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School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18 (Review)

Neil-Sztramko SE, Caldwell H, Dobbins M

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TABLE OF CONTENTS

[Intervention Review]

School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18

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ABSTRACT

Background

Physical activity among children and adolescents is associated with lower adiposity, improved cardio-metabolic health, and improved fitness. Worldwide, fewer than 30% of children and adolescents meet global physical activity recommendations of at least 60 minutes of moderate to vigorous physical activity per day. Schools may be ideal sites for interventions given that children and adolescents in most parts of the world spend a substantial amount of time in transit to and from school or attending school.

Objectives

The purpose of this review update is to summarise the evidence on effectiveness of school-based interventions in increasing moderate to vigorous physical activity and improving fitness among children and adolescents 6 to 18 years of age.

Specific objectives are:

• to evaluate the effects of school-based interventions on increasing physical activity and improving fitness among children and adolescents;

• to evaluate the effects of school-based interventions on improving body composition; and

• to determine whether certain combinations or components (or both) of school-based interventions are more effective than others in promoting physical activity and fitness in this target population.

Search methods

We searched CENTRAL, MEDLINE, Embase, CINAHL, PsycINFO, BIOSIS, SPORTDiscus, and Sociological Abstracts to 1 June 2020, without language restrictions. We screened reference lists of included articles and relevant systematic reviews. We contacted primary authors of studies to ask for additional information.

Selection criteria

Eligible interventions were relevant to public health practice (i.e. were not delivered by a clinician), were implemented in the school setting, and aimed to increase physical activity among all school-attending children and adolescents (aged 6 to 18) for at least 12 weeks. The review was limited to randomised controlled trials. For this update, we have added two new criteria: the primary aim of the study was to increase physical activity or fitness, and the study used an objective measure of physical activity or fitness. Primary outcomes included proportion of participants meeting physical activity guidelines and duration of moderate to vigorous physical activity and sedentary time (new to this update). Secondary outcomes included measured body mass index (BMI), physical fitness, health-related quality of life (new to this update), and adverse events (new to this update). Television viewing time, blood cholesterol, and blood pressure have been removed from this update.

Data collection and analysis

Two independent review authors used standardised forms to assess each study for relevance, to extract data, and to assess risk of bias. When discrepancies existed, discussion occurred until consensus was reached. Certainty of evidence was assessed according to GRADE. A random-effects meta-analysis based on the inverse variance method was conducted with participants stratified by age (children versus adolescents) when sufficient data were reported. Subgroup analyses explored effects by intervention type.

Main results

Based on the three new inclusion criteria, we excluded 16 of the 44 studies included in the previous version of this review. We screened an additional 9968 titles (search October 2011 to June 2020), of which 978 unique studies were potentially relevant and 61 met all criteria for this update. We included a total of 89 studies representing complete data for 66,752 study participants. Most studies included children only (n = 56), followed by adolescents only (n = 22), and both (n = 10); one study did not report student age. Multi-component interventions were most common (n = 40), followed by schooltime physical activity (n = 19), enhanced physical education (n = 15), and before and after school programmes (n = 14); one study explored both enhanced physical education and an after school programme. Lack of blinding of participants, personnel, and outcome assessors and loss to follow-up were the most common sources of bias.

Results show that school-based physical activity interventions probably result in little to no increase in time engaged in moderate to vigorous physical activity (mean difference (MD) 0.73 minutes/d, 95% confidence interval (CI) 0.16 to 1.30; 33 studies; moderate-certainty evidence) and may lead to little to no decrease in sedentary time (MD -3.78 minutes/d, 95% CI -7.80 to 0.24; 16 studies; low-certainty evidence). School-based physical activity interventions may improve physical fitness reported as maximal oxygen uptake (VO_2max) (MD 1.19 mL/kg/min, 95% CI 0.57 to 1.82; 13 studies; low-certainty evidence). School-based physical activity interventions may result in a very small decrease in BMI z-scores (MD -0.06, 95% CI -0.09 to -0.02; 21 studies; low-certainty evidence) and may not impact BMI expressed as kg/m^2 (MD -0.07, 95% CI -0.15 to 0.01; 50 studies; low-certainty evidence). We are very uncertain whether school-based physical activity interventions impact health-related quality of life or adverse events.

Authors' conclusions

Given the variability of results and the overall small effects, school staff and public health professionals must give the matter considerable thought before implementing school-based physical activity interventions. Given the heterogeneity of effects, the risk of bias, and findings that the magnitude of effect is generally small, results should be interpreted cautiously.

PLAIN LANGUAGE SUMMARY

Do school-based physical activity interventions increase moderate to vigorous physical activity and improve physical fitness among children and adolescents?

Key messages

School-based interventions may improve physical fitness but may have little to no impact on body mass index (which is used to assess whether body weight is in a healthy range), although we do not have confidence in the evidence.

Very few studies have reported on any potential harmful effects.

Careful consideration is needed about the type of school-based physical activity programme to be implemented, and future studies should seek to identify the best types of physical activity interventions for school settings.

Why is it important to promote physical activity in children?

It is estimated that as many as 5.3 million deaths worldwide are caused by not getting enough exercise (physical inactivity), and this is a big risk factor leading to most long-lasting diseases and cancers. This is a topic of concern, particularly because it is known that physical activity patterns in childhood can lead to similar patterns in adulthood. Programmes that encourage children to exercise while at school are thought to be a way to increase activity levels of all children, regardless of other factors such as parent behaviours and social or financial factors of a child's early lifetime.

What did we find?

We found 89 studies that looked at the effects of programmes in schools that focused on increasing physical activity, which included 66,752 children and adolescents (between the ages of 6 and 18) from around the world. The length of programme time varied from 12 weeks to 6 years. No two school-based physical activity programmes used the same combination of intervention parts. How often and how long each part of a programme was run varied a lot across studies.

Across all included studies, only very small changes were noted in the number of students undertaking physical activity or in minutes per day of moderate to vigorous physical activity or sedentary time, although these programmes were found to improve students' physical fitness. These programmes were found to have little to no impact on measurements used to assess whether body weight is in a healthy range. Not many studies reported on any potential harmful effects, such as injury or psychological harm.

What are the limitations of the evidence?

We have little confidence in the evidence because studies were done in different ways and interventions were delivered and assessed in different ways. Also, people in the studies may have been aware of which interventions they were getting, and this can sometimes affect the outcomes reported. In addition, not all studies provided data about everything we were interested in.

How up-to-date is the evidence?

The evidence is up-to-date to June 2020 (although we did run a new search for studies in February 2021 and found studies that may be included in a future update and are now described in the "Studies awaiting classification" table).

SUMMARY OF FINDINGS

Summary of findings 1. School-based physical activity programmes for promoting physical activity and fitness in children and adolescents aged 6 to 18 years

School-based physical activity programmes for promoting physical activity and fitness in children and adolescents aged 6 to 18 years

Population: children and adolescents aged 6 to 18 years

Settings: primarily within the school setting

Intervention: educational, health promotion, counselling, and management strategies focused on promotion of physical activity and fitness

Comparison: standard, currently existing physical education programmes in schools

Outcomes	Anticipated effects (95% CI)		No. of participants (trials)	Certainty of the evidence (GRADE)
	Risk with control	Risk with intervention		
% of participants physically active [follow-up: 12 weeks to 12 months]	% physically active ranged from 2% to 50%	% physically active ranged from 1.11% lower to 12.22% higher.	6,068 (5)	⊕⊝⊝⊝ **very low[a]**
Moderate to vigorous physical activity (minutes/d) [follow-up: 12 weeks to 3 years]	-3.63 (-5.03 to -2.23)	MD 0.73, 95% CI 0.16 to 1.30	20,614 (33)	⊕⊕⊕⊝ **moderate[b]**
Sedentary time (minutes/d) [follow-up: 12 weeks to 28 months]	27.77 (-21.34 to 76.88)	MD -3.78, 95% CI -7.80 to 0.24	11,914 (16)	⊕⊕⊝⊝ **low[c]**
Physical fitness (VO_2 max, mL/kg/min) [follow-up: 12 weeks to 1 year]	-1.00 (-1.59 to -0.41)	MD 1.19, 95% CI 0.57 to 1.82	3,980 (13)	⊕⊕⊝⊝ **low[d]**
BMI (z-score) [follow-up: 12 weeks to 4 years]	-0.01 (-0.08 to 0.06)	MD -0.06, 95% CI -0.09 to -0.02	22,948 (21)	⊕⊕⊝⊝ **low[e]**
BMI (kg/m^2) [follow-up: 12 weeks to 4 years]	-0.35 (-1.06 to 0.36)	MD -0.07, 95% CI -0.15 to 0.01	34,337 (50)	
Health-related quality of life [follow-up: 15 weeks to 12 months]	Not estimable; insufficient data reported within studies		4,687 (7)	⊕⊝⊝⊝ **very low[f]**
Adverse events [follow-up: 12 weeks to 3 years]	Not estimable; only 3 studies reported any adverse events		11,698 (16)	⊕⊝⊝⊝ **very low[g]**

BMI: body mass index; **CI:** confidence interval; **MD:** mean difference; **min/d:** minutes per day; VO_2max: maximal oxygen uptake.

GRADE Working Group grades of evidence.
High quality: we are very confident that the true effect lies close to that of the effect estimate.
Moderate quality: we are moderately confident in the effect estimate. The true effect is likely to be close to the estimate of effect, but there is a possibility that it is substantially different.

Low quality: our confidence in the effect estimate is limited. The true effect may be substantially different from the estimate of the effect.
Very low quality: we have very little confidence in the effect estimate. The true effect is likely to be substantially different from the estimate of the effect.

[a]Downgraded by one level each for inconsistency (large variation in effects across studies), imprecision (wide confidence intervals), and risk of bias (high or unclear in most studies).
[b]Downgraded by one level for inconsistency (visual inspection of forest plots and I^2 value from meta-analysis).
[c]Downgraded by one level for imprecision of results (wide confidence intervals) and risk of bias (high or unclear in many studies).
[d]Downgraded by one level for inconsistency (visual inspection of forest plots and I^2 value from meta-analysis) and indirectness (estimated vs measured VO_2 peak).
[e]Downgraded by one level for inconsistency (visual inspection of forest plots and I^2 value from meta-analysis), risk of bias (high or unclear in most studies).
[f]Downgraded by one level for inconsistency (large variation across studies), risk of bias (high or unclear in most studies), publication bias (most studies not reporting on health-related quality of life or describing full results).
[g]Downgraded by one level for inconsistency (large variation across studies), publication bias (most studies not reporting on adverse events or methods for monitoring), risk of bias (high or unclear in most studies).

