement likely requires longer duration and integration with school and community systems to reinforce behaviour change.
Cowley et al., 2024 (HERizon)³⁸	United Kingdom & Ireland Multi-arm pilot RCT (12-week intervention + 3-month follow-up) n = 153 girls, aged 13–16 yrs	Fully remote, home-based PA and behaviour change intervention with four arms: (1) PA only (live online workouts, logbook, SMS); (2) behaviour change mentoring (weekly SDT-based coaching); (3) combined PA + mentoring; (4) comparison (logbook only); delivery via live sessions, mentoring calls, Instagram group & SMS prompts	Individual/Psychological → Motivation, perceived competence & autonomy support (SDT)	When autonomy, competence and relatedness are supported through flexible PA choice and remote mentoring, psychological engagement improves. However, without sufficient dose, duration and environmental reinforcement, these gains do not translate into sustained MVPA change.	Device-measured MVPA: No significant between-group effects at post-intervention or 3-month follow-up ($p > .50$ across all arms). Psychosocial: Perceived competence ↑ in PA, Behaviour Change and Combined arms (+0.6 to +0.8 vs control; $p < .05$); identified regulation ↑ in PA arm (+0.7; $p = .002$); intrinsic motivation ↑ in PA arm (+0.9; $p = .009$). Fitness: Push-ups higher at 3 months in Combined arm vs control (+5 reps; $p = .019$). Policy implication: Remote PA models improve motivation and competence at low cost, but population-level MVPA requires hybrid school–home delivery, longer exposure, and protected activity time to convert psychological gains into sustained behaviour.
Direito et al., 2015³⁹	New Zealand 3-arm parallel RCT (8 weeks) n = 51 insufficiently active adolescents, aged 14–17 yrs, mean age 15.7 ± 1.2, 57% female	Stand-alone commercial fitness smartphone apps: (1) Immersive app (Zombies, Run! 5K Training); (2) Non-immersive app (Get Running Couch-to-5K); both fully automated 8-week running programs (3 sessions/week); control = usual behaviour	Digital/Behavioural → App design, immersion & self-regulatory behaviour change techniques (BCTs)	When apps rely primarily on instruction and self-monitoring without sufficient autonomy support, social integration, or external accountability, engagement remains intermittent and too shallow to produce meaningful improvements in habitual MVPA. Immersive design improves enjoyment and acceptability but does not overcome low adherence and limited behavioural dose.	Primary outcome (CRF, 1-mile run): No significant differences vs control (Immersive: –28.4 sec, $p = .20$; Non-immersive: –24.7 sec, $p = .32$). Accelerometer MVPA: No group effects (Immersive +1.74 min/day vs control, $p = .98$; Non-immersive –1.82 min/day, $p = .99$). Psychosocial: No effects on enjoyment, competence, autonomy, relatedness or self-efficacy. Adherence: Only 31% used app ≥3 times/week. Per-protocol: Significant fitness improvement only in adherent non-immersive users (–79 sec vs control, $p = .003$). Policy implication: Commercial fitness apps alone are ineffective as population PA interventions for adolescents. Digital tools should be embedded within multi-component, supervised or school-supported programs with accountability, autonomy support and sustained engagement mechanisms to achieve meaningful PA and fitness gains.
Gammon et al., 2019 (CASE – Physically Active Lessons)⁵⁴	United Kingdom (East England) Feasibility study + Pilot cluster RCT (~8-week follow-up) Students: n = 321 (51% male), mean age 12.9 yrs; Teachers: n = 78	Teacher training programme to integrate movement into secondary school lessons: Two 2-hour after-school PAL training sessions; indoor + outdoor active learning strategies; underpinned by Social Cognitive Theory (barrier identification, modelling); whole-school delivery in pilot	Organisational/Environmental → Teacher acceptability, classroom time-pressure & curriculum demands	When teachers perceive PAL as competing with curriculum delivery, insufficiently challenging, or disruptive to classroom control, implementation fidelity and sustainability are reduced. Even when student acceptability is high, teacher buy-in and perceived impact on learning are decisive for success in secondary schools.	Feasibility: High student retention (>90%); PAL delivered in ~35% of Year 7–9 lessons (~6–7 PAL/week). Teacher acceptability: Positive in feasibility school, but low in pilot school (training viewed as primary-school-oriented, repetitive, and disruptive to learning time). Device-measured activity during PAL: No change in sedentary ($\Delta +1.0$ min), light ($\Delta -1.1$ min), moderate ($\Delta 0.0$ min) or vigorous activity ($\Delta 0.0$ min). Whole-day PA: No significant changes in sedentary time, light activity, MVPA, time-on-task, academic efficacy, disruptive behaviour or HRQoL. Students: >90% wanted PAL to continue; reported PAL were fun and helped learning, but also increased off-task behaviour. Policy implication: Teacher training alone is insufficient to reduce sedentary time in secondary schools without PAL designs that clearly protect learning outcomes. Education policy should prioritise curriculum-aligned, subject-specific PAL models with evidence of both academic and activity benefits to secure sustained teacher buy-in and system-level scalability.
Gaudet et al., 2017 (A Bit of Fit)⁵⁶	Canada Quasi-experimental crossover design (7-week intervention × 2 periods) n = 46 adolescents, aged	Minimalist school-PA tracker intervention using Fitbit Charge HR; students set SMART goals and self-monitored activity via device and web dashboard; no additional behaviour-change	Individual / Psychological → Stage of behaviour change (preadoption vs adoption stage)	Adolescents already in the action or maintenance stages of PA behaviour respond positively to wearable self-monitoring, while those in preadoption stages (precontemplation, contemplation, preparation) show no benefit. This indicates that readiness to change is a critical moderator of wearable intervention effectiveness. Minimalist digital	Primary MVPA outcome (accelerometer): No overall intervention effect on MVPA across the total sample. Subgroup effect: Adolescents in adoption stages increased MVPA by >15 min/day during intervention ($p = .01$), while preadoption adolescents showed no change ($p = .81$). Post-intervention difference between groups >23 min/day MVPA ($p = .02$). Wearable data: Adoption-stage adolescents accumulated ~2900 more steps/day and 20 more active minutes/day than preadoption peers. Novelty effect: Wear time and steps peaked in first 2 weeks, then declined sharply ($p < .001$).

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
	13–14 yrs, 52% girls	program; control = no intervention		strategies alone are insufficient to initiate behaviour change in less motivated adolescents.	Policy implication: Wearable trackers should not be deployed as stand-alone population interventions for adolescents. They are best used as targeted support tools for adolescents already motivated to be active, while preadoption youth require structured, multi-component behaviour-change programs (education, social support, cognitive strategies) before wearables can be effective.
Gorely et al., 2019 (Girls Active – Process Evaluation)³³	United Kingdom Mixed-methods process evaluation embedded in 14-month cluster RCT 20 secondary schools (10 intervention, 10 control); girls aged 11–14 yrs; exit survey n = 722 girls	Whole-school, peer-led PA and culture-change programme. Included: teacher training, peer-leadership and marketing groups, student voice, tailored school action plans, PA promotion, limited £1,000 school capacity funding, Youth Sport Trust (YST) mentorship and hub-school support.	Organisational / School System → Implementation fidelity, leadership support, timelines, staff capacity & prioritisation	When implementation guidance is too flexible, timelines are unclear, and PA promotion competes with multiple other school priorities, delivery shifts toward low-dose “support activities” (posters, surveys, branding) rather than sustained PA provision. Late funding, delayed mentoring support, weak senior leadership buy-in, and limited staff time substantially undermine fidelity, reach, and behavioural impact—even when acceptability is high.	Primary RCT outcome (context): No significant effect on objectively measured MVPA at 14 months; small short-term effect at 7 months only. Implementation evidence: Only 36% of girls reported participating in Girls Active activities; 79% had heard of the programme but mainly associated it with research measurements. Only 25–48% felt their opinions were sought; 40% felt encouraged to participate. Most schools focused on support activities (reward cards, posters, kit changes) with limited sustained PA provision. Barriers: lack of time, competing school demands (e.g., inspections), unclear timelines post-training, delayed action plans and funding, limited senior leadership engagement, transport and space constraints, difficulty delegating to peer leaders. Facilitators: Teacher enthusiasm, peer leader empowerment, non-judgemental YST support, funding flexibility. Policy implication: Whole-school PA culture-change programmes require clear implementation timelines, early and continuous mentoring, mandated senior leadership accountability, and protected staff time for delivery. Without system-level delivery enforcement and early practical guidance, even well-accepted peer-led PA programmes are unlikely to translate into sustained population-level PA gains.
Gråstén et al., 2017³⁰	Finland Longitudinal non-randomised controlled school-based intervention (12 months) n = 240 adolescents (143 intervention; 97 control), aged 13–16 yrs	PA as Civil Skill Program: task-involving motivational climate in PE + environmental restructuring. Included: PE teacher training (task-focused pedagogy, self-referenced assessment, positive feedback), 30-min extended daily break, access to fitness hall during breaks, supervised ball games, and free equipment access across one school year.	Individual / Psychological → Physical competence (self-perceived ability) & BMI	When PE environments prioritise task-involving climate, individual improvement, and autonomy over performance comparison, perceived physical competence improves, especially among students with lower confidence. However, higher BMI remains a barrier, being negatively associated with both competence and MVPA. Enhancing psychological competence alone is insufficient to shift total habitual MVPA.	Primary outcomes: Physical competence increased significantly in intervention group over 12 months (stable in controls). MVPA remained stable in both groups (no intervention effect on total MVPA). Cross-lagged modelling: Physical competence was linked to MVPA at baseline and follow-up in both groups. BMI: Negatively associated with physical competence and MVPA at follow-up in intervention group. PE assessments: Related to competence and MVPA only in controls, not when task-involving support was provided. Gender: Boys had higher physical competence at follow-up. Policy implication: School-based interventions can successfully enhance perceived physical competence at low cost through task-focused PE and environmental access changes, but psychological gains do not automatically translate into population MVPA increases. Education policy should prioritise task-involving PE climate, autonomy-supportive assessment, and structured opportunities for in-school movement, while recognising that out-of-school environments must be simultaneously targeted to achieve meaningful activity behaviour change.
Gråstén et al., 2015⁵⁷	Finland Non-randomised controlled school-based intervention (1 academic year) n = 847 adolescents (208 intervention; 639 control), aged 12–14 yrs; 49.8% girls	Sotkamo PA as Civil Skill Program: Dual-component, whole-school intervention targeting (1) task-involving motivational climate in PE via teacher training (4 × 90-min workshops), autonomy-supportive pedagogy, self-referenced assessment, and positive feedback; and (2) physical school environment restructuring via extended daily breaks, access to fitness hall, supervised ball games, and extensive free equipment access during recess.	Environmental + Psychological → Physical school environment access & task-involving PE climate	When structural opportunities for movement (extended recess, access to facilities, equipment supply) are combined with a task-involving PE climate, the typical early-adolescent decline in MVPA can be significantly attenuated at the population level. Structural environmental change exerted a stronger effect on MVPA than motivational change alone, indicating that access and opportunity are foundational drivers of behaviour change at scale.	Primary MVPA outcome (self-report): Significant treatment effect on MVPA (F = 15.56, p < .001, η^2 = 0.20). Over 1 school year, intervention students' MVPA increased while control students' MVPA declined, resulting in a 13.4% higher MVPA change in the intervention group. Path modelling: Physical school environment treatment had a moderate direct effect on MVPA (β = 0.19, p < .001); task-involving climate had no direct effect on task orientation and only a small negative effect on ego-orientation (β = –0.07). Interpretation: Structural environmental change (recess duration, facility access, equipment) was easier to implement and more impactful on MVPA than motivational pedagogy alone. Policy implication: Multilevel school-initiated PA programs that extend break time, guarantee access to facilities, and fully resource recess activity opportunities are highly effective at preventing the sharp decline in adolescent MVPA. Education policy should prioritise school-day environmental restructuring alongside PE quality improvement, rather than relying on motivational teaching strategies alone to drive population-level behaviour change.
Guthrie et al., 2015⁵⁸	United States Multi-site 3-arm pilot RCT (6 weeks) + device	Zamzee accelerometer-linked online incentive system: Wearable activity monitor linked to a web platform	Digital/Behavioural → Incentive motivation, proximal feedback & self-	When proximal real-time feedback is combined with frequent small financial and symbolic incentives, adolescents markedly increase MVPA regardless of sex or BMI. Incentives enhance motivation, while	Primary MVPA outcome: Zamzee group achieved 15.26 min/day MVPA, vs 10.27 min/day (passive control) and 9.12 min/day (DDR) — a 49% increase vs passive control and 67% vs active control (both p < .0001). Sex effects: Females +39% MVPA (p = .0049); males +76% (p < .0001). BMI: Effects significant in both normal-