BACKGROUND

Description of the condition

International public health and health promotion organisations have identified health risks across the lifespan associated with physical inactivity. Recent estimates suggest that 5.3 million deaths per year throughout the world are attributable to physical inactivity (Lee 2012a). Globally, physical inactivity has been identified as the fourth leading risk factor for global mortality (6% of all deaths), following high blood pressure, tobacco use, and high blood glucose, and overweight and obesity are responsible for 5% of deaths globally (Warburton 2017; WHO 2008). Physical inactivity is estimated to cause 10% of the burden of disease from breast cancer and colon cancer, as well as 7% from type 2 diabetes, and 6% from coronary heart disease (Lee 2012a). The burden of these and other chronic diseases has rapidly increased in recent decades (WHO 2008). In fact, physical activity was labelled as "today's best buy in public health" almost three decades ago (Morris 1994). Recent estimates suggest that physical inactivity cost healthcare systems $ (INT$) 53.8 billion worldwide in 2013 (Ding Ding 2016). In addition, the literature indicates that an elevated body mass index (BMI) places children and adolescents at greater risk for cardiovascular disease as adults, and that diet and physical activity are important factors in maintaining a healthy BMI range (Hills 2011). Longitudinal data have shown that for each weekday that adolescents of normal weight participated in physical education (PE), the odds of becoming overweight in adulthood decreased by 5% (Menschik 2008).

Previous reports have concluded that the intensity, frequency, and duration of physical activity contribute to overall physical health status and suggest that a 'threshold' must be maintained to produce positive health effects (CDC 1999; Shephard 1997; Tolfrey 2000). In fact, a positive linear association between duration of physical activity and positive health effects has been established, with longer duration associated with improved physical health (Carson 2017; Janssen 2010; Shephard 1997). Maximal oxygen uptake (VO_2max) is a standard measure associated with fitness levels, with increasing values expected as fitness level improves, and is an important indicator of successful physical activity interventions. Recent analyses have shown a dose-response relationship between physical activity behaviours (minutes/week of moderate to vigorous physical activity (MVPA)) and fitness levels (measured by VO_2max) and measures of cardio-metabolic health, including measures of body composition, blood pressure, and blood cholesterol (Nevill 2020; Sriram 2021).

Current guidelines suggest that children and adolescents should engage in at least 60 minutes of MVPA per day, along with muscle and bone strengthening activities at least 3 days per week (Chaput 2020). Examples of moderate to vigorous activities include brisk walking, jogging, stair climbing, basketball, racquet sports, soccer, dance, lap swimming, skating, strength training, cross-country skiing, and cycling. In the most recently released global physical activity guidelines, evidence suggests that time spent in sedentary behaviour is associated with poorer health outcomes in both children and adolescents, and it is recommended that children and adolescents limit sedentary time, especially when sedentary time is combined with recreational screen time (Chaput 2020). Research suggests that the best primary strategy for improving the long-term health of children and adolescents through exercise may involve creating a lifestyle pattern of regular MVPA that will carry over to the adult years (Freedson 1992; Telama 2005; Twisk 2000). Despite this, the Global Matrix 3.0 Physical Activity Report Card Grades for Children and Youth on physical levels of children and youth from 49 countries revealed a mean letter grade of C for the percentage of children and youth meeting the physical activity recommendation of 60 minutes of MVPA per day, representing 27% to 33% of children and youth (Aubert 2018). Therefore it is of primary importance to identify approaches that will be effective in increasing and sustaining activity levels of children and adolescents in places where they spend long periods of time, such as schools.

Description of the intervention

To ensure sustained progress towards major improvements in chronic disease prevention, the World Health Organization (WHO) has called on public health organisations within and between countries to work collaboratively with key partners, including educators and health professional bodies, educational institutions, consumer groups, researchers, and the private sector, to provide a comprehensive strategy to promote physical activity among children and adolescents (WHO 2008). The school setting is an ideal environment for population-based physical activity interventions, as no other institution has as much influence on children during their first two decades of life (Naylor 2009; Story 2009). Recognising the unique opportunity that exists to formulate and implement an effective strategy to substantially reduce deaths and disease burden worldwide by improving diet and promoting physical activity, the WHO has adopted the Health Promoting School (HPS) framework to promote healthy living, learning, and working conditions. An HPS encourages moving beyond individual behaviour change and considering and addressing the whole-school environment (IUHPE 2010). The WHO specifically identified schools as a target setting for promotion of physical activity among children and youth and suggested that schools implement opportunities and programming for physical activity and provide safe and appropriate spaces that facilitate participation in physical activity (WHO 2008).

Schools are considered an ideal setting for promoting physical activity among children due to their broad reach and multiple opportunities to promote physical activity over the course of the school week, including physical education classes, before and after school programmes, recess programming, active school travel, and classroom-based physical activity (Singh 2017; Watson 2017a). To effectively promote MVPA, the Centers for Disease Control and Prevention suggests that schools engage in comprehensive approaches to develop, implement, and evaluate physical activity policies and practices; establish school environments that support physical activity; implement a quality physical activity programme with quality physical education as a cornerstone; implement health education that provides students with the knowledge, attitudes, and skills needed for physical activity; provide students with health, mental health, and social services to promote physical activity and prevent chronic disease; partner with families and community members in development and implementation of physical activity policies; provide a school employee wellness programme that includes physical activity services for all school staff members; and employ qualified persons and provide professional development opportunities for physical education and physical activity (CDC 2011).

Studies conducted to date have generally utilised different combinations of physical activity promotion interventions in schools, including before and after school programmes, multi-component physical activity interventions, enhanced PE, and schooltime physical activity, such as physically active lessons. Generally, interventions focused on providing students with information about the benefits of physical activity and healthy nutrition, the risks associated with inactivity and unhealthy food choices, and the importance of increasing the amount of time students were engaged in MVPA during the school day, as well as ensuring that they expend greater amounts of energy during physical activity sessions. Interventions targeted the school curriculum (related to PE classes specifically and to the whole curriculum generally), teacher training, educational materials, changes in the format of the school day, and accessibility to exercise equipment. Interventions included training sessions for teachers (to learn more effective ways to promote physical activity and to incorporate it into curricula) and training materials including kits, packages of materials to be used in curricula, and materials to be given to students and parents. Packages included teaching notes on exercise, how the body works, and healthy eating and nutrition. Interventions also targeted PE classes by increasing the level of activity students engaged in during these classes, introducing activities geared to the age and level of development of the child, and putting greater emphasis on games. Students were encouraged to be more active outside of school during leisure time. The curriculum focused on creating a positive self-image through awareness of physical activity benefits. Curriculum changes were implemented in other courses as well, such as science courses, which incorporated discussions of healthy eating and physical activity. Some interventions included changes in the food provided in school cafeterias, so as to increase the number of healthy food choices. Other strategies included a risk factor assessment of students to identify students with established risk factors and development of a plan to reduce student risk through increased physical activity, healthy nutrition, and goal attainment.

How the intervention might work

Given that school-aged children spend a significant amount of their wakeful time in transit to or in the school setting, and that almost all children in many countries attend school until they reach adolescence, school-based physical activity promotion interventions have the potential to reduce population-wide chronic disease (Macnab 2014). In fact, several published systematic reviews have highlighted the benefits of physical activity among healthy children (Brown 2009; Cesa 2014; Granger 2017; Janssen 2010; Kriemler 2011a; Marker 2016; Poitras 2016). School-based interventions can target simultaneously children at risk and children not at risk for future chronic disease and can increase both knowledge and behaviour conducive to healthier lifestyles. School-based strategies targeting all students through curriculum ensure that 100% of students are exposed to the intervention, thereby increasing the reach of these interventions. Increased physical activity is an essential public health and health promotion strategy to improve child health (WHO 2008).

The intent of school-based physical activity interventions is to increase the overall percentage of children and adolescents engaged in MVPA each day while increasing the duration of MVPA engaged in on a weekly basis. The aim of these interventions is to create a school environment that is conducive to achieving a greater proportion of children and adolescents who meet physical activity guidelines, while increasing time spent engaged in MVPA. Generally, this means that significant changes to the school curriculum are needed to support increased time for physical activity as well as increased levels of activity during this time. School-based interventions offer an important opportunity to improve knowledge of how to prevent non-communicable disease, and to provide both knowledge about the importance of physical activity and the opportunity for students to be more active before, during, and after school hours, thereby helping them develop healthier behaviours that may track into adulthood (Hayes 2019).

Why it is important to do this review

This systematic review was first published in 2009, with an update provided in 2013. Although the benefits of physical activity for healthy children have been documented, at the time the original review was conducted no other reviews had systematically examined the effectiveness of various combinations of school-based interventions in promoting physical activity and fitness among children. Since that time, several new trials have been published (and are included in this update) and methodological advances have been made (e.g. using accelerometers rather than relying on self-report data). The purpose of this update is to synthesise new data on the effectiveness of school-based physical activity interventions with data included in the original review. This update includes evaluations of published studies indexed up to and including 1 June 2020.

Given that school-aged children spend a significant amount of time in the school setting, and that many barriers prevent participation in physical activity outside of the school setting (e.g. resources, availability, cost), it is particularly important to understand the extent to which school-based physical activity promotion interventions are effective in increasing activity and improving fitness levels. It is important to evaluate how these types of interventions may impact (positively or negatively) students' overall well-being and health-related quality of life and to discern any potential adverse events or harms. When school-based interventions are combined with broader community-based interventions, it is difficult to ascertain the impact of school-based strategies. However, in developing comprehensive physical activity or chronic disease prevention strategies, it is crucial to incorporate effective school-based strategies. Therefore, it is timely, given low worldwide participation in regular physical activity, that a review focused solely on the effectiveness of school-based physical activity interventions be conducted and regularly updated.

OBJECTIVES

The purpose of this review update is to summarise the evidence on effectiveness of school-based interventions in increasing moderate to vigorous physical activity and improving fitness among children and adolescents 6 to 18 years of age.

Specific objectives are:

- to evaluate the effects of school-based interventions on increasing physical activity and improving fitness among children and adolescents;
- to evaluate the effects of school-based interventions on improving body composition; and
- to determine whether certain combinations or components (or both) of school-based interventions are more effective than

others in promoting physical activity and fitness in this target population.

METHODS

Criteria for considering studies for this review

Types of studies

In accordance with the last update, we included randomised controlled trials (RCTs) or cluster-RCTs with a minimum intervention duration of 12 weeks. There are four unique departures from the protocol of this update in comparison to the original review.

- Due to growing availability and use of technology-based assessments of physical activity and sedentary time via accelerometers, and known limitations of self-report physical activity data for children in particular, we limited this review to studies that included a device-based measure of physical activity or sedentary time (e.g. with accelerometers). This resulted in exclusion of measures related to TV watching time from the review, replaced by overall measures of sedentary time. This change in inclusion criteria resulted in exclusion from this update of several studies that included only self-report measures that were included in the original review.
- Studies not primarily aimed at increasing levels of physical activity were excluded from this update. This resulted in exclusion of some studies that were primarily focused on nutrition or reducing/preventing obesity.
- Outcomes of blood pressure and pulse rate were excluded from this update. Again, this resulted in exclusion of a very small number of studies that included only these outcomes.
- For included studies, we extracted outcomes related to health-related quality of life and adverse events when reported. This did not result in any change to inclusion or exclusion criteria.