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	validation study n = 182 adolescents (62 intervention; 61 active control; 59 passive control), aged 11–14 yrs; 48% female	providing real-time visual feedback, goal tracking, social comparison, avatars, and financial & pro-social incentives (\$5/week equivalent) based on MVPA “Zone Activity Minutes.” Active control = Dance Dance Revolution (DDR). Passive control = monitor only, no feedback.	determination support	autonomy (choice of activities), competence (progress feedback), and relatedness (social comparison) together amplify engagement. However, effects are demonstrated only in the short term, with unknown maintenance once incentives are withdrawn.	and high-BMI groups (no BMI × group interaction, $p = .91$). Engagement: 82% accessed website; median reward earned ≈ US\$5/week. Device validity: MVPA sensitivity 85.9%, specificity 97.5%, $r = .94$ vs gold-standard RT3. Effect stability: No decay across 6 weeks (Group × Week $p = .60$). Magnitude: ~5 min/day absolute MVPA gain (~Cohen's $d = 0.4$). Policy implication: Incentive-linked digital wearables with real-time feedback can produce short-term, population-relevant MVPA increases in early adolescents across sex and weight status. However, sustainability is unknown beyond 6 weeks. Policy should embed incentive-based digital tools within longer-term school or community programs with tapering rewards, behavioural skill development, and environmental reinforcement to support maintenance while preserving scalability and cost-effectiveness.
Harrington et al., 2018 (Girls Active) ²⁹	United Kingdom Cluster RCT (14 months) 20 secondary schools; n = 1,752 girls at baseline; n = 1,211 with valid accelerometer data at 14 months; aged 11–14 yrs	Whole-school, peer-led PA and PE culture-change programme developed by Youth Sport Trust. Teachers completed self-review and action plans; attended training; established girls' leadership & peer-marketing groups; flexible school-led activity changes; hub-school mentoring; two × £500 capacity-funding instalments; usual-practice control.	Organisational / Policy → Programme flexibility, implementation fidelity & school size	When programmes rely on highly flexible, non-prescriptive school-led implementation, delivery fidelity becomes highly variable, weakening population-level impact. School size moderates effectiveness, with larger schools better able to absorb leadership, staffing and peer-network demands. Flexibility without mandated delivery standards limits scalability and sustained behavioural change.	Primary outcome (accelerometer MVPA at 14 months): No significant between-group difference ($\Delta = 1.7$ min/day). Short-term effect at 7 months: Small but significant benefit ($\Delta = 2.4$ min/day). Subgroups: At 14 months, significant benefit in larger schools (≥ 850 pupils) (+3.9 min/day, $p < .001$); control schools outperformed intervention in smaller schools (−4.4 min/day, $p = .004$). At 7 months, effects favoured White European girls (+3.1 min/day) and early maturers (+5.1 min/day). Secondary PA outcomes: Small short-term improvements in light PA and after-school sedentary time only. Psychosocial: Mixed, very small effects, several favouring controls. Policy implication: Flexible, peer-led PA culture-change programmes do not produce sustained population-level MVPA gains without mandated implementation standards, protected curriculum time, and system-level accountability. Education policy should prioritise structural school-day activity provision and minimum delivery requirements, rather than discretionary culture-change models alone. Larger schools may be better suited to complex peer-led delivery, but equity risks remain for smaller and resource-limited schools.
Isensee et al., 2018 ⁵⁹	Germany Cluster RCT with 1-year post-intervention follow-up 29 secondary schools; n = 1,020 adolescents with matched baseline–follow-up data; mean age 13.7 yrs; 47.6% girls	“lauft.” 12-week school-based pedometer programme integrating: real-time step self-monitoring via Omron pedometers, individual goal setting, class-level step competitions with financial and symbolic rewards, creative class PA projects, four educational lessons, plus information for teachers and parents. Control = usual school practice.	Behavioural / Environmental → Self-monitoring, everyday activity integration & peer competition	When self-monitoring is combined with class-level competition and a focus on everyday movement (walking, cycling, leisure activity), adolescents can sustain increases in multiple PA domains even 12 months after programme cessation. The non-prescriptive, lifestyle-integrated design enables PA to be maintained outside structured sport and school hours.	Primary PA outcomes (1-year follow-up): Significant group × time effects favouring intervention for all three PA indicators: Days with ≥ 60 min MVPA/week increased in intervention but declined in controls (interaction $p < .001$); Active commuting increased by +16.4 min/day in intervention vs −3.0 min/day in controls ($p < .001$); Out-of-school sport increased by +1.30 h/week in intervention vs +0.39 h/week in controls ($p < .05$). Fitness: VO_2max improved in intervention group only, but interaction not significant ($p = .157$). Body composition: Body fat increase was almost twice as high in controls as intervention ($p < .01$); Waist-to-height ratio remained stable in intervention but increased in controls ($p < .05$); BMI percentile increased in both groups (no intervention effect). Interpretation: A low-burden, pedometer-based school programme can produce sustained lifestyle PA changes and favourable body-fat trajectories, even without effects on BMI. Policy implication: Simple, low-cost school pedometer programmes that prioritise self-monitoring, peer-group competition and everyday active transport can generate long-term population-level PA benefits beyond programme delivery. Education policy should prioritise step-based monitoring, class competitions and active travel integration as scalable, equity-friendly PA promotion tools, particularly in resource-constrained school systems.
Jago et al., 2021 (PLAN-A) ⁶⁰	United Kingdom Cluster RCT (Definitive Trial) n = 1,558 Year 9 girls (758 intervention; 800 control), aged 13–14 yrs, 20	Peer-led PA diffusion intervention. Top 18% of girls nominated as peer supporters. Peer supporters received 3-day SDT- and Diffusion-of-Innovation-based training + booster session. Informal PA promotion over 10 weeks. Control = usual PE.	Socio-cultural / Peer Influence → Peer nomination, peer diffusion, autonomy-supportive motivation (SDT)	The intervention relied on informal peer diffusion of PA norms without structural or environmental change. While peer influence is theoretically strong, lack of protected time, curriculum integration, and environmental reinforcement limited behaviour transfer. Additionally, older adolescents showed poorer engagement, and some schools delivered training on-site instead of off-site, reducing fidelity and impact.	Primary Outcome (Accelerometer MVPA): No significant benefit. Adjusted difference at follow-up = −2.84 min/day MVPA ($p = 0.071$), indicating a slightly greater decline in MVPA in the intervention group. Secondary outcomes: No effects on sedentary time or self-esteem. Subgroup effects: Peer supporters showed a significantly larger MVPA decline vs non-peer supporters (−5.98 min/day, $p < .01$). Cost-effectiveness: £2,817 per school (£31 per girl); not cost-effective for MVPA or QALYs. Policy implication: Large-scale peer-led diffusion models without structural school change or protected PA time are ineffective for adolescent girls. Peer-support strategies must be embedded within curriculum, environmental modification, and

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
	secondary schools				formal delivery systems to generate sustained population-level PA gains. Stand-alone peer diffusion should not be adopted as a public health strategy.
Kennedy et al., 2020 (Burn 2 Learn – Process Evaluation) ⁷⁶	Australia (NSW) Cluster RCT process evaluation (12 months) 10 intervention schools; n = 337 older adolescents (50% female), mean age = 16.0 ± 0.4 yrs; n = 22 teachers	Teacher-facilitated HIIT program during curriculum time for senior students (Years 11–12), delivered across 3 phases: Phase 1 (competence), Phase 2 (autonomy), Phase 3 (independence). Guided by Self-Determination Theory and CFIR implementation framework. Sessions 4–16 min using aerobic + resistance HIIT.	Organisational / System → Time availability, teacher support & implementation fidelity	When HIIT is embedded into curriculum time with trained teacher champions, early-phase delivery and fidelity are high. However, when responsibility shifts toward student self-direction and formal timetable protection is removed, delivery dose collapses rapidly. Sustained success depends on institutionalised scheduling, staff capacity, and workload protection, not just program acceptability.	Dose delivered: Phase 1 = 2.0 ± 0.8 sessions/week; Phase 2 = 1.7 ± 0.6; Phase 3 = only 0.6 ± 0.7. Fidelity: High session quality (overall 16.0/20 on SAAFE); however, only 17% achieved mean HR ≥85% HRmax, and ~50% reached peak HR ≥85% → intensity partially achieved. Reach: 79% student consent. Sustainability: 81.8% teachers intended to continue; 69.6% students intended to keep doing HIIT. Determinants: High adaptability (3.4/4), teacher self-efficacy (3.5/4), school support (3.3–3.4/4), but time acceptability was low (2.3/4). Policy implication: HIIT is highly acceptable and scalable only when formally timetabled and staff workload is protected. Education policy must mandate curriculum-embedded delivery models, not optional or self-directed phases, or program dose and physiological stimulus will decay rapidly at scale.
Kolle et al., 2020 (School in Motion – SciM) ⁶²	Norway 3-arm cluster RCT (9 months) 30 lower secondary schools; N = 2,084 adolescents; mean age 14.0 ± 0.3 yrs; ~50% girls	Two mandatory, curriculum-embedded school-based PA models delivering +120 min/week PA: PAL arm: +60 min PE + 30 min physically active learning + 30 min PA lesson per week (teacher-led). DWBH arm: +60 min “Be Happy” student-led PA + 60 min “Don’t Worry” PE-based activity per week. Control = usual curriculum PE only.	Policy / Organisational → Mandated curriculum time, teacher-led delivery & system resourcing	When PA is mandated within the formal curriculum, teacher-led, funded and structurally protected, adolescents receive a reliable activity dose and PA decline is attenuated. When delivery relies on student self-organisation without strong instructional structure, fidelity weakens and behavioural benefit is lost.	Primary outcome (daily PA): PAL arm showed a significantly smaller decline vs control: +34.7 cpm and +4.7 min/day MVPA. Controls declined by –6.7 min/day MVPA vs only –2.0 min/day in PAL. School-hour effects (PAL): +86.4 cpm PA, +5.6 min/day MVPA, –4.0 min/day sedentary time. CRF: PAL improved running distance vs control (+19.8 m). DWBH: No PA benefit; sedentary time worsened during school hours, and CRF declined vs control (–11.6 m). Policy implication: Curriculum-mandated, teacher-led PA with protected time and resourcing is effective for slowing adolescent PA decline and improving fitness. Student-led, unstructured approaches without formal instructional control are insufficient at population scale. Education policy should mandate minimum weekly PA time delivered by trained teachers, not optional student-directed PA blocks.
Koorts et al., 2020 (RAW-PA) ⁷⁷	Australia (Melbourne, low-SES schools) Mixed-methods implementation evaluation embedded in 12-week cluster RCT 9 intervention schools; n = 144 adolescents (mean age 13.7 ± 0.4 yrs; ~51% boys); n = 17 teachers	Wearable + digital behaviour change intervention targeting inactive adolescents: Fitbit Flex + app, weekly individual/team challenges (email/SMS), Facebook group with videos & forums, and text/email prompts (2–3 per week). Delivered largely outside school hours with minimal teacher involvement.	Digital / Environmental → Access to technology, engagement fatigue & school policy constraints (phone use)	When interventions rely on personal devices, social media platforms, and self-directed digital engagement, early acceptability can be high but sustained adherence rapidly declines due to notification fatigue, technical issues, Wi-Fi/data access, and competing digital content. School policies restricting phone use further reduce exposure to core intervention components during the school day.	Acceptability: Fitbit easy to use (93.3%); program enjoyable (74.2%); information easy to understand (83.3%). Engagement: Facebook engagement declined sharply across 12 weeks; only 18.6% reported wearing Fitbit daily post-intervention. Perceived impact: 70.8% felt Fitbit increased motivation; 78.2% increased awareness of activity. Feasibility: 62.7% felt 12-week duration appropriate, but focus groups indicated motivation declined after ~8–10 weeks. Barriers: Device syncing/charging issues, limited Wi-Fi/data, excessive notifications, school phone restrictions. Facilitators: Teacher modelling increased student engagement, but teachers lacked access to intervention content and feedback. Policy implication: Wearable + social media interventions are highly acceptable but weakly adherent at scale when delivered as stand-alone, out-of-school digital programs. Education policy should require school-embedded delivery, protected device access, structured teacher oversight, and reduced platform complexity to convert short-term motivation into sustained population-level PA change.
Kwon et al., 2025 ⁶²	United States (Utah) 3-arm group randomised controlled pilot trial (6-week intervention) n = 75 middle school students recruited; n = 51 completers; Age = 12–13 yrs; 51% girls	Wearable-based family and peer challenge intervention using Fitbit Inspire 2. All groups received self-monitoring, PA education, and weekly motivational videos. Intervention arms: (1) Family Challenge Group (FCG) – child + parent challenge with shared dashboard; (2) Peer Challenge Group (PCG) – class-based social leaderboard. Control = Fitbit self-monitoring only.	Socio-cultural / Family → Parental support and social challenge structure	When parental involvement is integrated through shared monitoring, encouragement, and PA discussions, effects on MVPA are larger than peer-only challenges. Peer-based virtual challenges alone were insufficient to generate sustained social motivation, particularly when interaction was limited to app-based leaderboards without face-to-face reinforcement.	Primary outcome (device-measured PA): No statistically significant group × time effects for sedentary time, LPA, or MVPA across intervention arms. FCG vs control: +11.0 min/day MVPA, large effect size (d = 0.80) but not statistically significant due to small sample. PCG vs control: –0.1 min/day MVPA (d = 0.03). Adherence: Fitbit use ~60%; mobile app use 38%; group challenge engagement only 39%. Acceptability: High for Fitbit (74–83%) and app (78–89%); low for group challenge feature (42% overall). Contextual barriers: COVID-19 distancing, winter season, low app engagement, competition discouraging lower-ranked students. Policy implication: Wearables alone do not meaningfully increase adolescent PA in short interventions. However, family-supported wearable models show promise and should be prioritised over peer-only virtual competition. Education and public health policy should support family-linked digital PA programs, longer intervention duration, and youth-specific app design to convert high acceptability into sustained MVPA gains.