The review authors are aware that post hoc questions are susceptible to bias (Higgins 2011); however, in light of the growing body of literature on the effectiveness of school-based physical activity promotion interventions, we believe the changes in inclusion and exclusion criteria were necessary to ensure inclusion in this update of the most rigorous evidence related to the research question.

Types of participants

Studies that included school-attending children and adolescents between the ages of 6 and 18 years were included in this review. This included all otherwise healthy children and adolescents, whether they were overweight or obese, or were not. We excluded studies in which participants received a physical activity intervention as part of a treatment regimen for a specific critical illness or comorbidity (e.g. diabetes). Study participants were categorised as children (age 6 to < 12) or adolescents (age 12 to 18) based on Centers for Disease Control and Prevention categories (Centers for Disease Control and Prevention, 2021).

Types of interventions

Interventions

We included any school-based physical activity programme that aimed to increase physical activity and/or fitness among children and adolescents. We defined school-based physical activity programmes as any that implemented educational, health promotion, counselling, and/or management strategies focused on promotion of physical activity and/or fitness. The range of interventions included changes to school curriculum, training for teachers about incorporating physical activity into school curriculum and routines, and educational materials for teachers, students, and parents. In some instances, the intervention included strategies to engage parents in the intervention, as well as community-based strategies, mass media, policy development, and environmental changes. We included studies for which interventions were targeted primarily within the school setting. In some instances, interventions were implemented in the community and in the home, in addition to school-based interventions, although the primary focus needed to be the school setting. Included studies must have fallen within public health practice (meaning the focus was on health promotion from an individual or population-wide perspective and was not physician or clinic based) and must have been able to be implemented, facilitated, or promoted by staff in local public health units or by public health professionals.

Comparators

The comparison could be no intervention, usual care, or a concomitant intervention. Concomitant interventions had to be the same in both intervention and comparator groups to establish fair comparisons.

Minimum duration of intervention

The minimum duration of follow-up was 12 weeks. Given the abundance of literature, this criterion was added during the last update to focus on interventions that were most likely to result in meaningful and sustainable changes in the school setting (Dobbins 2013). We extracted data on extended follow-up periods. We defined extended follow-up periods as follow-up of participants that occurred once the original trial, as specified in the trial protocol, had been terminated (Buch 2011; Megan 2012).

Summary of specific exclusion criteria

We excluded studies in which participants received a physical activity intervention as part of a treatment regimen for a specific critical illness or comorbidity (e.g. diabetes), studies in which the intervention was conducted entirely outside the school setting (e.g. community setting, public place, recreation facility, physician office, camp setting), and studies in which the intervention could be delivered only by a specific health professional (e.g. physician) or fitness expert.

Types of outcome measures

To be included, studies had to report one or more of the following outcomes, presented as post-intervention measurement and standard deviation or confidence intervals, or as change from baseline with standard deviation or confidence intervals.

Primary outcomes

- Proportion of students meeting recommendations for moderate to vigorous physical activity (MVPA)
- Duration of MVPA
- Sedentary time

Secondary outcomes

- Physical fitness
- Body mass index (BMI)
- Health-related quality of life
- Adverse events

Method and timing of outcome measurement

Outcomes were primarily measured at baseline and immediately post intervention. In a small subset of studies, outcomes were measured at 6 months, at 9 months, and at 12 months, and in one study, up to 4 years post intervention.

- MVPA: assessed by accelerometers during school time or non-school (or both) time. The proportion of students who met physical activity guidelines was presented as reported or calculated by dividing the number of students engaged in 60 minutes/d of MVPA by the total number of students allocated to either the intervention group or the control group; duration of physical activity was measured as total minutes per day or weeks spent engaged in MVPA.
- Sedentary time: measured as time spent sedentary in total minutes or hours per day or per week, measured via accelerometers.
- BMI (kg/m^2or BMI z-score): measured by trained health professionals using calibrated scales; however, differences existed across studies in terms of which clothes were worn by participants during measurement and whether height and weight were measured during school time.
- Physical fitness: measured in different ways by trained professionals. In some instances, actual maximal oxygen uptake (VO_2max) was measured; in many, a field-based test such as a shuttle run or a step test was used to estimate VO_2max.
- Health-related quality of life: quantified with a validated instrument (e.g. Pediatric Quality of Life Inventory). Assessments completed by both students and parent proxies were eligible.
- Adverse events: any as reported by study authors were noted, as were specific statements of no adverse events occurring.

Search methods for identification of studies

Electronic searches

The search for this update was conducted from the date of our last search (October 2011) to 1 June 2020. Some minor changes were made to the search strategy, such as using validated search filters for RCTs that were not available at the time of our last search and adding terms for sedentary time. Validated search filters were used within MEDLINE Ovid (Lefebvre 2019), Embase Ovid (Glanville 2019a), and Cumulative Index to Nursing and Allied Health Literature (CINAHL) (Glanville 2019b). We searched the following databases.

- Cochrane Central Register of Controlled Trials (CENTRAL), in the Cochrane Library.
- MEDLINE Ovid.
- Embase Ovid.
- CINAHL EBSCO.
- PsycINFO Ovid.
- BIOSIS Web of Science.
- SPORTDiscus EBSCO.
- Sociological Abstracts ProQuest.

For detailed search strategies, see Appendix 1. We placed no restrictions on language of publication when searching electronic databases or reviewing reference lists of identified trials.

Searching other resources

We tried to identify other potentially eligible trials or ancillary publications, including trial registries, by handsearching the reference lists of all included trials and relevant systematic reviews and meta-analyses and health technology assessment reports that were identified in our search. We contacted authors of included trials to request additional information on retrieved trials and to determine if further trials exist, which we may have missed.

We did not use abstracts or conference proceedings for data extraction because this information source does not fulfil the Consolidated Standards of Reporting Trials (CONSORT) requirements, which call for "an evidence-based, minimum set of recommendations for reporting randomised trials" (CONSORT 2018 Scherer 2007). However, we specified trial details in the Characteristics of studies awaiting classification table, and we contacted study authors to determine whether further publications exist.

Data collection and analysis

Selection of studies

For this update, two review authors (SNS, HC) independently screened abstract, title, or both, for every record retrieved in the literature searches, to determine which trials should be assessed further. We obtained the full text of all potentially relevant records. We resolved disagreements through consensus or by recourse to a third review author (MD). If we could not resolve a disagreement, we categorised the trial as a 'study awaiting classification' and contacted trial authors for clarification. We prepared an adapted PRISMA flow diagram to show the process of trial selection (Figure 1) (Liberati 2009). We listed all articles excluded after full-text assessment in the Characteristics of excluded studies table and provided reasons for exclusion.

Figure 1. Trial flow diagram.

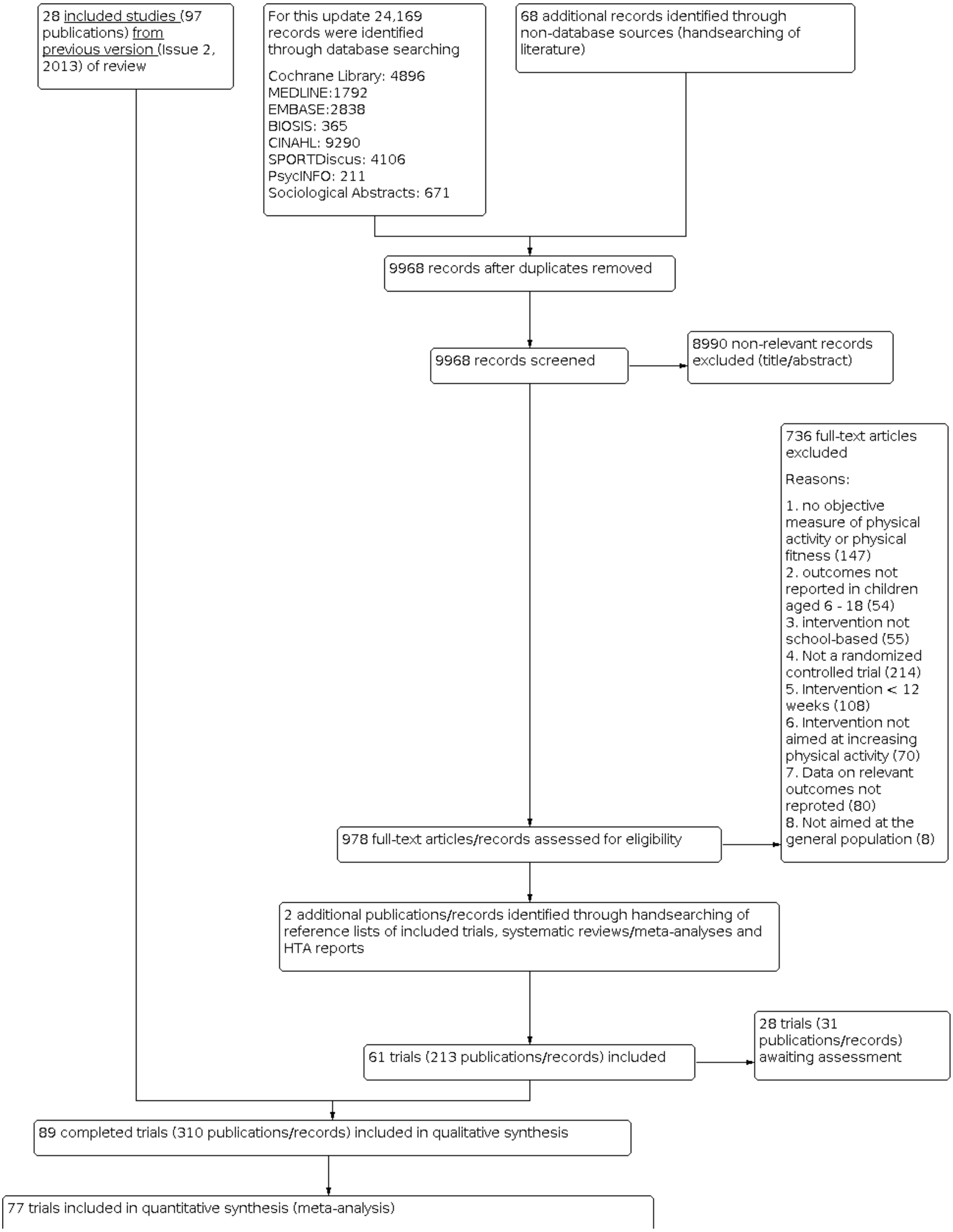


Figure 1. (Continued)

77 trials included in quantitative synthesis (meta-analysis)

Data extraction and management

For trials that fulfilled our inclusion criteria, two review authors (SNS, HC) independently extracted key participant and intervention characteristics. We reported data on efficacy outcomes and adverse events using standardised data extraction sheets. We resolved disagreements by discussion, or, if required, we consulted a third review author (MD) (for details, see Characteristics of included studies; Table 1; Appendix 2; Appendix 3). We provided information including trial identifiers for potentially relevant ongoing trials in the Characteristics of ongoing studies table.