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Lonsdale et al., 2019 (AMPED) ⁴⁶	Australia (Western Sydney, low-SES schools) Cluster RCT (baseline, 7–8-month post-intervention, 14–15-month maintenance) 14 schools; n = 1,421 Grade 8 students (693 intervention; 728 control); mean age ≈ 13 yrs; ~48% girls	Blended (online + face-to-face) professional learning intervention for PE teachers to maximise MVPA during lessons and enhance student motivation. Teachers received workshops, online modules, implementation tasks, mentoring, lesson videos and mobile app prompts. Strategies targeted: (A) maximising movement & skill development, (B) reducing transition time, (C) building competence, (D) supporting students.	Policy / Organisational → Teacher professional learning, lesson structure & time-on-task (MVPA opportunity)	When teachers are systematically trained to reduce transition time and actively structure lessons to maximise movement, students' MVPA increases even in low-SES school contexts. Gains depend on teacher behaviour change, not student motivation change. Without structured professional learning and lesson redesign, PE lessons typically fail to achieve health-enhancing MVPA thresholds.	Primary outcome (PE lesson MVPA, accelerometer): Post-intervention adjusted difference +5.58% of lesson time in MVPA (≈ +4 min/63-min lesson), $p < .001$. Maintenance: Effect sustained at +2.64–2.66% (≈ +2 min/lesson), $p \leq .001$. Sedentary time: Decreased by –11.1% at post-intervention ($p < .001$). Mediators: Teacher implementation of movement-maximisation, reduced transition time and supportive behaviours significantly mediated MVPA gains. Leisure-time PA: No meaningful intervention effect. Motivation: No significant change. Equity: Greater gains among least active students and girls at maintenance. Policy implication: Teacher professional learning is a high-impact, scalable policy lever for improving in-lesson adolescent MVPA, even in disadvantaged settings. Education policy should mandate evidence-based PE pedagogy standards focused on maximising movement and minimising inactive time, supported by blended online professional development for national scalability.
Malnes et al., 2023 (School in Motion – Active Travel Analysis) ⁴⁴	Norway Cluster RCT (9-month intervention) n = 1,370 adolescents with valid pre–post travel data from 28 schools (19 intervention, 9 control); 9th grade; age 14–15 yrs; ~52% girls	Curriculum-mandated school-based PA intervention adding +120 min/week of class-scheduled PA (extra PE + PA lessons) on top of usual 120–180 min/week of PE. Active travel (walking/cycling vs motorised travel) assessed by self-report across spring/summer and autumn/winter, to and from school.	Environmental / Transport Context → Habitual travel mode & commute environment (urban/rural context)	Travel mode is a highly habitual, structurally constrained behaviour shaped by distance, season, infrastructure, weather, safety, and family transport routines. Increasing school-day PA alone does not modify entrenched commuting behaviour, and school-based activity does not automatically spill over into active transport without direct environmental or policy supports targeting travel infrastructure and distance.	Primary outcome (change in active travel): 91% of pupils maintained their original travel mode over the intervention period; 6% switched to motorised travel and 3% to active travel. Intervention effect: No significant effect on likelihood of changing travel mode in any season or direction. Spring/Summer: Active→Motorised OR = 1.19; Motorised→Active OR = 1.18. Autumn/Winter: Active→Motorised OR = 0.78; Motorised→Active OR = 1.63. All effects non-significant. Interpretation: Extra school PA did not displace nor enhance active travel, supporting the displacement/compartmentalisation hypothesis rather than spillover. Policy implication: Increasing school-based PA alone is insufficient to shift adolescent active transport behaviours. Education and transport policy must directly address distance to school, safe walking/cycling infrastructure, seasonal conditions, and family transport reliance to meaningfully increase active travel alongside school PA provision.
Matthews, Moran & Hall, 2018 ⁴¹	Ireland School-level randomised feasibility trial (6-week intervention + 8-week follow-up) n = 49 older adolescents (24 intervention; 25 control); Mean age = 15.78 ± 0.52 yrs; 31% female	Theory-based self-regulation classroom intervention targeting leisure-time PA (LTPA). Six weekly 30-min classroom sessions delivered during school hours using Zimmerman's self-regulation model: (1) goal-setting, (2) self-monitoring, (3) mental imagery, (4) adaptive causal attributions. Delivered by trained researcher with teacher support; students applied techniques to their own out-of-school LTPA.	Individual / Psychological → Self-regulation skills (goal-setting, self-monitoring, imagery, controllable attributions)	When adolescents are explicitly taught how to plan, monitor, imagine success, and attribute PA outcomes to controllable factors, their capacity to self-direct leisure-time PA increases, particularly as they transition out of structured school environments. However, without strong environmental reinforcement or objective monitoring systems, behavioural gains remain small and difficult to verify objectively.	Primary outcome (self-reported LTPA): Small positive within-group effect in intervention (Cohen's $d = 0.29$); adjusted between-group difference at 14 weeks = +11.82 METs/week, not statistically significant ($p = 0.27$). Self-regulation skills: Significant improvements in goal-setting ($\Delta = +2.67$; $p = 0.02$), self-monitoring ($\Delta = +2.93$; $p = 0.02$), and feeling-based mental imagery (large effect, $d = 0.83$). Objective PA (pedometer): Not analysable due to extensive missing data (only 16% valid cases). Fidelity: High session delivery fidelity; 87% mean attendance; 90% used goal-setting; 84% used imagery. Policy implication: Classroom-based self-regulation training is highly feasible and improves psychological capacity for PA self-management in older adolescents, but on its own produces only small, uncertain behavioural change. Education policy should embed self-regulation skill development within broader, multi-component PA systems that also strengthen environmental access, objective monitoring, and community sport pathways to convert psychological gains into sustained MVPA.
McLaughlin et al., 2024 (PA4E1 – Scale-Up Process Evaluation) ⁷⁸	Australia (NSW) Mixed-methods process evaluation embedded within a Type III hybrid implementation-effectiveness cluster RCT (24 months) 24 low-SES secondary schools (program arm); surveys:	Whole-school secondary school PA program (PA4E1) comprising 7 PA practices (quality PE, student PA plans, enhanced school sport, recess/lunchtime PA, school PA policy, community links, parent communication) supported by 7 implementation strategies (principal engagement, funded In-School Champion, external Support Officers, teacher PD,	Policy / Organisational → Executive leadership, funded school champion role, multi-modal implementation support & school system capacity	Whole-school PA programs scale successfully when schools receive protected leadership time, executive buy-in, and sustained external support. Funding for a dedicated school champion legitimises PA as a school priority and strengthens accountability. However, staff turnover, competing school demands, limited casual teacher availability, and delayed leadership engagement erode feasibility and fidelity, even when acceptability is high. Flexible implementation without strong system accountability leads to uneven delivery.	Acceptability, appropriateness & feasibility: High across all groups (AIM >4.0; IAM >4.0; FIM >3.9). Practice implementation (trial primary outcome): At 24 months, 69.6% of intervention schools implemented ≥4 of 7 PA practices vs 0% of controls ($p < .001$). Key facilitators: Funded In-School Champion role; strong Principal buy-in; face-to-face workshops; External Support Officers with PE background; short, high-quality online PD videos; freely available recess/lunch equipment identified as a major “easy-win”. Key barriers: Difficulty releasing staff due to casual teacher shortages; staff turnover (40% schools changed Principal); competing academic priorities; late funding; inconsistent use of online communities of practice; reduced external support in year 2. Implementation insight: Schools receiving ongoing leadership support and protected coordination time were consistently high implementers.

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	Head PE teachers n=23, PE teachers n=45, In-School Champions n=20; interviews/focus groups across 12 schools	resources, prompts, monitoring & feedback). Schools received half-day/week funded release time for In-School Champion (~AUD \$7,000/year) plus local health district implementation support over 24 months.			Policy implication: Whole-school PA scale-up requires mandated executive leadership, funded coordination roles, sustained regional implementation support, and accountability for practice adoption. Acceptability alone is insufficient, system-level resourcing and workforce protection are decisive for population-level PA impact at scale.
Murphy et al., 2024 (WISH – Walking in ScHools) ⁴⁷	Ireland & Northern Ireland Cluster Randomised Controlled Trial with embedded process evaluation (school-year intervention, mean 19.9 ± 1.0 weeks) n = 589 adolescent girls (12–14 yrs) from 18 post-primary schools; only 12% met PA guidelines at baseline	Low-cost, peer-led school-based walking intervention. Trained older female students (15–18 yrs) acted as walk leaders, delivering 10–15 min brisk walks before school, at break and lunch, up to 2–3 walks/day. Walk leader training grounded in Self-Determination Theory (autonomy, competence, relatedness). Walks delivered on school grounds; booster session mid-intervention; social media support for walk leaders.	Organisational / Environmental → Timetabling, attendance at recess-based PA & post-COVID school environment	When PA opportunities are delivered outside formal curriculum time (before school, break, lunch), participation becomes highly vulnerable to timetabling pressures, supervision availability, student competing priorities, weather and school operational change. Post-COVID school environments further constrained horizons for voluntary recess-based activity, suppressing exposure and dose despite program acceptability.	Primary outcome (device-measured total PA, cpm at post-intervention): No significant difference between groups (Intervention 676 cpm vs Control 710 cpm; adjusted mean difference –33.5 cpm, <i>p</i> = 0.213). MVPA: No significant group effects. Guideline attainment: Baseline only 12% met guidelines; no post-intervention improvement. Dose delivered: Intervention delivered for mean 19.9 weeks. Attendance: Low walk attendance, despite positive qualitative feedback. Interpretation: Promising feasibility did not translate to effectiveness when scaled under real-world school conditions following COVID-19 disruption. Policy implication: Low-cost peer-led walking alone is insufficient to increase adolescent girls' PA when delivery relies on voluntary recess participation. Education policy must prioritise curriculum-embedded PA with protected supervision and timetable integration, rather than relying on discretionary break-time activity, particularly for girls.
Okely et al., 2017 (Girls in Sport) ¹⁶	Australia (NSW; urban, regional & rural) Group Cluster RCT (18-month follow-up) n = 1,769 Grade 8 girls invited; n = 1,518 assessed at baseline; mean age = 13.6 ± 0.02 yrs; 24 schools (12 intervention, 12 control)	Whole-school, multi-component PA promotion intervention delivered using a Health Promoting Schools & Action Learning framework. Each school developed a school-specific action plan targeting: (1) formal curriculum (enhanced school sport & PE), (2) school environment/culture, and (3) home–school–community links. Schools received professional development, funding support, and a ‘critical friend’ facilitator over 18 months.	Policy / Organisational → Implementation fidelity, whole-school action planning & leadership execution	When schools are given high autonomy to design local PA action plans without mandatory delivery structures or accountability for implementation, intervention fidelity becomes highly variable. Without enforced leadership responsibility, protected delivery time, and clear minimum standards, most schools fail to implement at scale, suppressing population-level effectiveness despite strong theoretical and co-design foundations.	Primary outcome (accelerometer-derived total PA): Significant decline in PA over 18 months in both intervention and control groups; no significant between-group differences for TPA, MVPA, light PA or sedentary time (all group × time <i>p</i> > .38). Per-protocol analysis (4/12 schools that implemented as intended): Girls had a smaller decline in MVPA vs controls (+0.5% of wear time, <i>p</i> = .05). Implementation: Only 4/12 schools met full implementation criteria; 5/12 met <50% of criteria. Psychosocial: PA self-efficacy decline was smaller in intervention; peer support declined more than in controls. Policy implication: Whole-school PA frameworks fail without mandatory system-level implementation enforcement. Education policy should require minimum delivery thresholds, executive accountability, protected curriculum time, and structured leadership oversight. Co-design and school autonomy alone are insufficient to achieve population-level activity impact at scale.
Ridgers et al., 2021 (RAW-PA) ⁶⁵	Australia (Melbourne; low-SES schools) Cluster RCT (12-week intervention + 6-month follow-up) n = 275 adolescents recruited; n = 264 baseline accelerometer; mean age = 13.7 ± 0.4 yrs; 52.3% female; 18 schools (9	Wearable + digital behaviour-change intervention: Fitbit Flex + smartphone app, weekly individual/team “missions”, behaviour-change infographics & short videos delivered via a private Facebook group, with SMS alerts (2–3/week). Grounded in Behavioural Choice Theory & Social Cognitive Theory. Delivered fully outside curriculum time.	Digital / Behavioural → Engagement burden, device usability & autonomous motivation	When PA interventions rely on self-directed digital engagement, frequent syncing/charging, and external outcome feedback, sustained adherence is vulnerable to effort burden, declining novelty, and reduced intrinsic motivation. Without face-to-face reinforcement or school-embedded accountability, digital wearables may fail to support lasting behaviour change and may even undermine longer-term motivation for some subgroups (notably boys).	Primary outcome (accelerometer MVPA): No significant effect post-intervention (Adjusted Δ = +0.5 min/day; <i>p</i> = 0.81). 6-month follow-up: Intervention group engaged in 5.0 min/day less MVPA than controls (<i>p</i> = 0.02). Males: –11.0 min/day at 6 months (<i>p</i> = 0.001); Females: no effect. Self-reported PA: No significant effects at any time point. Process insight (pages 7–8): Fitbit required regular syncing/charging; Facebook engagement declined; possible loss of autonomous motivation over time with outcome-driven feedback. Policy implication: Wearable + digital-only PA interventions are ineffective for increasing MVPA in disadvantaged adolescents and may produce adverse longer-term effects in boys. Digital tools should never be deployed as stand-alone PA strategies. Education and public health policy should embed wearables within supervised, curriculum-integrated, face-to-face programs with autonomy-supportive coaching, rather than relying on self-monitoring and online challenges alone.

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
	intervention, 9 wait-list control)				
Schmidt et al., 2020 (Active and Healthy Kids)⁶⁶	Norway (Telemark County) Quasi-experimental non-randomised controlled study (7 months) n = 644 Grade 8 pupils (197 intervention; 447 control); mean age ≈ 13.2 yrs; ~49% girls	Multi-component school health-promotion program with a strong Physically Active Learning (PAL) focus: PAL 135 min/week, physically active breaks 25 min/week, plus usual PE 135 min/week (~59 min/day PA exposure target). Teachers trained via 1-day PAL course + follow-up; schools appointed PAL resource teachers. Broader program also targeted diet and lifestyle awareness.	Environmental / Organisational → Curriculum-embedded PAL, classroom pedagogy & school system delivery	When PA is embedded directly into classroom teaching through PAL, schools can significantly increase school-time PA without displacing academic learning. However, spillover into total daily PA is limited when out-of-school environments, family transport routines, and leisure-time activity systems remain unchanged. School systems can buffer against sedentary drift during school hours, but cannot independently shift whole-day behaviour at scale.	Primary outcome (total daily PA): No significant group × time effect for full-day PA, sedentary time or MVPA. School-time PA: Significant group × time effects favouring intervention for school-time total PA (p = .005), school-time MVPA (<i>p</i> = .003) and school-time sedentary time (<i>p</i> = .001). Fitness: Significant group × time effect for cardiorespiratory fitness (<i>p</i> = .02) and muscular strength (p = .05). Well-being: Significant group × time effects for vitality (<i>p</i> < .001) and HRQoL domains in girls (physical well-being, psychological well-being, autonomy & parent relations). Guideline adherence: Only ~36% met 60 min/day MVPA at baseline and follow-up (no change). Policy implication: PAL is a powerful lever for improving in-school PA, fitness and psychosocial well-being in early adolescents, particularly girls. However, school-only strategies are insufficient to shift total daily PA at population level. Education policy should mandate PAL as core pedagogy, while transport, community sport access, family PA norms and after-school systems must be concurrently targeted to achieve full-day PA change and reduce health inequities in low public-health regions.
Sebire et al., 2019 (PLAN-A)⁶⁷	United Kingdom (South West England) Cluster feasibility RCT with mixed-methods process & economic evaluation 6 secondary schools; n = 427 Year 8 girls (269 intervention, 158 control); age 12–13 yrs	Informal peer-led diffusion model. Influential Year 8 girls nominated by peers (top ~18%) trained as Peer Supporters (PSs) via 2-day off-site training + 1 top-up day at 5 weeks, grounded in Self-Determination Theory. PSs then informally promoted PA to friends over a 10-week peer diffusion period. External female trainers delivered training; no curriculum time was used for delivery.	Socio-cultural / Social Networks → Peer influence, informal diffusion & friendship-group norms	When interventions leverage existing friendship networks and informal peer influence rather than formal peer leadership, acceptability, engagement and message diffusion are high among girls. However, peer supporters require clear guidance and confidence to initiate PA conversations, and sustained behavioural effects depend on maintaining the social credibility and ongoing support of peer supporters beyond the initial diffusion phase.	Primary MVPA outcome (accelerometer): No between-group difference at T1 (end of Year 8). At T2 (start of Year 9), weekday MVPA was +6.1 min/day higher in PLAN-A vs control, indicating prevention of the typical age-related decline. Reach: 94.7% of eligible girls participated. Peer supporter training attendance: 91–100%. Data completeness: Accelerometer returns >85% at all time points (valid wear: 83% at T0, 71% at T1, 62% at T2). Psychosocial outcomes: No consistent between-group effects. Cost: £2,685 per school (~£37 per girl); £61 per 10-min MVPA gain at 12 months. Process findings: High enjoyment and engagement; PSs needed greater support on how to start PA conversations and manage subtle peer influence. Policy implication: Informal, friendship-based peer diffusion is a promising, low-cost strategy for slowing PA decline in adolescent girls, with excellent reach and acceptability in more deprived schools. Education and public health policy should support peer-network-based PA promotion models, with structured supporter training, clear conversational guidance, and sustained reinforcement, as a scalable complement to formal curriculum-based PA delivery.
Sebire et al., 2019 (PLAN-A – Process Evaluation)⁷⁹	United Kingdom Mixed-methods process evaluation embedded in cluster feasibility RCT 6 secondary schools; qualitative samples: 52 girls (peer-supporters + non-supporters), 12 parents, 6 teachers, 5 trainers	Peer-led informal diffusion PA intervention for Year 8 girls (12–13 yrs). Influential girls (top ~18%) trained as Peer Supporters via 2-day off-site training + 1 top-up day, grounded in Diffusion of Innovations + Self-Determination Theory. Peer Supporters then subtly encouraged friends to be active over 10 weeks through normal social interaction.	Socio-cultural / Interpersonal → Peer influence credibility, confidence to initiate PA conversations & autonomy-supportive communication	Social credibility, subtlety, and confidence of peer supporters are critical determinants of message diffusion. When peer supporters feel confident and are trained to use non-pressuring, autonomy-supportive communication, PA promotion is socially acceptable and absorbed into friendship norms. However, lack of confidence to initiate conversations, technical language, and limited rehearsal of real-world scenarios constrain diffusion strength.	Acceptability: High among peer supporters, parents and teachers. Training enjoyment: Mean enjoyment higher on Day 2 than Day 1 (peer-supporter ratings ≈ 4.2 vs 3.7/5). Fidelity: High fulfilment of training objectives (“quite a lot” to “very well” across all schools). Autonomy support: Trainers rated as highly autonomy-supportive. Mechanisms of impact: Peer supporters retained key messages (“anything can count as PA”, empathy, encouragement, subtle influence) and reported actively walking with friends, encouraging park play, co-participation in clubs. Barriers: Some peer supporters lacked confidence to start conversations; role-play realism and reduction in technical jargon recommended. Contextual issues: In-school training caused distractions; off-site venues improved engagement. Perceived effects: Increased PA awareness, peer support, confidence, and social connection reported by parents and teachers. Policy implication: Peer-diffusion PA models are highly acceptable and feasible for adolescent girls when grounded in autonomy-supportive communication and real-world social credibility. For scale-up, policy should mandate high-quality social skills training, realistic conversational rehearsal, off-site delivery where possible, and structured booster support to maintain diffusion strength and reduce peer-supporter uncertainty.
Sebire et al., 2018 (PLAN-A – Feasibility RCT)⁶⁸	United Kingdom (South West England) Cluster randomised controlled feasibility trial 6	Peer-diffusion, school-based PA intervention for adolescent girls. Influential girls (~18%) identified via peer nomination and trained as Peer Supporters through a 2-day	Socio-cultural / Interpersonal → Peer influence, social credibility & informal diffusion of PA norms	When socially influential peers are trained to provide subtle, autonomy-supportive encouragement within friendship networks, PA messages diffuse more naturally and are more socially acceptable than formal peer-leadership models. Behaviour change is strengthened when peer support is integrated into	Primary MVPA outcome (accelerometer): At follow-up (Time 2, start of Year 9), +6.09 min/day higher weekday MVPA in intervention vs control, reflecting maintenance in intervention vs decline in controls. Sedentary time: Intervention group –23.3 min/day weekday sedentary time at Time 2. Feasibility: Peer-supporter recruitment 97% of those invited; training attendance 94%; accelerometer return