We emailed all authors of included trials to enquire whether they would be willing to answer questions regarding their trials. We thereafter sought relevant missing information on the trial from the primary trial author(s), if required.

Dealing with duplicate and companion publications

In the event of duplicate publications, companion documents, or multiple reports of a primary trial, we maximised the information yield by collating all available data, and we used the most complete data set aggregated across all known publications. We listed duplicate publications, companion documents, multiple reports of a primary trial, and trial documents of included trials (such as trial registry information) as secondary references under the study identifier (ID) of the included trial. Furthermore, we listed duplicate publications, companion documents, multiple reports of a trial, and trial documents of excluded trials (such as trial registry information) as secondary references under the study ID of the excluded trial.

Assessment of risk of bias in included studies

For this review, all newly included studies were assessed independently for risk of bias by two review authors (SNS, HC) according to six domains (sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessors, incomplete outcome data, and selective reporting) using the ‘Risk of Bias 1’ tool in the *Cochrane Handbook for Systematic Reviews of Interventions* to assign assessment of low, high, or unclear risk of bias (for details, see Appendix 4) (Higgins 2017). Incomplete outcome data were rated separately for (1) device-based measures of physical activity and sedentary time, and (2) BMI and fitness, due to the large proportion of missing data that is often seen in studies using accelerometers. For studies that used a cluster-randomised design, four additional domains (recruitment bias, baseline imbalance, loss of clusters, and incorrect analysis) were assessed. All disagreements were resolved through discussion. If adequate information was unavailable, trial authors were contacted to request missing data on ‘Risk of bias’ items.

Two main changes were made to the assessment of risk of bias for this update. First, due to changes to Cochrane recommendations, blinding is now assessed separately for participants and personnel, and outcome assessors. Previously included studies were re-assessed for this domain. In this update, we do not include assessment for control for confounders or reliability and validity of data collection methods. Second, previously included studies that utilised a cluster-randomised design were appraised for the four new cluster-randomised trial domains. Finally, assessment of 'other' risk of bias has been removed.

Risk of bias for an outcome across trials and across domains

These are the main summary assessments that we incorporated into our judgements about quality of evidence in Summary of findings 1. We defined outcomes as at low risk of bias when most weight in the meta-analysis comes from trials at low risk of bias, unclear risk when most weight in the meta-analysis comes from trials at low or unclear risk of bias, and high risk when a sufficient proportion of information comes from trials at high risk of bias. We defined single studies as having low risk of bias when all but one domain was assessed to be at low risk of bias, or when all but two domains were assessed at low risk of bias, one of which was 'blinding of participants and personnel', as adequate blinding of study participants is nearly impossible to do well in school-based physical activity interventions. We defined single studies to be at high risk of bias when at least three domains were assessed as having unclear or high risk of bias, or when four domains were assessed as having unclear or high risk of bias, one of which was 'blinding of participants and personnel'.

Measures of treatment effect

When at least five included trials were available for comparison of a given outcome measured on the same scale (e.g. MVPA in minutes/d), we combined effects into a meta-analysis. When available, we extracted data on post-intervention values adjusted for baseline differences, along with confidence intervals or standard deviation. When only changes from baseline were reported, these differences, along with confidence intervals or standard deviations, were extracted. Both were combined in meta-analyses, with the calculator function in RevMan 5.4 used to calculate adjusted between-group difference, as outlined in the *Cochrane Handbook for Systematic Reviews of Interventions* (Deeks 2021).

When possible, we combined multiple study groups into a single pairwise comparison using formulae for combining continuous data from multiple groups as provided in the Cochrane Handbook for Systematic Reviews of Interventions when separate data were presented for each group, or when between-group comparisons from multiple group had independent control groups (e.g. when results were presented separately for boys and girls or by grade level) (Higgins 2017). When between-group differences were reported between multiple intervention groups and the same control group, we did not include these data in the meta-analysis, so as not to double-count participants in control groups.

Unit of analysis issues

We considered the level at which randomisation occurred, such as cluster-randomised trials and multiple observations for the same outcome. If more than one comparison from the same trial was eligible for inclusion in the same meta-analysis, we used the end of intervention comparison.

Standard errors for cluster-RCTs that were not appropriately adjusted for potential clustering of participants within clusters in analyses were adjusted using the design effect (1 + (*M*-1) × ICC), where M is the average cluster size, and ICC is the intraclass correlation coefficient (Higgins 2017). The ICC was estimated at 0.01, as has been previously reported (Murray 2006).

Dealing with missing data

If possible, we obtained missing data from authors of included trials. We carefully evaluated important numerical data such as screened, randomly assigned participants, as well as intention-to-treat and as-treated and per-protocol populations. We investigated attrition rates (e.g. dropouts, losses to follow-up, withdrawals), and we critically appraised issues concerning missing data and use of imputation methods (e.g. last observation carried forward). When included trials did not report sufficient data for inclusion in the meta-analysis (e.g. provided only P values) and we did not receive requested information from trial authors, we did not include these studies in the meta-analysis; however, we included them in the narrative tables.

Assessment of heterogeneity

We identified heterogeneity (inconsistency) by visually inspecting forest plots and by using a standard Chi^2 test with a significance level of $\alpha = 0.1$ (Deeks 2021). In view of the low power of this test, we also considered the I^2 statistic, which quantifies inconsistency across trials to assess the impact of heterogeneity on the meta-analysis (Higgins 2002; Higgins 2003). When we found heterogeneity, we attempted to determine possible reasons for this by examining individual trial and subgroup characteristics in the narrative summary.

Assessment of reporting biases

If we included 10 or more trials that investigated a particular outcome, we planned to use funnel plots to assess small-trial effects. Several explanations may account for funnel plot asymmetry, including true heterogeneity of effect with respect to trial size, poor methodological design (and hence bias of small trials), and publication bias (Sterne 2017).

Data synthesis

We planned to undertake (or display) a meta-analysis only if we judged participants, interventions, comparisons, and outcomes to be sufficiently similar to ensure an answer that is clinically meaningful. We used random-effects meta-analyses to calculate the mean of the effects of included studies (Borenstein 2017a; Borenstein 2017b; Higgins 2009). We performed statistical analyses according to the statistical guidelines presented in the *Cochrane Handbook for Systematic Reviews of Interventions* (Deeks 2021).

When studies could not be included in the meta-analysis, for example, because they did not report the required data or they measured the outcome in a format that was incompatible with other studies, we summarised results from each study under Results and in table form. We used vote counting based on the direction of effect to determine whether the majority of studies found a positive or negative effect (McKenzie 2021).

Subgroup analysis and investigation of heterogeneity

Given the differences between children and adolescents with respect to school setting, types of interventions, etc., we explored the effects of interventions on these two age groups separately, using the subgroup function in Review Manager 5.4.

Given the substantial heterogeneity in types of interventions included, we conducted secondary analyses to synthesise results with respect to each outcome type by subcategories of intervention types. For this purpose, we broadly categorised each intervention type as primarily focused on (1) before or after school physical activity programmes, for example, after school dance clubs, walk to school programmes; (2) enhanced PE classes that focused on increasing the frequency, duration, intensity, or types of activities above and beyond the usual PE classes; (3) multi-component interventions that typically included a whole-school approach and utilised multiple strategies including environmental changes to increase physical activity, and often promoted healthy eating or healthy weight amongst students; and (4) schooltime physical activity interventions, such as active academic lessons or cycling desk interventions that focused on integrating physical activity throughout the school day itself rather than restricting physical activity to recess or PE classes.

Sensitivity analysis

We performed no sensitivity analyses.

Summary of findings and assessment of the certainty of the evidence

We used the GRADE approach to assess overall certainty of evidence for each of the primary and secondary outcome measures. GRADE takes into account issues related to both internal and external validity to state how confident we are in the effect estimates presented. Two review authors (SNS, HC) independently rated the certainty of evidence for each outcome. We resolved differences in assessment by discussion. For each outcome, we rated evidence certainty as very low, low, moderate, or high based on the GRADE domains as described in Chapter 14 of the *Cochrane Handbook for Systematic Reviews of Interventions* (Schünemann 2021). As only RCTs were included, the starting point for certainty of evidence was high. Then we considered each GRADE domain to determine whether downgrading of certainty was needed based on:

- risk of bias - based on critical appraisal using the Cochrane 'Risk of bias' tool;
- inconsistency of results - based on visual inspection of forest plots and I^2 in meta-analyses and consistency of effects reported across narrative syntheses;
- indirectness - based on the validity of outcome measures used and how directly they measured the outcome of interest, for example, studies that measure VO_2 peak as a direct measure of fitness provide greater certainty than studies that report estimated fitness based on functional tests;
- publication bias - based on a small number of studies or indication of publication bias based on funnel plots; and
- imprecision - based on width of the confidence intervals, and whether they include the possibility of a small or null effect.

We presented a summary of the evidence in Summary of findings 1. This provides key information about the best estimate of the magnitude of effect as absolute differences for each relevant comparison, numbers of participants and trials addressing each important outcome, and a rating of overall confidence in effect estimates for each outcome. We created the 'Summary of findings' table using the methods described in the *Cochrane Handbook for Systematic Reviews of Interventions* (Schünemann 2021), along with Review Manager (RevMan 5.4) table editor (RevMan 2014). We reported the following outcomes, listed according to priority.

- MVPA (proportion meeting guidelines, duration).
- Sedentary time.
- Physical fitness.
- BMI.
- Health-related quality of life.
- Adverse events.

RESULTS

Description of studies

For a detailed description of trials, see Table 1, Characteristics of included studies, Characteristics of excluded studies, and Characteristics of ongoing studies sections.

Results of the search

A total of 16,219 records related to physical activity interventions with children and adolescents were identified for the last update. Of these, 587 studies were assessed for eligibility, and 44 were deemed to meet the criteria for inclusion in the review. The most common reasons studies were judged as not relevant were data on relevant outcomes not reported, studies not RCTs, and studies not relevant to public health.

For this update, when the new inclusion and exclusion criteria were applied (i.e. only studies in which the primary aim was to increase levels of physical activity and that included an objective measure of physical activity, physical fitness, or body composition), 16 of the original 44 studies were excluded: 11 included only self-report measures (Araujo-Soares 2009a; Colin-Ramirez 2010; Dishman 2004; Haerens 2006; Jones 2008; Kipping 2008; Lubans 2009; McManus 2008; Petchers 1988; Singhal 2010; Verstraete 2006); three did not include any measure of physical activity or physical fitness (Li 2010; Martinez 2008; Stephens 1998); and two did not have a primary objective to increase physical activity (Robinson 1999; Singh 2009). Therefore, this update includes 28 of the 44 studies included in the last update (Angelopoulos 2009; Barbeau 2007; Bayne-Smith 2004; Burke 1998; Bush 1989; Donnelly 2009; Dorgo 2009; Ewart 1998; Gentile 2009; Haerens 2006; Kriemler 2010; Luepker 1996; Neumark-Sztainer 2009; Neumark-Sztainer 2010; Peralta 2009; Reed 2008; Salmon 2008; Simon 2004; Stone 2003; Trevino 2004; Walter 1988; Walther 2009; Wang 2008; Webber 2008; Weeks 2008; Williamson 2007; Wilson 2011; Young 2006).

The search strategy for this update from October 2011 to June 2020 yielded 9968 records. Of these, 978 unique full texts were assessed for eligibility. A total of 61 studies met all relevance criteria and were included in this update (Aburto 2011; Adab 2018; Andrade 2014; Ardoy 2011; Belton 2019; Breheny 2020; Carlin 2018; Cohen 2015; Corepal 2019; Daly 2016; de Greeff 2016; de Heer 2011; Donnelly 2017; Drummy 2016; Fairclough 2013; Farmer 2017; Ford 2013; Grydeland 2013; Harrington 2018; Have 2018; Ickovics 2019; Jago 2011; Jago 2014; Jago 2015; Jago 2019; Jansen 2011; Jarani 2016; Ketelhut 2020; Kipping 2014; Kobel 2014; Kocken 2016; Lau 2016; Leahy 2019; Lonsdale 2019a; Madsen 2015; Magnusson 2011; Martinez-Vizcaino 2014; Melnyk 2013; Müller 2019; Muros 2015; Nogueira 2014; Okely 2011; Ordóñez Dios 2019; Pablos 2018; Resaland 2016; Robbins 2018; Sacchetti 2013; Santos 2014; Seibert 2019; Seljebotn 2019; Siegrist 2013; Siegrist 2018; Suchert 2015; Sutherland 2016; Sutherland 2017; Tarp 2016; Ten Hoor 2018; Thivel 2011; Toftager 2014; Torbeyns 2017; Zhou 2019). The most common reasons studies were judged as not relevant were (1) studies were not RCTs; (2) no device-based measure of physical activity or physical fitness was included; and (3) the intervention lasted < 12 weeks. This update includes 89 studies (28 from the last review and 61 from this update). A flow diagram depicting these results is presented in Figure 1.

A total of 84 authors were contacted for missing information, and 126 responses were received (median 1 response, range 0 to 4). In most cases, study authors were able to provide clarification on risk of bias or study characteristics, but few of them provided updated outcome data.

Included studies

In addition to information included in the Characteristics of included studies table, we have presented greater detail for each study in Table 1 (overview of study populations) and in Appendix 2 (baseline characteristics). The following is a succinct overview.

Trial design

All included studies were RCTs, with nine randomising participants at the level of the individual, and 80 using a cluster design, whereby schools or classrooms were the unit of randomisation. Across comparator groups, a majority of comparator groups (n = 67) specified continuation of usual school curriculum, standard PE, or no intervention; others reported offering a delayed intervention (n = 3). Some comparator groups included an intervention unrelated to physical activity, such as nutrition education, theatre play group, or education about alcohol or tobacco use (n = 10), and 13 of the comparator groups were not clearly described. The number of included schools ranged from 1 to 96. Most trials were multi-centre (n = 81), and only 8 trials were conducted within a single school. A total of 31 trials were conducted in 2 to 10 schools, 27 trials in 11 to 20 schools, and 23 trials in more than 20 schools. A majority of trials were not double-blinded; only 9 of 89 trials reported blinding participants, personnel, and outcome assessors; 6 trials reported blinding participants and personnel but not outcome assessors; and 24 trials reported blinding outcome assessors but not participants or personnel; the remaining 50 trials did not report blinding at all. Trials were conducted from 1983 to 2018. Duration of intervention ranged from 12 weeks to 6 years. Trials were most commonly 12 weeks to 6 months in duration (n = 31), followed by longer than 6 months to 1 year (n = 29), 1 to 2 years (n = 17), and longer than 2 years (n = 12). A majority of studies evaluated only outcomes immediately following the intervention (n = 72); others collected additional data during post-intervention follow-up (n = 17). Post-intervention follow-up ranged from 2 weeks to 1 year. No trials described a run-in period, and no trials reported that they were terminated before the planned end of study.

Participants

Across all studies, 96,740 participants were randomised, with at least 46,073 individuals in intervention groups and 40,566 in comparator groups, as not all studies reported the exact numbers randomised to each group. A total of 66,752 participants completed the trials and were included in the analyses. The number of participants randomised ranged from 33 to 11,158, and the number of participants completing trials ranged from 32 to 4063. The average percentage of participants completing the trials was 69.0%, ranging from 35.7% to 100%. Within intervention groups, the average percentage of participants completing the trial was 60.9%, and within control groups, 58.3%, when reported.

A majority of studies were conducted in children 12 years of age or younger at baseline (n = 56); others included only adolescents between the ages of 12 and 18 (n = 22), and some included both children and adolescents (n = 10). One study did not report the age of participants. Most included studies were conducted in the USA (n = 26), Australia (n = 12), and the UK (n = 9). Other countries included Germany (n = 6), Spain (n = 5), The Netherlands (n = 4), Denmark (n = 3), Norway (n = 3), Northern Ireland (n = 3), Belgium (n = 2), Canada (n = 2), China (n = 2), and France (n = 2), and one study each from Albania, Ecuador, Greece, Iceland, Ireland, Italy, Mexico, New Zealand, South Africa, and Switzerland. A range of ethnic groups was represented across trials; however, ethnicity was not reported in 40 of the 89 included studies. Most studies included both male and female students and reported a roughly even split between genders; one study included male students only, 11 included female students only, and 4 did not report the breakdown of male and female students.

Interventions

All studies had intervention components that were delivered in the school setting. Some projects provided additional interventions in the home, community, local theatre, or after school programmes, or via the computer. All studies included a control group that represented a school or a group of schools from a different community, city, or state that did not receive the school-based intervention. However, in some studies, control schools received other physical activity promotion interventions provided through other health organisations or venues or by a standard PE curriculum. The duration of interventions varied greatly from a minimum of 12 weeks to 6 years, with 10 studies reporting intervention periods of 3 years or longer (Bush 1989; Daly 2016; Donnelly 2009; Donnelly 2017; Ickovics 2019; Luepker 1996; Simon 2004; Stone 2003; Walter 1988; Wang 2008). Several theoretical frameworks were used to develop the physical activity interventions, with some studies citing more than one framework. In 36 studies, it is unclear if a theoretical framework had been used to design and/or deliver the intervention. The most commonly cited theoretical models were social cognitive theory (n = 20), a socioecological model (n = 11), self-determination theory (n = 10), and the theory of planned behaviour (n = 6). Studies reported in this review differed in funding levels, numbers of project staff, and resources available to deliver the programmes. Further, although all projects were primarily school based, no projects used the same combination of interventions with the same intensity, making each programme unique; however, some similarities were observed with respect to the ways in which interventions were delivered. Most commonly, interventions were multi-component, whole-school interventions that included a combination of educational materials, changes to the school environment, and/or school curriculum; and they targeted students, teachers, and/or parents (n = 40). Other interventions (n = 19) were focused primarily on providing opportunities for MVPA within school time, such as active academic lessons. All but one of these interventions targeted children rather than adolescents. Also common were interventions that enhanced the usual school PE programme (n = 15) by incorporating high-intensity activity into PE classes or increasing the frequency or duration of PE classes. Finally, other interventions included additional opportunities for physical activity before school activities (such as walking groups), lunchtime physical activity programmes, or after school programmes within the school environment (n = 14). One study used a factorial design, comparing enhanced PE and/or an after school programme to usual school activities.

Comparisons

Across 89 trials, a total of 93 comparison groups were described, as each of four studies reported two comparison groups. Most often, investigators described the comparison group as continuing with normal school activities or regular school physical activity or PE without specifying what that might include (40 studies). Sixteen studies described what the typical physical activity in a school would be, which ranged from one PE class per week to two hours of PE per week. Thirteen comparison groups were simply described as 'no intervention' or participating only in data collection, with no indication of whether physical activity or PE was a part of the regular school setting. Ten studies described alternative or sham interventions, such as an alcohol and drug abuse prevention programme, with health screening only. One study used a spillover group as a second comparator group, which comprised students who were eligible but declined to participate in the intervention. The remaining 13 studies provided no description of the comparator group.

Outcomes

A protocol paper or trial registry was available for 59 of the 89 included trials; for the remaining 30 trials, a trial document was not identified. Within the 59 trial documents, a single primary outcome was specified in 38 trials; 17 trials documented multiple primary outcomes, and 4 trial documents did not specify a primary outcome. When a single primary outcome was stated, 17 were measures of MVPA, 8 were measures of BMI, 4 were measures of fitness, and 9 involved other endpoints, including other measures of body composition, academic achievement, feasibility, executive function, diabetes, and screen time.

Of the 55 studies that specified a primary outcome in their trial documents, 38 reported the same primary outcome in the publication, 12 specified a different primary outcome in the publication, and 5 did not specify a primary outcome in the publication at all.

Physical activity

A total of 38 of the 89 included trials reported some measure of activity using accelerometers. A number of different devices and protocols were used. Participants were asked to wear the accelerometer for anywhere from 3 to 9 days, but most often (n = 21), participants were asked to wear the accelerometer for 7 days. Three studies did not report accelerometer wear time. Most studies had participants wear the accelerometer for both weekday and weekend days (n = 29); however others recorded only weekday activity (n = 3), and 6 did not specify whether weekend days were included.

Five studies reported on the proportion of students who were physically active, and all studies used the criterion of reaching more than 60 minutes of MVPA per day. Each of two studies measured activity using the Actiheart and Actigraph accelerometers, and 1 used the GENEactive. The specific cut points used to classify activity as MVPA were not reported in 2 studies using the Actiheart (Adab 2018; Kobel 2014); different cut points were used in the other 3 studies using Actigraph and GENEactive accelerometers.

Of the 38 studies that reported on duration of MVPA, most used a model of Actigraph accelerometer (n = 26), and 7 did not report the type of accelerometer model used. Other models include the MTI (n = 2), Actiheart (n = 2), Minimeter (n=1), and GENEactive (n=1). The most commonly used cut points for classifying MVPA were Evenson cut points (17 studies), and 12 studies did not report the cut points used to classify MVPA. Across the remaining 9 studies, a variety of different cut points were reported.