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
	secondary schools (4 intervention, 2 control); n = 427 Year 8 girls aged 12–13 yrs (269 intervention, 158 control); >94% recruitment rate	off-site training + 1 top-up day at 5 weeks, grounded in Diffusion of Innovations + Self-Determination Theory (autonomy, competence, relatedness). Peer supporters then informally encouraged friends to be active over a 10-week diffusion period via encouragement, co-participation, active travel, and social support.		existing social identity and daily routines, rather than being delivered through structured instruction.	>85% at all timepoints; questionnaire completion >91%. Cost: £2,685 per school (~£37 per girl). Safety: No adverse events. Policy implication: Peer-diffusion is a feasible, low-cost and socially powerful strategy for preventing adolescent girls' PA decline, with excellent reach in more deprived schools. Education and public-health policy should support informal peer-network-based PA promotion models, with structured training and booster support, as a scalable complement to curriculum-based PE and whole-school PA policies.
Suchert et al., 2015 ⁶⁹	Germany Cluster RCT (12-week intervention, immediate post-test) 29 secondary schools; n = 1,162 adolescents with matched data; mean age = 13.74 ± 0.67 yrs; 48% girls	Multi-component school-based pedometer + class competition program. All students received Omron pedometers for self-monitoring. Two class competitions: (1) weekly step-count challenges with cash prizes (€750–€100; total €3,250); (2) creative PA-in-everyday-life projects with prizes (€2,750). Four educational lessons supported goal-setting, PA integration, and reflection. Parents and teachers received written program materials.	Socio-cultural / Behavioural → Social norms via class competition, self-monitoring & incentive-based motivation	When self-monitoring is combined with class-level social competition and incentives, adolescents increase PA not only at school but also in out-of-school sports and active commuting. The social-norm mechanism (class competition) amplifies motivation beyond individual self-tracking alone. However, sedentary time does not decrease without dedicated SB components, showing that PA promotion alone is insufficient to shift screen-based behaviours.	MVPA (days/week): Significant group × time effect (b = −0.29, p = .002). Intervention increased from 3.98 → 4.37 days/week (+0.38); control +0.10 only. Guideline compliance: Increased from 6.5% → 11.3% in intervention vs 8.3% → 9.0% in controls. Out-of-school sport: Significant effect (b = −1.09, p = .008); +1.64 h/week in intervention vs +0.55 in controls. Active commuting: Strong effect (b = −20.41 min/day, p = .001); +19.31 min/day in intervention. Sedentary behaviour: No effect (b = 0.06, p = .881). Fitness: Shuttle-run improvement borderline significant (p = .065), slightly greater in intervention (d = 0.39 vs 0.27). Policy implication: Pedometer-based class competitions with financial and symbolic incentives are effective for increasing adolescent MVPA, sport participation and active commuting at scale, but do not reduce sedentary behaviour without explicit screen-time components. Education and public health policy should integrate self-monitoring + social-norm competition + incentive structures within schools, alongside parallel SB-reduction strategies, to maximise 24-hour movement behaviour change.
Sutherland et al., 2021 (PA4E1 – Scale-Up) ⁷⁰	Australia (NSW) Type III hybrid implementation-effectiveness cluster RCT (24 months) 49 low-SES secondary schools (24 intervention, 25 control)	State-wide scale-up of PA4E1 whole-school PA system, supporting schools to implement 7 evidence-based PA practices (quality PE, student PA plans, enhanced sport, recess/lunch PA, school PA policy, community links, parent communication) using 7 structured implementation strategies: executive support, funded in-School Champion, external support officers, teacher professional learning, resourcing, prompts/reminders, and automated monitoring & feedback.	Policy / System → Executive leadership mandate, funded school champion, structured external implementation support & monitoring accountability	When leadership accountability, dedicated workforce capacity (funded Champion), and continuous external implementation support are embedded within the school system, large-scale adoption of whole-school PA practices becomes achievable and sustainable. Without these structural supports, schools rarely implement multiple PA practices in combination, even when individual strategies are acceptable.	Primary implementation outcome: At 24 months, 69.6% of intervention schools (16/23) implemented ≥4 of 7 PA practices vs 0% of controls (0/25) (p < .001). Mean number of PA practices: 4.1 vs 0.5 (+3.6 practices; p < .001). Fidelity & reach: High across strategies (>75% overall). Cost: AUD \$415,112 total; \$17,296 per school; \$117 per student over 24 months. Key barriers to participation: inability to nominate a school Champion, weak executive support, and concerns about randomisation. Policy implication: Whole-school PA system reform can be successfully scaled when education and health systems jointly fund leadership roles, mandate executive engagement, provide continuous external implementation support, and automate performance feedback. This model is implementation-effective and potentially cost-effective for population-level adolescent PA promotion, and provides a ready-to-deploy framework for state-wide and national policy scale-up.
Sutherland et al., 2020 (PA4E1 – 12-month scale-up) ⁸⁰	Australia (NSW) Type III hybrid implementation-effectiveness cluster RCT 49 secondary schools (24 intervention, 25 control); ~6,476 students across all schools	Statewide scale-up of the PA4E1 whole-school PA system, supporting adoption of 7 evidence-based PA practices: (1) Quality PE (SAAFE principles), (2) student PA plans, (3) enhanced school sport, (4) recess/lunchtime PA, (5) school PA policy, (6) community PA links, (7) parent PA communication. 7	Policy / System → Executive leadership mandate, funded school champion workforce, structured external implementation support & performance-feedback accountability	When executive leadership endorsement, a funded in-school implementation workforce, and continuous external facilitation with automated feedback loops are embedded, schools can overcome well-established barriers to adopting multi-component PA systems. Without these structural levers, voluntary uptake of multiple PA practices rarely occurs at scale in disadvantaged secondary schools.	Primary implementation outcome (12 months): 66.7% of intervention schools (16/24) implemented ≥4 of 7 PA practices vs 4% of controls (1/25); OR = 33.0), p < .001. Mean number of practices: 3.9 (SD 1.5) in intervention vs 0.7 (SD 1.0) in controls (+3.2 practices, p < .001). Fidelity: 95.6% across 23 sub-strategies. Reach: 81.5% uptake across strategies. Key participation barrier in non-consenting schools: inability to release staff as an in-School Champion (n = 61 refusals). Policy implication: Large-scale adoption of whole-school PA systems is achievable in disadvantaged secondary schools when workforce funding, executive accountability, and automated performance feedback are mandated. Education and health policy should co-fund permanent school PA champion roles and external

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		implementation strategies: executive partnership agreement, funded in-School Champion (0.5 day/week), external Health Promotion Support Officer, teacher professional learning, resourcing (equipment + online resources), automated prompts, and performance monitoring with feedback to Champions and Principals over 4 school terms.			implementation infrastructure to enable sustainable, population-level PA system reform.
Sutherland et al., 2016 (PA4E1 – 24-month outcome s)¹⁵	Australia (NSW; disadvantaged secondary schools) Cluster RCT with 24-month follow-up 10 schools (5 intervention, 5 control); baseline accelerometer sample n = 1,150 (49% male); valid 24-month accelerometer data n = 441	Whole-school, multi-component PA system guided by the WHO Health Promoting Schools Framework, targeting: (1) Curriculum (maximising MVPA in PE via pedometer lessons; student PA plans; enhanced school sport), (2) School environment (recess/lunchtime PA, PA equipment, PA policy), (3) Parents & community (newsletters, PA provider promotion). Supported by six implementation strategies: in-school PA consultant (change agent 1 day/week), school leadership committee, teacher training, resourcing (equipment + manuals), prompts/reminders, and quarterly performance feedback.	Policy / System → Embedded change-agent workforce, leadership governance & multi-level whole-school implementation	When multi-component PA strategies are delivered with continuous on-site implementation support (change agents), formal leadership structures, teacher training, resourcing, and ongoing performance feedback, schools in disadvantaged communities can not only prevent but reverse the typical adolescent decline in MVPA. Without this system-level infrastructure, individual PA components alone are unlikely to achieve sustained population impact.	Primary outcome (accelerometer MVPA): Adjusted between-group difference in change = +7.0 min/day MVPA at 24 months ($p < .002$). Intervention group: +4.4 min/day from baseline; Control: -2.6 min/day. Sensitivity analyses: Consistent (multiple imputation $\Delta = +6.0$ min/day, $p = .031$). Secondary outcomes: Significant effects favouring intervention for VPA (+2.5 min/day, $p = .026$), MPA (+4.5 min/day, $p = .002$), % wear time in MVPA & VPA, and total accelerometer counts. Subgroups: Effects observed in both boys (+10.4 min/day) and girls (+4.0 min/day). Fidelity: All 5 intervention schools implemented 6/7 PA strategies; 4/5 implemented PA policy. Acceptability: 91% of students used pedometers in PE; 57% participated in organised recess/lunchtime PA. Policy implication: Sustained improvements in adolescent MVPA are achievable in low-SES secondary schools when whole-school PA systems are paired with permanent implementation infrastructure and leadership accountability. Education and health policy should invest in dedicated in-school PA champions/change agents, formal governance structures, and continuous performance monitoring to achieve long-term, equitable population-level PA gains.
Ten Hoor et al., 2018⁷¹	Netherlands Cluster RCT (12 months) 9 secondary schools; n = 695 adolescents aged 11–15 yrs (4 intervention, 5 control schools)	Curriculum-embedded strength training + motivational programme. PE teachers delivered 15–30 min of strength exercises in every PE lesson ($\approx 30\%$ of lesson time; ~ 3 h PE/week) using free weights, medicine balls and bands. This was combined with monthly 1-hour motivational lessons (plus online components in first 5 months) based on motivational interviewing, action planning, self-reflection, norms and coping planning to encourage out-of-school PA. Control schools continued usual PE.	Environmental / Program Design + Psychological → Strength-based PE curriculum & motivational skill development	When strength training is embedded within routine PE and paired with structured motivational skill development, adolescents experience physiological improvements in body composition and are partially protected against the typical age-related decline in PA. Focusing on absolute strength rather than relative bodyweight performance reduces stigma, improves perceived competence (especially in heavier youth), and supports sustained engagement. However, this approach primarily attenuates decline rather than producing large MVPA increases.	Body composition (primary outcome): After 12 months, 1.6% lower fat mass % in intervention vs control ($p = .007$), reflecting +0.9 kg fat-free mass ($p = .041$) and -0.7 kg fat mass ($p = .054$). PA: Daily PA decreased in both groups, but decline was significantly smaller in intervention ($p = .049$). MVPA: +0.4% greater MVPA at follow-up in intervention ($\sim +6$ min/day; $p = .046$). Sedentary & light PA: No significant group differences. Equity effects: Boys had higher FFM and lower fat mass than girls at baseline and follow-up; intervention effects did not differ by sex. Policy implication: Embedding strength-based PE alongside motivational behaviour-change education is an effective, scalable school strategy for improving adolescent body composition and buffering the normative decline in PA. Education policy should support strength-focused PE as standard practice, particularly for obesity prevention and metabolic health, while pairing it with motivational skill development to maximise transfer beyond PE lessons.
Tessier et al., 2022⁷²	France Cluster-randomized controlled trial n	Theory-based classroom intervention targeting PA through (1) intrinsic goal-	Individual / Psychological → Goal content	Framing messages alone increases intention and attitudes, but does not change behaviour without volitional support. When planning is added,	Primary PA outcomes (accelerometer): Compared with control, both experimental groups did not increase moderate PA, but showed significantly higher light PA post-intervention. Psychological outcomes: Both IMC+P and EMC+P increased attitude