Sedentary time

Sedentary time was measured via accelerometer in 20 studies. The most common cut points used to categorise time spent in sedentary behaviour were Evenson cut points of fewer than 100 counts per minute (n = 9); 6 studies did not specify the cut points used, and 5 studies reported other cut points.

Fitness

Objective physical fitness assessments were reported in 42 studies. Field-based running tests were used most often, with 13 studies using the Progressive Aerobic Cardiovascular Endurance Run (PACER) test by Leger et al, and an additional 10 studies using a 20-metre shuttle run protocol but not specifying whether it was the PACER protocol. Studies that used a shuttle run reported outcomes as number of laps completed, estimated VO_2max, age, and sex-specific z-scores for number of laps, highest level reached, and/or number of stages completed. Six studies reported using the Anderson 10-minute interval test with distance run and estimated VO_2max as the outcome variable. One study used a 1-kilometre run, 1 used a mile run, and 1 used a 9-minute run protocol. Incremental treadmill tests with gas analysis were used in 3 studies, expressed as VO_2max, and 1 employed a peak power test on a cycle ergometer, expressed as Watts per kilogram of body mass. Last, 2 studies used the Queens College Step Test, 1 used the bench-stepping test, 1 used the Harvard step test, 1 used the British Athletics Linear Track Test, and 1 used a 6-minute run test.

Body mass index

Seventy-one studies reported on BMI using objective measures. The most common expression of BMI, reported in 49 studies, was as kg/m^2. Three studies used country-specific z-scores (England and Germany), and 2 studies used German-specific BMI percentile values. WHO z-scores were used in 2 studies, Centers for Disease Control and Prevention z-scores were used in 3 studies, and percentiles were used in an additional 3 studies. One study used the International Obesity Task Force cutoffs for weight status. Twelve studies used z-scores but did not specify the source, 6 studies did not describe methods, and 1 study reported percentage body fat.

Health-related quality of life

Only 7 studies reported some aspect of health-related quality of life; a summary of the instruments used can be found in Appendix 5. Only one tool - the Child Health Utility 9D - was used in more than 1 study (Breheny 2020; Harrington 2018; Jago 2019).

Adverse events

Adverse events were not commonly reported in studies. Only 16 of 89 included studies provided any information about adverse events, most commonly to say that no adverse events were noted. Only 3 studies reported data about the number and nature of adverse events that occurred during the study in the intervention or control group.

Excluded studies

For this update, we excluded a total of 736 studies after full-text review. The most common reason for exclusion was that trials were not randomised trials or trials did not include an objective measure of physical activity or physical fitness. Reasons for exclusion of studies from this update are available in the Characteristics of excluded studies table.

Risk of bias in included studies

For details on the risk of bias of included trials, see Characteristics of included studies and a summary across trials in Figure 2 and Figure 3.

Figure 2. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included trials (blank cells indicate that the particular outcome was not measured in some trials).

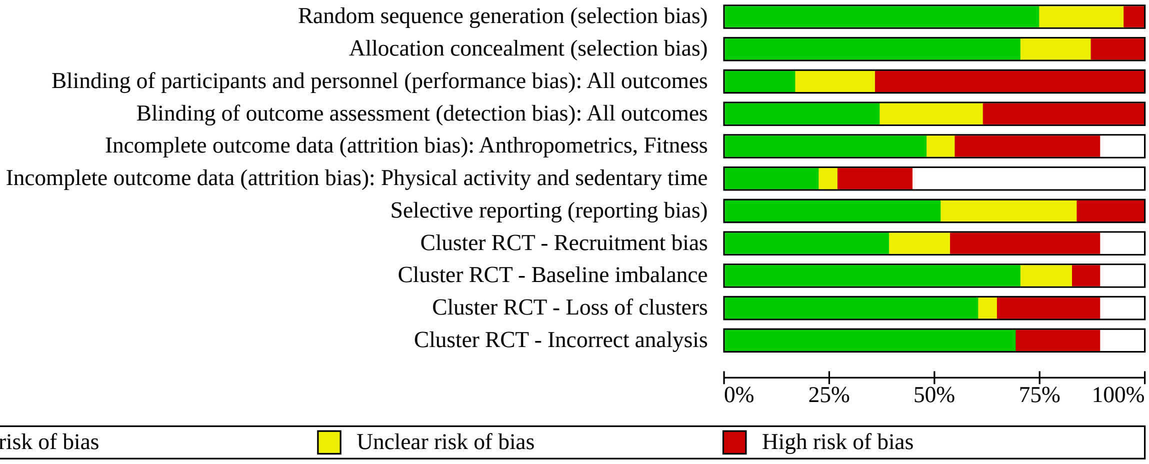


Figure 3. Risk of bias summary: review authors' judgements about each risk of bias item for each included trial (blank cells indicate that the particular outcome was not measured in some trials).

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias): All outcomes	Blinding of outcome assessment (detection bias): All outcomes	Incomplete outcome data (attrition bias): Anthropometrics, Fitness	Incomplete outcome data (attrition bias): Physical activity and sedentary time	Selective reporting (reporting bias)	Cluster RCT - Recruitment bias	Cluster RCT - Baseline imbalance	Cluster RCT - Loss of clusters	Cluster RCT - Incorrect analysis
Aburto 2011	+	?	-	-	+		-	-	+	-	+
Adab 2018	+	+	-	+	+	+	+	+	+	+	+
Andrade 2014	+	?	+	?	+	+	+	-	+	+	+
Angelopoulos 2009	+	+	?	?	-		?	?	+	+	+
Ardoy 2011	?	?	-	+	+		+	?	+	+	-
Barbeau 2007	?	+	?	?	-		?				
Bayne-Smith 2004	?	+	?	?	?		?				
Belton 2019	-	-	-	-	-	-	-	-	+	-	+
Breheny 2020	+	+	-	+	+		+	+	+	-	+
Burke 1998	?	+	?	?	+		?	?	+	+	+
Bush 1989	?	+	?	?	-		?	?	+	-	-
Carlin 2018	+	+	-	-	+		-	+	-	+	-
Cohen 2015	+	+	-	-	-	-	+	+	+	+	+
Corepal 2019	+	+	?	?		-	+	?	?	+	+
Daly 2016	+	+	-	-		+	-	+	+	+	+
de Greeff 2016	?	+	-	?	?		+	?	+	-	+
de Heer 2011	+	+	-	-	-		?	+	+	+	+
Donnelly 2009	?	+	-	+	+	?	+	?	+	-	+
Donnelly 2017	+	?	-	+	-		-	-	-	-	+
Dorgo 2009	+	+	?	?	-		?	+	-	-	-
Drummy 2016	-	?	-	-	-	-	?	-	+	+	-

Figure 3. (Continued)

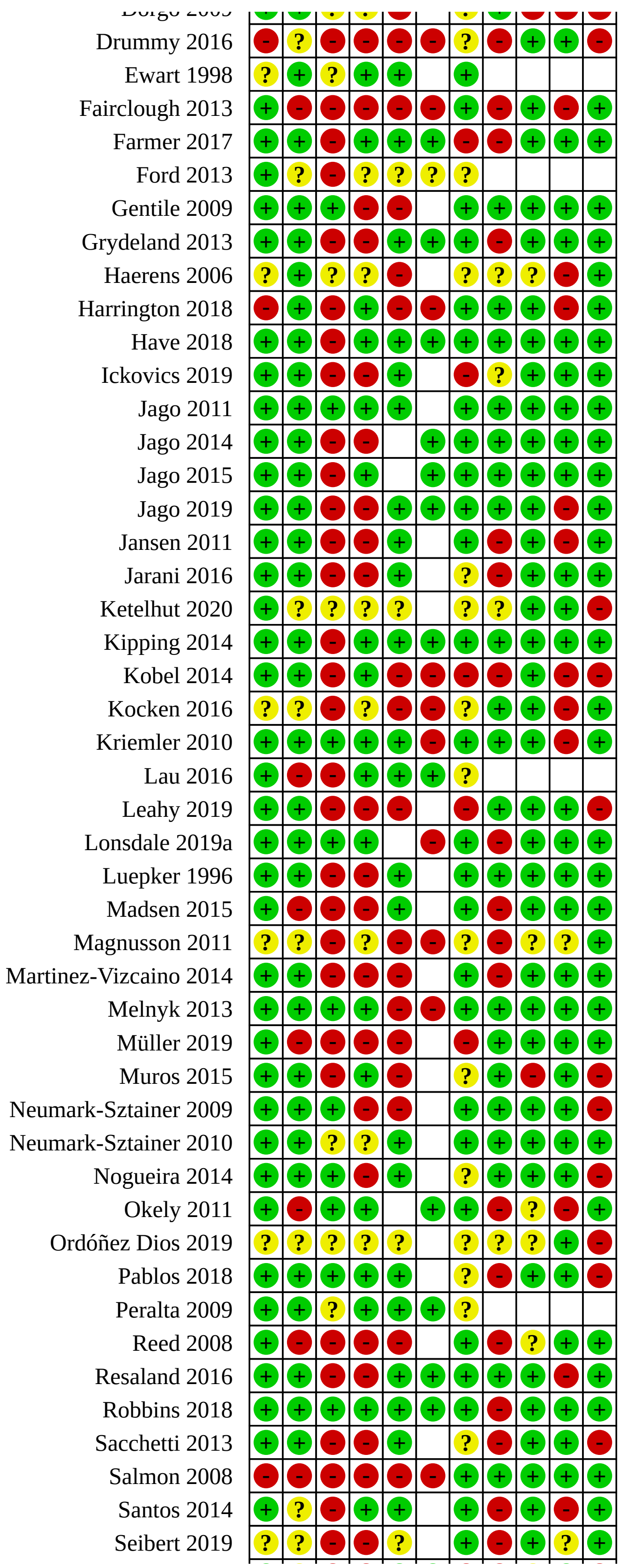
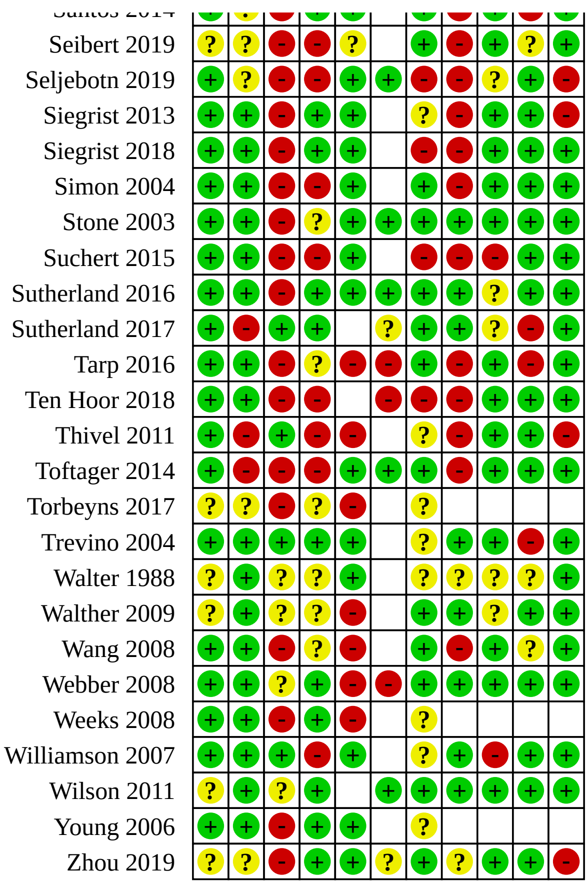


Figure 3. (Continued)



Allocation

All included studies were RCTs, and a majority of included studies provided an adequate description of the methods used to generate the randomisation sequence (e.g. computer randomisation) and the methods used to conceal allocation from participants and personnel. Sixty-seven of 89 studies adequately described randomisation sequence, 18 of 89 studies were unclear in their reporting, and 4 of 89 studies did not report an adequate method for creating the randomisation sequence and were described as high risk of bias in this domain. Sixty-three of 89 studies adequately described allocation concealment, 15 of 89 were unclear or did not describe allocation concealment well, and in 11 of 89 studies, allocation concealment was not performed, introducing high risk of bias in this domain.