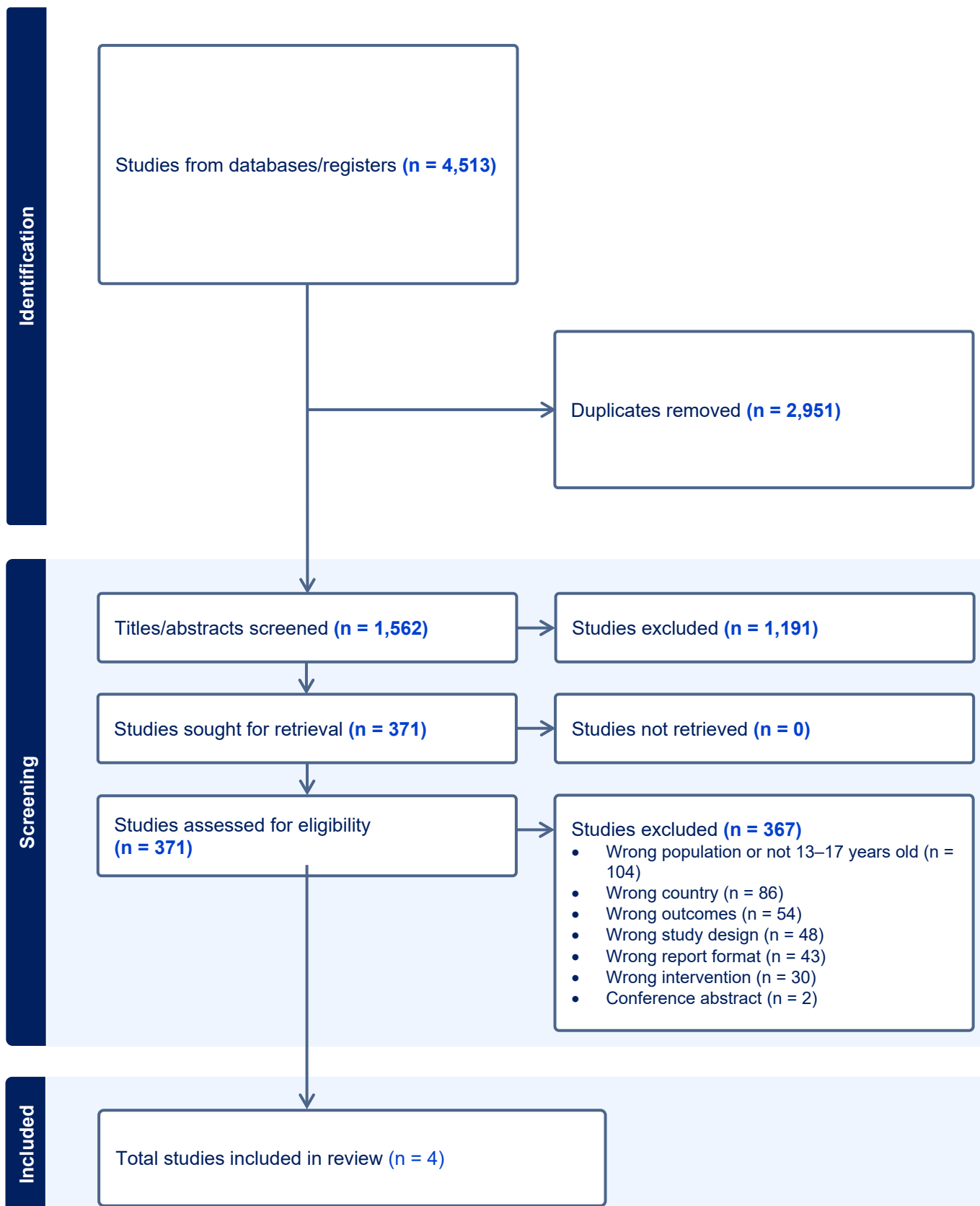
Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
	= 193 low-active adolescents (mean age ≈ 16.9 yrs) across 15 classes; three arms	framed message + planning (IMC+P), (2) extrinsic goal-framed message + planning (EMC+P), and (3) control. Messages delivered via standardized 20-min PowerPoint (well-being vs appearance focus), combined with action planning + coping planning. PA measured by accelerometer pre–post; TPB and SDT constructs assessed as mediators.	(intrinsic vs extrinsic) + volitional planning (action & coping planning)	adolescents translate motivation into behaviour—primarily by increasing light PA rather than MVPA. Intrinsic vs extrinsic goal content did not differentially influence MVPA, indicating that planning, not message framing, is the critical driver of behaviour change in low-active adolescents.	and intention toward PA; no mediation effects of TPB variables between condition and PA were detected. Interpretation: Planning improves enactment but goal-framing content (well-being vs appearance) does not meaningfully alter behavioural outcomes. Policy implication: Motivational messaging alone is insufficient for changing adolescent PA behavior. Education and public health policy should prioritise structured action and coping planning within school PA programs, regardless of whether messages emphasise intrinsic or extrinsic goals. Planning should be treated as a core implementation requirement for low-active adolescents to move from intention to action.
Thompson et al., 2016 ⁷³	United States 4-group randomized feasibility trial (12 weeks) n = 160 adolescents aged 14–17 yrs; evenly split by sex; diverse race/ethnicity	Multi-component mobile PA intervention: Pedometer (New-Lifestyle AT-82) + (1) weekly goal-prompt texts, and (2) Self-Determination Theory (SDT)–informed daily texts targeting autonomy, competence, and relatedness. Four arms: control; pedometer only; pedometer + goal prompts; pedometer + goal prompts + SDT texts. Automated SMS delivery system; objective PA via ActiGraph accelerometers.	Digital / Psychological → SDT-informed motivational texting + self-monitoring with pedometers & goal prompts	High feasibility and acceptability demonstrate that daily motivational texting combined with pedometer self-monitoring can engage adolescents at scale with minimal attrition. However, motivation support alone produced only modest short-term PA increases, indicating that digital autonomy-support without structural or environmental change is insufficient for population-level MVPA growth. Behavioural dose and environmental reinforcement remain critical.	Feasibility: Recruitment target met (n=160 in ~6 months); attrition 2%; 86% complete accelerometer data; minimal technical errors; program satisfaction 17.47/20 (highest in full-intervention arm: 18.18/20). PA trends (not powered for efficacy): Full-intervention group showed the largest increases (+317.8 steps/day; +1.73 min/day MVPA); no significant group × time effects. Psychological needs & motivation: No significant changes. Adolescent feedback: 85% felt steps were a good PA strategy; 75% wanted the program to set step goals for them; 90% liked daily texts; preferred delivery time 3–6pm. Policy implication: Text messaging + pedometer programs are highly scalable, acceptable, and low-cost entry points for adolescent PA promotion, but should not be used as stand-alone interventions. Policy should embed digital motivation tools within school-day or community-based PA structures (protected activity time, coaching, and environmental access) to convert high engagement into meaningful and sustained MVPA gains.
Toftager et al., 2015 (SPACE Study) ⁴⁵	Denmark (Region of Southern Denmark) Cluster RCT, 2-year follow-up 14 schools (7 intervention, 7 control); baseline n = 1,348 adolescents aged 11–13 yrs; valid accelerometer follow-up n = 797 (≈49% girls)	Multicomponent non-curricular, school-environment intervention based on a socio-ecological framework with 11 components: Physical environment (upgrading outdoor areas with unfixed equipment; adolescent-designed play spots; improving active-transport safety; after-school fitness program) and Organisational environment (school PA policy; teacher “kick-starters” for recess; play patrol; mandatory outdoor recess/open gym; traffic patrol; cycle safety education; annual PA theme week). Implementation fidelity was mixed: most core school-based components implemented; after-school fitness and cycling infrastructure only partially implemented due to staffing and funding constraints.	Environmental / Policy / System → Physical school environment restructuring + school PA policy + organisational recess systems	Large-scale environmental and organisational restructuring alone is insufficient to shift total habitual PA at the population level when (1) key components are only partially implemented (after-school fitness, active-transport infrastructure), and (2) changes are largely confined to the school setting without strong links to out-of-school behaviour. Environmental change can increase context-specific PA (e.g., recess), but without sufficient dose, external reinforcement, and full infrastructure delivery, total daily PA remains unchanged.	Primary outcome (overall PA, counts·min ⁻¹): No significant intervention effect at 2 years: adjusted difference = +219 cpm. MVPA: No significant effect (–3 min/day). Sedentary time: No effect (adjusted difference ≈ 0). School-time PA: No significant effect (+6 cpm). Recess PA: Sensitivity analysis showed a small positive effect at recess only (+95 cpm), but not sustained across total school time. Equity/moderation: No significant interactions by sex, household income, weight status, or baseline PA. Implementation limits: After-school fitness only implemented in 2/7 schools due to lack of instructors; cycling infrastructure largely unimplemented due to cost. Policy implication: Non-curricular, multicomponent environmental school interventions alone are unlikely to produce meaningful population-level MVPA change without full infrastructure delivery, sustained staffing, and strong links to out-of-school contexts. Education and transport policy must co-invest in active-transport infrastructure, staffed after-school programs, and community sport linkages, not just in-school environmental upgrades, to achieve durable PA impacts.
van de Kop et al., 2023	Netherlands 2-year cluster RCT 22 prevocational secondary	Participatory, co-designed whole-school PA intervention using the Triple-I Interactive Method (students + teachers +	Socio-cultural / Organisational → Student participation (co-design intensity),	When students actively co-design interventions and shape their own school PA environment, implementation becomes highly acceptable and ownership is strengthened. However, co-design	Primary PA outcome: No significant intervention effect on total self-reported PA (hours/week) versus controls over 2 years (GEE models, <i>p</i> > .05). Fitness outcomes: Significant improvements in multiple indicators favouring intervention schools, including standing broad jump, handgrip strength, 20 m shuttle run, and

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
(SALVO Study)⁷⁴	schools; n = 2,685 adolescents aged 13–14 yrs (1,446 intervention; 1,239 control)	school boards). Schools developed locally tailored PA initiatives including: school-break activities, after-school sports, PE program modifications (choice, goal setting, student evaluation), rooftop playgrounds, Run2BeFit programs, community sports clinics, Topscore sport programs, energy-bike challenges, and student-led competitions. Interventions varied by school but ran for 2 years.	school ownership & local tailoring	alone is insufficient to increase total habitual PA at the population level without system-level guarantees of intensity, frequency, and protected time. Higher participation strengthens fitness effects but does not consistently shift total PA behaviour.	sum of skinfolds (all $p < .05$). Participation gradient: Schools with higher student co-design participation showed significantly higher shuttle-run performance than low-participation schools. No consistent moderation by sex or ethnicity. Policy implication: Co-designed, asset-based school PA interventions are feasible at scale and can improve adolescent physical fitness, but do not reliably increase total PA without mandated dose, protected curriculum time, and structural guarantees of delivery. Education policy should integrate student agency with enforced PA provision (minimum frequency, curriculum protection, facility access) to translate co-design into population-level PA gains.
Verswijveren et al., 2022 (RAW-PA Mediators Study)⁸¹	Australia Secondary analysis of cluster RCT 18 secondary schools; analytic sample n = 159 inactive adolescents (~14 yrs; 58% female)	12-week multicomponent wearable + digital behaviour change intervention in socioeconomically disadvantaged schools: Fitbit Flex + app, weekly missions, infographics, videos, researcher-moderated private Facebook group, and behaviour change techniques grounded in Social Cognitive Theory and Behavioural Choice Theory. Targeted mediators: self-efficacy, peer support, family support, teacher support, self-regulation strategies, perceived barriers, and enjoyment.	Individual / Interpersonal → Perceived barriers, self-efficacy, social support & self-regulation as mediators of PA change	When wearable-based interventions fail to positively shift core psychological and social mediators (self-efficacy, support, self-regulation), behaviour change does not occur—even with high-tech delivery. Unexpected increases in perceived barriers may actively suppress behavioural response, indicating that digital prompts alone can heighten awareness of challenges without building sufficient coping capacity.	Intervention effects at 6 months: Adolescents in the intervention group accumulated higher sedentary time and lower light-intensity PA than controls; no effect on MVPA. Mediator effects (post-intervention): Only perceived barriers increased in the intervention group vs control (mean adjusted difference = +1.77; $p = .03$). No significant intervention effects on self-efficacy, peer support, family support, teacher support, self-regulation strategies, or enjoyment. Mediation analysis: No indirect (mediated) effects for any outcome — perceived barriers did not mediate PA or sedentary time at 6 months. Interpretation: The intervention failed to beneficially activate the intended theoretical mechanisms, explaining the absence of behavioural effects. Policy implication: Wearable + social media PA interventions for inactive adolescents should not be deployed without robust, skill-building components that directly strengthen coping, self-regulation, and environmental opportunity. Policy should prioritise multi-level interventions that reduce real-world barriers (time, access, safety, transport) alongside digital tools, rather than assuming self-monitoring alone will drive sustained activity change—particularly in socioeconomically disadvantaged youth.
Mateo-Orcajada et al., 2023⁸²	Spain (Region of Murcia) Longitudinal quasi-experimental study with control group (10 weeks) n = 400 adolescents (210 boys, 190 girls), aged 12–16 yrs (mean age 13.96 ± 1.21)	Mandatory after-school PA intervention delivered via PE, using mobile step-tracking applications (Pokémon Go, Pacer, Strava, MapMyWalk) prescribed as compulsory “homework” for PE. Adolescents required to complete ≥3 sessions/week, each ≥5000 steps, over 10 weeks; control group received usual PE only	Policy / Organisational → Mandatory participation, digital accountability & curriculum constraints	When mobile PA apps are optional or self-directed, adolescent adherence rapidly declines and health benefits are minimal. Embedding compulsory app-based PA within PE policy substantially improves adherence and overcomes a major limitation of previous digital interventions—poor sustained engagement—while compensating for insufficient curriculum PE time	PA: Significant improvement in PAQ-A scores in intervention vs control ($p < 0.05$). Body composition: Significant favourable changes in BMI, muscle mass, corrected girths and sum of skinfolds (all $p < 0.05$). Physical fitness: Significant improvements in VO_2 max, muscular strength (handgrip, push-ups), endurance (curl-ups), power (CMJ), speed (20-m sprint) and flexibility compared with control ($p < 0.05$). Adherence: Very high overall completion (~95%); lowest attrition for Strava and Pokémon Go, highest for MapMyWalk. Comparative apps: All compulsory app conditions outperformed control despite some between-app differences. Policy implication: Mandating monitored, app-based PA as part of PE assessment or homework is an effective, scalable strategy to increase adolescent PA and fitness. Education policy should formally support compulsory out-of-school PA to offset limited curriculum PE time, rather than relying on voluntary digital tools
Mateo-Orcajada et al., 2023⁶⁴	Spain (Region of Murcia) Cluster randomized controlled trial (10-week intervention) n = 400 adolescents (240 intervention; 160 control), aged 12–16 yrs (mean age 13.96 ± 1.21);	School-promoted, compulsory after-school PA intervention delivered through PE. Adolescents in the intervention group were required to use step-tracking mobile applications (Strava, Pacer, MapMyWalk or Pokémon Go) ≥3 times/week over 10 weeks, with progressively increasing step targets (≈7000	Individual / Socio-demographic → Gender and academic year (school grade) as moderators of intervention effectiveness	The effectiveness of mobile app-based PA interventions is not uniform across adolescents. Gender and academic year significantly modify both engagement with the apps and resulting changes in PA, body composition and fitness. Females and older adolescents demonstrate higher uptake, better adherence and greater health benefits, indicating that “one-size-fits-all” digital PA interventions risk underserving younger students and boys unless additional supports are built in	Engagement: App use was significantly higher in females than males (71.1% vs 50.0%; $p < 0.001$) and in higher academic years compared with lower grades (74.4% fourth year vs 53.8% first year; $p < 0.001$). Body composition: App use prevented increases in fat-related variables (BMI, fat mass, sum of skinfolds, waist and hip girths) relative to control. Significant gender differences observed for BMI, fat mass, corrected calf girth, handgrip strength and CMJ (all $p \leq 0.025$). Academic-year differences were significant for fat mass, skinfolds and girths ($p = 0.019$ – 0.048). Physical fitness: Improvements favoured females and older adolescents for handgrip strength and CMJ ($p = 0.002$ – 0.008). PA: Overall PA levels improved in