Blinding

The most notable methodological weakness of these studies is the lack of blinding of participants and personnel, with only 15 out of 89 studies adequately reporting that participants and study personnel were blinded to group allocation. This was primarily done by not informing participants about the overall goal of the study or the presence of other intervention arms. Blinding of participants and personnel was unclear in 17 of 89 studies, and in 57 of 89 studies, blinding of participants or personnel was not done, introducing high risk of bias in this domain. Adequate blinding of outcome assessors was described in 33 of 89 trials and was unclear in 22 of 89 trials. In 34 of 89 trials, outcome assessors were not blinded, introducing high risk of bias in this domain. All outcomes included in this review were objective measures and did not rely on self-report, therefore reducing but not eliminating the potential for bias.

Incomplete outcome data

We assessed incomplete outcome data separately for physical activity and sedentary time outcomes and for physical fitness and anthropometric data. Among studies that assessed physical activity participation or duration, risk of bias due to incomplete outcome data was deemed low in 20 out of 40 studies, unclear in 4 of 40 studies, and high in 16 of 40 studies. Among studies that assessed sedentary time, 11 of 20 studies were deemed at low risk of bias for incomplete outcome data, 2 of 20 studies were unclear, and 7 of 20 studies had large quantities of missing data that introduced high risk of bias.

For studies that measured physical fitness, 23 of 42 studies were deemed at low risk of bias, 5 of 42 studies were unclear in their reporting of outcome data completion, and 14 of 42 had large quantities of missing data that introduced high risk of bias. Among studies that measured BMI, 40 of 74 studies were deemed at low risk of bias for completion of outcome assessment, 5 of 74 studies were unclear in the quantity of missing data, and 29 of 74 had large quantities of missing data that introduced high risk of bias.

Selective reporting

Forty-six of 89 studies were deemed at low risk of bias for selective outcome reporting and reported on all of the outcomes specified in trial protocols or published protocol papers. Twenty-nine studies were unclear in their selective outcome reporting, often because a protocol paper was not published, and 14 studies were deemed at high risk of bias for selective outcome reporting.

Other potential sources of bias

Cluster-randomised trials

A total of 80 included trials were cluster-randomised trials; therefore, risk of bias was appraised within four additional categories (recruitment bias, baseline imbalances, loss of clusters, and incorrect analysis). With respect to recruitment bias, 35 of 80 trials were deemed at low risk of bias, 13 were unclear in the timing of recruitment and randomisation, and 32 were at high risk of bias, often because schools or classes were aware of their intervention status prior to participant enrolment in the trial. With respect to baseline imbalance, 63 of 80 trials were deemed at low risk of bias, 11 of 80 were unclear, and 6 of 80 were deemed at high risk of bias. For loss of clusters, 54 out of 80 were deemed at low risk of bias, as they retained all clusters in the trials, 4 of 80 were unclear, and 22 were deemed at high risk of bias due to loss of clusters throughout the trial. Finally, with respect to incorrect analysis of cluster-RCTs, 62 of 80 were deemed at low risk of bias, as they properly accounted for the clustered nature of the data in their statistical analysis, and 18 trials were deemed at high risk of bias for failing to incorporate clustering into their analyses.

Effects of interventions

See: **Summary of findings 1** School-based physical activity programmes for promoting physical activity and fitness in children and adolescents aged 6 to 18 years

See Summary of findings 1.

Effects of school-based physical activity interventions on primary outcomes

Physical activity participation

Overall, we are very uncertain about the effects of school-based physical activity programmes on the proportion of students meeting physical activity guidelines due to inconsistency of effects between studies, imprecision around the effects, and risk of bias in the included studies contributing to this outcome.

This outcome was reported in only 5 studies with quite different interventions (Analysis 1.1). One study explored the effects of after school dance classes on the proportion of girls meeting physical activity guidelines (Jago 2015). At the end of the 20-week study, between-group differences in adherence to guidelines were found to be -1.11% (95% confidence interval (CI) -1.68 to -0.73) in the intervention group compared to the control group. One study found that although both groups had fewer adolescents meeting guidelines at the end of study, the decline was noted to be smaller in the intervention group than in the control group; however confidence intervals were not reported (difference 12.22%; P < 0.01) (Andrade 2014). Another study found an uncertain effect on the odds of meeting the guidelines in the intervention group compared to the control group at end of study (odds ratio (OR) 0.65, 95% CI 0.23 to 1.85) (Harrington 2018). One study found a similar proportion of students meeting the guidelines at 15 or 18 months following a whole-school physical activity and nutrition intervention (difference at 15 months 0.005%, 95% CI -0.101 to 0.140) (Adab 2018). One study found that after one year, differences in the proportion of participants meeting guidelines between intervention and control groups were 10.4%; study authors noted that the difference between groups was not statistically significant but included no measure of variation (Kobel 2014).

Physical activity duration

Overall, school-based physical activity interventions probably have little to no effect on minutes per day of MVPA among children and adolescents (mean difference (MD) 0.73, 95% CI 0.16 to 1.30; 33 studies; Analysis 1.2 moderate-certainty evidence). These findings should be interpreted with caution due to the inconsistency in outcomes reported based on visual inspection of forest plots and substantial heterogeneity across studies (I^2 = 75%).

Six additional studies provided data that were not included in the meta-analysis. Most findings were consistent with results from the meta-analysis (Analysis 1.4). Following one year of PE enhanced with strength training and motivational interviewing among adolescents, a significant between-group difference was found in the percentage of time spent in MVPA; however, the magnitude of this difference was not reported (Ten Hoor 2018). In a study of Grade 7 students, those who took part in a biweekly after school PA programme, enhanced PE, or both were found to increase the percentage of time spent in MVPA (MD 1.99%, 95% CI 1.68 to 2.30; MD 3.12%, 95% CI 2.76 to 3.48; MD 4.98%, 95% CI 4.62 to 5.34, respectively), which was noted by study authors as statistically significant (Zhou 2019).

In one study, changes in vigorous activity were reported from an intervention targeting behavioural modification (MD 2.8 minutes/d, 95% CI 0.3 to 5.4) or fundamental movement skills (MD 7.8 minutes/d, 95% CI 3.4 to 12.3 minutes/d), and combining behavioural modification and fundamental movement skills (MD 3.1 minutes/d, 95% CI -0.58 to 6.7) compared to control (Salmon 2008). Grade 2 children who engaged in physical activity during school, lessons, and recess were noted to take part in more MVPA at study midpoint but not at the end of the intervention; values were not reported (Magnusson 2011). Following implementation of a brisk walking programme during the school day, moderate to vigorous accelerometer counts were reported in the intervention group compared to a control group (MD -27.4 counts/min, 95% CI -91.0 to 36.2) (Ford 2013). Finally, within-school and between-school pedometer step challenges among adolescents age 12 to 14 years were found to be feasible, but minutes/d of MVPA appeared stable across groups throughout the intervention periods (MD -14.4 minutes/d, no measure of variance reported) (Corepal 2019).

In subgroup analyses, no differences in effects were found between interventions targeting children and adolescents (test for subgroup differences, P = 0.35; Analysis 1.2); however there were subgroup differences by intervention type (test for subgroup difference, P = 0.03; Analysis 1.3).

Children

In subgroup analyses, school-based physical activity interventions targeting children probably do not result in a meaningful change in minutes per day of MVPA (MD 1.01 minutes/d, 95% CI 0.08 to 1.93; 22 studies; Analysis 1.2 moderate-certainty evidence). These findings should be interpreted with caution due to substantial heterogeneity across studies (I^2 = 69%). Across studies that were not included in the meta-analysis, findings were consistent (Analysis 1.4).

Adolescents

School-based physical activity interventions probably do not result in a meaningful change in minutes per day of MVPA among adolescents (MD 1.84 minutes/d, 95% CI 0.34 to 3.35; 11 studies; Analysis 1.2; moderate-certainty evidence), with substantial heterogeneity (I^2 = 81%); when differences were found, they were generally small in magnitude (Analysis 1.4).

Before and after school programmes

A total of 6 included studies implemented before and after school programmes in the school setting. Overall, before and after school programmes probably do not increase time spent in MVPA (MD 0.77 minutes/d, 95% CI -1.40 to 2.94; 6 studies; Analysis 1.3; moderate-certainty evidence). Moderate heterogeneity was found across studies (I^2 = 50%).

Enhanced PE

Three studies tested the effects of enhanced PE interventions. These interventions probably do not change MVPA (MD -0.23 minutes/d, 95% CI -1.58 to 1.11; 3 studies; Analysis 1.3; moderate-certainty evidence); however results should be interpreted with caution due to high heterogeneity (I^2 = 83%).

Multi-component interventions

Multi-component interventions in the school setting probably result in small increases in MVPA among children and adolescents (MD 2.42 minutes/d, 95% CI 0.62 to 4.22; 16 studies; Analysis 1.3; moderate-certainty evidence); however results should be interpreted with caution due to high heterogeneity (I^2 = 76%).

Schooltime PA

Schooltime PA interventions probably do result in small increases in MVPA among children and adolescents (MD 5.30 minutes/d, 95% CI 0.89 to 9.72; 8 studies; Analysis 1.3; moderate-certainty evidence); however results should be interpreted with caution due to high heterogeneity (I^2 = 73%).

Sedentary time

Identified evidence suggests that school-based physical activity interventions may have little to no difference in minutes per day of sedentary time (MD -3.78 minutes/d, 95% CI -7.80 to 0.24; 16 studies; Analysis 1.5; low-certainty evidence). These findings should be interpreted with caution due to imprecision of the effect estimate and risk of bias of included studies.