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
	210 boys, 190 girls	steps/session in week 1 to ≈12,500 steps/session in week 10). Completion contributed to PE academic reward; control group continued usual PE and habitual activity			the intervention group, with greater adherence driving stronger effects in females and higher grades. Policy implication: Digital PA interventions embedded in PE are effective, but their impact is moderated by gender and age. Education policy should require differentiated delivery strategies (e.g., tailored motivational supports for boys and younger students) when mandating app-based PA, rather than assuming equal effectiveness across all adolescent subgroups
Domin et al., 2022 ³⁴	Luxembourg 4-week within-subject pilot trial (baseline week + 3 intervention weeks) n = 18 healthy adolescents, aged 16–18 yrs (mean age 16.33 ± 0.57)	Theory-informed, personalised mHealth PA intervention (“Mobile App for Physical Activity”) using a Fitbit Charge 4 and smartphone app. Included daily personalised PA prompts (push notifications after school), step and Active Zone Minutes goals, real-time feedback, reminders to move, interactive assistance via messaging, and small incentives (sport store vouchers). Participants served as their own controls	Individual / Digital Behavioural → Personalisation, timing of prompts & self-regulation support	Personalised, just-in-time prompts that are tailored to adolescents’ real-time behaviour and delivered at contextually relevant moments (after school) can transiently reduce sedentary behaviour and stimulate short bursts of PA. However, without sufficient duration and broader environmental reinforcement, effects attenuate over time and do not translate into sustained increases in total daily MVPA or step counts	Sedentary behaviour: Significant reduction in sedentary time during week 1 of the intervention compared with baseline ($t_{17} = -1.79$; $p = .04$; bootstrapped $p = .02$), with diminishing effects over subsequent weeks. MVPA: No significant overall change in MET-based MVPA minutes; heart rate–based MVPA showed no overall increase. Prompt-specific effects: Change-point analyses showed personalised PA prompts significantly increased heart rate per minute in week 2 ($t_{16} = 1.84$; $p = .04$; bootstrapped $p = .04$) and produced a marginally significant increase in steps per minute following prompt delivery (bootstrapped $p = .05$). Steps/day: No significant overall increase. Interpretation: Personalised prompts influence momentary behaviour rather than habitual activity. Policy implication: Personalised mHealth tools can play a supportive role in adolescent PA promotion, particularly for reducing sedentary time, but should not be deployed as stand-alone strategies. Policy and practice should embed personalised digital prompts within longer, multi-component school or community programmes that provide sustained structure, accountability and environmental opportunities for activity
Gómez-Cuesta et al., 2024 ⁵⁶	Spain (Region of Murcia) Randomized controlled trial (10 weeks) n = 430 adolescents completed (270 intervention; 160 control), aged 12–16 yrs (mean age 13.76 ± 1.41); 225 boys, 205 girls	School-promoted, compulsory after-school PA intervention delivered through PE using step-tracking mobile apps (Strava, Pacer, MapMyWalk, Pokémon Go). Adolescents used apps ≥3 times/week over 10 weeks with progressive step targets (≈7,100 to 12,500 steps/session). App use contributed to PE academic reward; control group continued usual PE without app use	Individual / Behavioural → Baseline activity status (active vs inactive) and responsiveness to digital PA interventions	Adolescents’ baseline PA status is a critical moderator of digital intervention effectiveness. Inactive adolescents demonstrate larger behavioural and health gains from compulsory app-based PA, while already-active adolescents primarily show improvements in fitness and body composition rather than perceived PA increases. Ignoring baseline activity status risks underestimating intervention impact in inactive populations and overestimating effects in already active youth	PA: Only inactive intervention adolescents showed a significant increase in PAQ-A scores post-intervention; active adolescents did not perceive increased PA despite objective improvements. Body composition: Inactive intervention adolescents increased muscle mass and reduced sum of three skinfolds; active intervention adolescents significantly reduced fat mass and skinfolds (all $p < 0.05$). Physical fitness: Both inactive and active intervention groups improved cardiorespiratory fitness (VO_{2max}), muscular strength (handgrip), muscular endurance (curl-ups, push-ups) and overall fitness; CMJ improved only in active adolescents. Comparisons vs control: Significant favourable differences for BMI and CMJ in intervention vs control. Moderators: Gender and biological maturity significantly influenced outcomes; app type did not meaningfully alter effectiveness. Policy implication: App-based PA programs embedded in PE are particularly effective for inactive adolescents and should be prioritised as an equity-focused strategy. Education policy should support compulsory, structured digital PA for inactive students, while recognising that outcome metrics should differ by baseline activity status (behaviour change vs fitness optimisation)
Cushing et al., 2021 ⁵⁴	United States Non-randomised controlled trial (20-day intervention) n = 40 adolescents (20 intervention; 20 attention-control), aged 13–18 yrs (mean age 15.25 yrs); 75% female	Adaptive mHealth PA intervention (NUDGE – Network Underwritten Dynamic Goals Engine) delivered via tailored SMS text messaging. Intervention used control theory principles: daily goal-setting, self-monitoring of MVPA, personalised feedback, and adaptive goal revision based on recent behaviour. PA measured objectively via wrist-worn ActiGraph accelerometers; control group received passive monitoring only	Digital / Behavioural → Adaptive goal-setting, self-monitoring & personalised feedback (control theory)	Adaptive, theory-driven digital interventions that actively engage adolescents in goal-setting, self-monitoring and feedback can produce meaningful short-term increases in MVPA. Personalisation and behavioural adaptation appear critical; passive monitoring alone is insufficient. However, short intervention duration limits conclusions about sustained behaviour change	PA: Intervention group accumulated an estimated +20.84 min/day MVPA relative to control ($b = 20.84$, $SE = 8.19$), indicating a clinically meaningful short-term increase. Sedentary behaviour: Exploratory analyses suggested –82 min/day sedentary time in intervention vs control, but this effect was not statistically significant due to high variability ($b = -81.98$, $SE = 46.86$). Feasibility: Very high engagement; average ≈3 message exchanges/day with minimal drop-off across 20 days. Acceptability: 90% reported being very or mostly satisfied; mean CSQ-8 satisfaction score 26.65/32. Adolescents valued reminders, goal feedback and ease of integration into daily routines. Interpretation: Adaptive goal-feedback loops influence near-term PA behaviour by supporting adolescent self-regulation, but durability beyond the intervention period is unknown. Policy implication: Personalised, adaptive mHealth interventions grounded in behavioural theory can meaningfully increase adolescent MVPA in the short term and are highly acceptable. Education and public health policy should position such tools as adjuncts within multi-component school or community PA strategies, rather than stand-alone solutions, to support longer-term maintenance and scalability

Citation	Country Study Design Sample Size	Intervention Context	Factor Category	How this factor(s) influences the success or failure of the physical activity (PA) intervention	Key findings & policy implication
Lee et al., 2020 ⁶³	Singapore Randomized controlled trial (16 weeks) n = 311 adolescents randomized (156 onymous; 155 anonymous); n = 282 completers; aged 13–16 yrs (mean age 14.6 ± 1.0); 67.9% female	Digital social norm–based PA intervention using pedometer-measured step counts (Fitbit Flex™). Adolescents received weekly SMS feedback ranking group members’ step counts. Two arms: Onymous (ranked steps displayed with full names) vs Anonymous (ranked steps without names). Groups of 12 participants; no structured PA program, goals, or curriculum integration	Socio-cultural / Digital → Social norms, observability & peer comparison	Simply increasing the observability of peers’ PA through named rankings does not increase adolescents’ PA. Social norm feedback without structured behavioural support, goal-setting, or contextual relevance is insufficient to drive behaviour change, even when peer comparison is made explicit. Observable ranking alone does not meaningfully leverage peer pressure or motivation in heterogeneous adolescent groups	Primary outcome (steps): No significant differences in weekly step counts between Onymous and Anonymous arms at any time point ($p > .05$ across all weeks). Trajectories: Four distinct step-count trajectories identified; only 21.6% showed increasing steps over time. Moderation: In trajectory analysis, females in the Onymous arm were more likely to belong to higher-activity trajectories (Group 3: $\beta = 2.42$, $p = .001$; Group 4: $\beta = 2.65$, $p = .005$), but this did not translate into overall group-level effects. Knowing other participants in the group was not a significant predictor. Psychosocial outcomes: No significant between-arm differences in quality of life, depression, social support, self-efficacy or PA enjoyment (all $p > .05$). Engagement: ~65% wore pedometers nearly daily and checked SMS rankings weekly; satisfaction was moderate and similar across arms. Policy implication: Stand-alone digital social norm interventions based on peer ranking, even when identifiable, are insufficient to increase adolescent PA. Education and public health policy should avoid reliance on norm-based feedback alone and instead embed social comparison tools within structured, contextually relevant school or community PA programs that include goal-setting, skill development, and environmental opportunities for activity

Appendix 9 – PRISMA flow diagram for studies included in the scoping review (Question 3)



Appendix 10 – Study overview for Question 3 (scoping review): Characteristics and findings of culturally responsive physical activity interventions for Aboriginal and Torres Strait Islander adolescents (n = 4 studies/program evaluations)

Citation	Intervention (Co-Design, Indigenous Leadership & Community Partnership)	Population & setting	Intervention type & delivery (Physical activity, PA-relevant components highlighted)	PA outcomes (if reported)	Program engagement & acceptability (Culturally relevant outcomes)	Effectiveness in Aboriginal adolescents compared to non-tailored approaches	Policy implications for culturally responsive PA interventions
Jackson-Barrett, Price & Featch, 2021 - Deadly Sista Girlz Final Evaluation Report⁴⁹	- Program established, led and governed by the Wirrpanda Foundation a recognised Aboriginal community organisation. - Delivered exclusively by Aboriginal women mentors across all sites. - Strong cultural foundation: yarning, storytelling, identity building, cultural pride, self-determination. - Embedded in partnerships with schools, Elders, local communities and families. - Program design and delivery align with the Aboriginal Cultural Standards Framework, ensuring cultural safety and responsiveness.	~732 Aboriginal and Torres Strait Islander girls (100% female). - Ages 11–18 years (covers 13–17 age group). - Delivered across 15 school sites: 13 WA metropolitan/regional schools, 1 WA Catholic school (Broome), and 1 Victorian school. - All schools host a dedicated Deadly Sista Girlz (DSG) Room.	School-based culturally grounded wellbeing and mentoring program. Not a PA intervention, but includes PA-relevant elements: - Occasional movement-based excursions (e.g., F45 sessions, sport/fitness activities). - Health & wellbeing curriculum covering healthy lifestyles, movement, body confidence. - Individual mentoring addressing barriers to participation in school activities (including sport/PE). - Daily access to a culturally safe DSG room enabling relational support and wellbeing activities.	No PA outcomes were measured. - The program does not include structured PA sessions, PA behaviour-change components, or PA monitoring. - Occasional fitness or movement excursions were described but not evaluated. - Therefore, no PA effectiveness comparisons with mainstream or non-tailored programs are possible.	- Very high engagement across all sites. - DSG rooms described as essential safe spaces fostering belonging, identity, trust and emotional wellbeing. - Strong relational connections with mentors were central to participation and retention. - Program seen as culturally safe, empowering, and highly valued by girls, families, and schools. - Engagement driven primarily by cultural connection rather than activity type.	- DSG is not comparable to standard PA programs as it does not aim to increase PA. - However, relative to non-tailored wellbeing programs, DSG demonstrates: - Substantially higher engagement due to cultural safety and Indigenous leadership. - Stronger sense of identity, belonging and trust, known precursors to improved participation in school-based activities, including PA. - DSG showcases cultural elements likely to enhance engagement in future PA programs for Aboriginal girls.	- DSG demonstrates that culturally grounded programs achieve high engagement even without PA-specific content. - For PA programs targeting Indigenous adolescents, DSG highlights essential design features: - Indigenous leadership and workforce. - Co-design with local communities. - Dedicated culturally safe spaces. - Relational mentoring models. - Future PA interventions for Aboriginal girls should embed DSG-like cultural principles to enhance uptake, engagement, and sustainability.
NSW Ministry of Health & UNSW, 2021 - Go4Fun Aboriginal Program Evaluation⁵¹	- Developed through an extensive co-design process with Aboriginal Community Controlled Health Services (ACCHOs), Elders, families, community members, and Aboriginal health workers. - Delivered by Aboriginal	- Aboriginal children and adolescents aged 7–13 years, with some sites including older siblings up to age 15+. - Community, ACCHO, school and sport-facility settings. - Programs delivered across regional, remote and metropolitan	Culturally adapted healthy lifestyle, nutrition and PA program. Core PA-relevant components: - Weekly structured PA sessions (1 hour/week). - Games-based moderate-intensity activity suitable for families and siblings. - Emphasis on fun, culturally safe	Objective PA outcomes were not collected. - No accelerometer or pedometer data. - No self-reported MVPA minutes. However: - Families and children reported increased participation in active play, increased confidence with	High cultural acceptability. - Families consistently described the program as culturally safe, welcoming, fun and accessible. - Engagement increased when sessions were: - delivered by Aboriginal staff, - held in familiar community venues, - inclusive of extended family, - incorporating yarning. - Flexible attendance model considered culturally appropriate.	Compared to standard Go4Fun programs: - Aboriginal families showed higher engagement, greater trust, and higher cultural safety ratings in the Aboriginal-adapted model. - Retention and session completion were significantly higher in the culturally adapted program. - Qualitative data suggests greater willingness to participate in PA activities compared with the mainstream program. - Cultural adaptations-especially Aboriginal leadership and family	- Culturally adapted programs demonstrate substantially better engagement and acceptability than non-tailored models. - For future PA interventions targeting Aboriginal adolescents: - Partner with ACCHOs and Elders. - Employ Aboriginal facilitators. - Use yarning-based, family-centred delivery. - Ensure programs occur in culturally familiar community locations. - PA measurement should be incorporated in future evaluations to assess behavioural impact. - Strong potential for scale-up across Aboriginal communities when cultural adaptations are integral - not optional.

Citation	Intervention (Co-Design, Indigenous Leadership & Community Partnership)	Population & setting	Intervention type & delivery (Physical activity, PA-relevant components highlighted)	PA outcomes (if reported)	Program engagement & acceptability (Culturally relevant outcomes)	Effectiveness in Aboriginal adolescents compared to non-tailored approaches	Policy implications for culturally responsive PA interventions
	facilitators and health staff, with non-Indigenous staff receiving cultural capability training. - Program content adapted to reflect Aboriginal culture, family context, preferred learning styles, community priorities, and local language. - Incorporates yarning, storytelling, shared meals, extended family participation, and community-selected locations.	NSW Aboriginal communities.	movement, and family participation. - Delivered by Aboriginal facilitators or co-delivery teams including ACCHO staff. Additional components: - Group nutrition workshops. - Family-centred goal setting. - Incorporation of cultural practices such as yarning.	movement, and improved attitudes towards PA (qualitative). Facilitators observed improvements in fundamental movement skills and willingness to be active.	- Strong relationships with facilitators drove retention. - Barriers included transport and competing family/community obligations.	involvement-were identified as essential to engagement.	
Stanley et al., 2024 — “Strong Culture, Healthy Lifestyles: A mixed-methods feasibility study for a co-created afterschool cultural programme for Australian Aboriginal children”⁵⁰	- Fully co-created with Aboriginal Elders, Aboriginal Child & Family Centre, community members, caregivers, teachers and children. - Guided by Aboriginal Relational Research Methodology (ARRM), with Country as a central teacher. - Programme delivered by local Aboriginal mentors (male & female) selected by Elders. - Activities reflect local cultural protocols, cultural knowledge, storytelling, bushfoods, language, dance,	111 Aboriginal children, aged 5–13 years (≈96% Aboriginal). 6 programmes across 3 Aboriginal communities in regional NSW (Yuin Country). - Delivered in Aboriginal community centres, primary schools, and cultural sites (river, ocean, bushland).	10-week afterschool cultural programme (2 days/week, 2 hours each). PA-relevant cultural movement activities included: - Bushwalks, time on Country, traditional games, outdoor movement. - Boomerang throwing, collecting/harvesting bushfoods. - Dance, cultural activities involving physical engagement. - Photography and storytelling as reflective tools. Delivered by Aboriginal mentors, with Elders/volunteers leading cultural sessions.	No direct PA outcomes measured. - Accelerometry was collected but only to assess feasibility (completion rates: 85% baseline; 66% follow-up). - Effectiveness on PA behaviour was not analysed (study objective = feasibility only).	- Very high enjoyment: 89% “liked it” or “loved it.” - High retention: 92.5%. - Attendance median 73%. - Children valued: “learning about culture”, “going out on Country”, “trying new things”, “sharing culture”. - Parents, teachers and mentors reported strong increases in cultural pride, connection, confidence and engagement. - Programme strongly accepted due to cultural safety, flexibility, community ownership, and Aboriginal leadership.	- Not designed as a PA intervention, but compared to non-tailored afterschool programs, this study shows: - Substantially higher engagement due to cultural safety and Aboriginal leadership. - Stronger connection, identity, belonging — key precursors to PA participation. - Program acceptability far exceeds typical non-tailored afterschool programs. - Provides indirect evidence that embedding cultural identity strengthens readiness for PA engagement, especially among Aboriginal youth.	- Highlights essential elements for future PA programs in Aboriginal adolescents: - Indigenous leadership, co-design, and deep community partnerships. - Activities grounded in Country, culture, relationality and local knowledge. - Flexibility rather than fixed Western program structure. - Need for culturally appropriate PA outcome measures (current tools considered culturally inappropriate). - Demonstrates that culturally grounded programs achieve high retention and engagement, even without explicit PA goals. - Future PA interventions should embed cultural practices (Country-based movement, traditional games, storytelling) and be co-designed with communities to maximise effectiveness.

Citation	Intervention (Co-Design, Indigenous Leadership & Community Partnership)	Population & setting	Intervention type & delivery (Physical activity, PA-relevant components highlighted)	PA outcomes (if reported)	Program engagement & acceptability (Culturally relevant outcomes)	Effectiveness in Aboriginal adolescents compared to non-tailored approaches	Policy implications for culturally responsive PA interventions
	traditional games, and time on Country. • Programme flexible and adapted continually based on messages from Country, weather, community age groups and need.						
Macgregor et al., 2015 - Indigenous Youth Sports Program (IYSP) ⁸⁴	• Program developed through consultation with local agencies, education support organisations, and Inala Community Health Service (pp. 88–89). • Incorporated cultural components including dance, storytelling and arts (p. 92). • Aimed specifically at Indigenous youth, with community and school support required for participation. • Although not a fully co-designed program by Aboriginal Elders, it included culturally relevant content and was targeted exclusively toward Aboriginal and Torres Strait Islander students.	• Indigenous youth aged 10–15 years (mean age 13). • 254 participants across 3 regional Queensland sites: Rockhampton, Gladstone, Bundaberg. • Mixed-gender group (~59% male). • Participants nominated by local schools based on interest in learning and positive school engagement.	• 3–5 day campus-based program delivered at CQUniversity. • Sport-focused program (sport comprised 59.8% of contact time). - Activities included: – multiple sports clinics, skill development – fitness and movement sessions – reinforcing concepts of effort, persistence, training technique. • Additional cultural movement sessions (dance, storytelling), arts activities (18.6%), culture (11.9%), and education/academic sessions (9.7%). • Daily transport and accommodation provided to maximise participation.	• No PA behaviour or fitness outcomes measured. • No MVPA, steps, activity duration, or fitness testing reported. • Sports participation included as an engagement mechanism, not evaluated as a health/PA outcome.	• Extremely high participation - 98% daily attendance. • Students reported strong interest in sports; sport used as an “incentive” to attend university-based activities. • Positive shifts in perceptions of higher education: significant improvements across 6 of 8 Likert-scale statements. • Increased discussions with parents/ family/ teachers about careers. • Programme acceptable, enjoyable and perceived as beneficial by students and schools.	• IYSP is not a culturally co-designed PA behaviour intervention, and does not measure PA outcomes. • Compared to non-tailored school outreach programs, IYSP shows: – much higher engagement and attendance, driven by sport as a culturally meaningful medium. – Increased educational aspirations and confidence. • However, due to the absence of cultural co-design and lack of PA outcomes, it provides limited evidence on PA effectiveness relative to culturally embedded PA interventions.	• Demonstrates that sport is an effective engagement tool for Aboriginal youth and can be embedded within broader education pathways. • Highlights the need for: – stronger Indigenous leadership and co-design in future sport/PA programs. – incorporation of culturally grounded movement (Country, culture, identity) rather than generic sports clinics. – rigorous PA outcome measurement to determine behavioural impact. • Reinforces that sport-based programs can act as entry points for culturally responsive PA interventions, but cultural governance is essential for long-term impact.

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