Four additional studies provided data that were not included in the meta-analysis. A majority of findings were consistent with meta-analysis results, finding little or no effect (Analysis 1.7). Three studies reported sedentary time as an outcome within enhanced PE interventions in adolescents. In a study of teacher PE training, the between-group mean difference in time spent sedentary at 7 months was 0.92% (95% CI -0.28 to 2.13) and was 0.02% (95% CI -0.99 to 0.95) at 14 months (Lonsdale 2019a). After one year of strength training and motivational interviewing, study authors note no statistically significant decrease in the percentage of time spent sedentary; however only P values were reported (Ten Hoor 2018). In a study of Grade 7 students, the change in percentage of time spent sedentary among those who took part in a biweekly after school PA programme, enhanced PE, or both was found to be 1.34% (95% CI -0.73 to 3.41), 1.11% (95% CI -1.09 to 3.31), and 0.11% (95% CI -2.31 to 2.54), respectively (Zhou 2019). Finally, within-school and between-school pedometer step challenges in adolescents age 12 to 14 years were found to be feasible, but sedentary time appeared stable across groups throughout intervention periods (MD 1.2 minutes/d; no measure of variance reported) (Corepal 2019).

In subgroup analyses, no differences in effects were found between children and adolescents (test for subgroup differences, P = 0.58; Analysis 1.5) or by intervention type (test for subgroup difference, P = 0.58; Analysis 1.6).

Children

Overall, school-based physical activity programmes may not reduce sedentary time among children (MD -3.35 minutes/d, 95% CI -9.30 to 2.60; 11 studies; Analysis 1.5; low-certainty evidence), with low heterogeneity of 37% (Analysis 1.5).

Adolescents

School-based physical activity programmes may result in little to no difference in sedentary time of adolescents (MD -5.67 minutes/d, 95% CI -11.48 to 0.14; 5 studies; Analysis 1.5; low-certainty evidence), with no heterogeneity observed (I^2 = 0%) (Analysis 1.5).

Before and after school programmes

Before and after school programmes in the school setting may not decrease sedentary time (MD 2.01 minutes/d, 95% CI -15.28 to 19.31; 2 studies; Analysis 1.6; low-certainty evidence). Moderate heterogeneity was found across studies (I^2 = 46%).

Enhanced PE

Only one study explored the impact of enhanced PE on sedentary time (MD -11.18 minutes/d, 95% CI -21.96 to -0.40; 1 study; Analysis 1.6; low-certainty evidence).

Multi-component interventions

Multi-component interventions in the school setting may result in small decreases in sedentary time (MD -4.60 minutes/d, 95% CI -9.08 to -0.12; 11 studies; Analysis 1.6; low-certainty evidence). No heterogeneity was noted (I^2 = 0%).

Schooltime PA

Schooltime PA interventions may not decrease sedentary time (MD -3.26 minutes/d, 95% CI -19.05 to 12.52; 2 studies; Analysis 1.6; low-certainty evidence); however results should be interpreted with caution due to the small number of studies and high heterogeneity (I^2 = 70%).

Effects of school-based physical activity interventions on secondary outcomes

Fitness

Evidence suggests that school-based physical activity programmes may improve physical fitness assessed by measured or estimated VO_2max (MD 1.19 mL/kg/min, 95% CI 0.57 to 1.82; 13 studies; Analysis 1.8; low-certainty evidence). These findings should be interpreted with caution due to inconsistency in effect estimates (based on the high level of heterogeneity in the meta-analysis (I^2 = 90%) and visual inspection of forest plots) and indirectness in measuring fitness using estimated VO_2max in most studies.

Twenty-nine additional studies provided data that were not included in the meta-analysis. Most results were consistent with the direction of the pooled effect (Analysis 1.10).

Four studies explored the impact of before and after school physical activity interventions. One study found an improvement in shuttle run performance with MD of 3.87 laps (standard error (SE) 1.51; P = 0.012) laps following 12 weeks of health education and after school physical activity (de Heer 2011). In a second study, the authors noted a statistically significant improvement in heart rate response to a step test after the 'FitKid' after school physical activity programme, although absolute values were not reported (Wang 2008). In a study of a brisk walking intervention delivered to adolescents, authors reported that the intervention had little to no effect on fitness (Carlin 2018); however no values for physical fitness were reported. In another study, a bi-weekly after school programme on its own or combined with enhanced PE yielded statistically significant improvement in shuttle run performance in both intervention groups (MD 8.86 laps, 95% CI 5.68, 12.04 and 22.26 laps; 95% CI 19.15 to 25.37, respectively) (Zhou 2019).

Five studies investigated the effects of enhanced PE on the fitness of school-age children. Following 12 weeks of adding a daily run to regular physical activity, between-group difference in 1-km run time was MD -0.55 minutes (95% CI -0.75 to -0.35) (Ordóñez Dios 2019). An additional 120 minutes/week of supervised PE resulted in a between-group difference in shuttle run stages of MD 0.36 stages (95% CI 0.23 to 0.49) (Thivel 2011). One study found that two additional 45-minute PE lessons per week resulted in a between-group difference in stages on the shuttle run test favouring the control group (MD -0.12 stages, 95% CI -0.21 to -0.03) (Kriemler 2010). After 12 weeks of high-intensity interval training, between-group difference in z-scores in Grade 3 students was MD 7.7 (95% CI 2.3 to 13.2) (Ketelhut 2020). In another study, enhanced PE on its own or combined with a biweekly after school programme yielded statistically significant improvement in shuttle run performance in both intervention groups (MD 14.33 laps, 95% CI 11.16 to 17.50; and MD 22.26 laps, 95% CI 19.15 to 25.37, respectively) (Zhou 2019).

Eleven studies explored the effects of multi-component interventions. After 12 months of teacher learning, physical activity policies, and school community linkages, MD of 5.4 laps (95% CI 2.3 to 8.6) was found in children (Cohen 2015). A one-year multi-component intervention resulted in between-group differences among students in Grades 3 to 5 of 0.57 laps (95% CI 0.13 to 1.01) and in Grades 6 to 8 of 0.04 laps (95% CI -0.45 to 0.53) (Jansen 2011). Following a 9-month intervention, study authors reported that the number of laps completed by children on the shuttle run significantly increased in the intervention group versus the control group, but values were not reported (Burke 1998). After 11 months of a whole-school physical activity programme, between-group difference in shuttle run laps in intervention versus control groups was +6 laps (95% CI 1.6 to 10.4) (Reed 2008). In one study, authors reported that the difference in change in shuttle run performance at 2.5 years was 0.2 laps (95% CI -0.5 to 0.9) following a multi-component intervention for children consisting of education, social marketing, changes to the food environment, and PE curriculum (Jago 2011). One study reported that physically active lessons, physically active homework, and physically active recess resulted in within-group differences in laps in the control group (m 5.8, SE 0.4) and in the intervention group (m 4.7, SE 0.4), with a between-group MD of -1.1 (95% CI -2.2 to 0.01) favouring the control group (Seibert 2019). Following an intervention with environmental and policy-level changes, study authors reported no statistically significant differences in distance covered during a nine-minute run test; however absolute values were not reported (Aburto 2011). Following two years of nutrition education, Playworks structured recess, and before and after school activities, the between-group difference in mile run time was MD 0.2 minutes (95% CI -0.8 to 0.4) (Madsen 2015). After 28 months of individual- and environmental-based interventions, between-group difference in time during a shuttle run for adolescents was MD -0.19 minutes (95% CI -0.54 to 0.16) (Andrade 2014). Following seven months of health programming and health messaging targeting diabetes control and goal-setting, between-group difference in Harvard Step Test scores was MD 1.87 points (95% CI -1.44 to 5.17; P = 0.04) (Trevino 2004). Last, the mean difference in shuttle run test distance between adolescents in schools that underwent physical and organisational environmental changes and a control group was MD 6 metres (95% CI -20 to 31 after two years of follow-up) (Toftager 2014).

Finally, ten studies reported on the impact of schooltime PA interventions. Following 12 months of the Daily Mile programme, results favoured the control group (MD -37.4 metres, 95% CI -74.7 to -0.19) (Breheny 2020). Study authors noted that shuttle run performance increased by 0.8 laps in both intervention and control groups after two years of physically active math and language lessons (MD 0.05 stages, SE 0.14; not statistically significant) (de Greeff 2016). After three years of physically active lessons, mean difference in shuttle run test was 1.3 laps (95% CI -0.5 to 3.1) (Donnelly 2017). One study found that active math lessons delivered over one 10-month school year resulted in mean difference in shuttle run test distance of 10 metres (SE 13.9; P > 0.05) (Have 2018). An intervention including 60 minutes of physical activity during school time and physical activity homework found a between-group difference in shuttle run distance of MD 9.4 metres (95% CI -3.7 to 22.4) at 20 weeks (Tarp 2016). An intervention consisting of 7 months of physical activity lessons, homework, and breaks found MD 6.9 metres (95% CI -8.9 to 22.6) (Resaland 2016). After 22 weeks of using cycling desks in the classroom, the mean difference in 20-metre shuttle run was 0.5 stages (95% CI -0.5 to 1.5) (Torbeyns 2017). After two years of active physical activity, PE lessons, classroom physical activity, and additional physical activity equipment and teaching materials, the mean difference in maximal cycling test output was 0.37 watts/kg (95% CI -0.27 to 1.01) (Magnusson 2011). Physically active lessons, active homework, and recess did not produce a statistically significant effect, although no data were reported (Seljebotn 2019). Finally, 14 weeks of high-intensity interval training resulted in a mean difference of 8.9 laps (95% CI 1.7 to 16.2) at 14 weeks (Leahy 2019).

In subgroup analyses, no differences in effects were found between children and adolescents (test for subgroup differences, P = 0.08; Analysis 1.8). Differences in effects by intervention type were noted (test for subgroup difference, P < 0.001; Analysis 1.9).

Children

Overall, evidence suggests that school-based physical activity programmes probably improve physical fitness among children (MD 1.47 mL/kg/min, 95% CI 0.84 to 2.09; 9 studies; Analysis 1.8

moderate-certainty evidence). However, this should be interpreted with caution, as only 9 of 31 included studies reported sufficient data to be included in the meta-analysis. Moderate heterogeneity was also noted across trials (I^2 = 64%).

Adolescents

Generally, school-based physical activity programmes probably result in little to no difference in physical fitness (Analysis 1.10). Pooled analysis from studies that reported VO_2max revealed no difference (MD 0.58 mL/kg/min, 95% CI -0.18 to 1.35; 4 studies; moderate-certainty evidence; moderate heterogeneity (I^2 = 87%).

Before and after school programmes

Before and after school programmes in the school setting probably improve physical fitness (MD 1.38 mL/kg/min, 95% CI 0.34 to 2.41; 5 studies; Analysis 1.9 moderate-certainty evidence). High heterogeneity was found across studies (I^2 = 88%).

Enhanced PE

Studies that enhanced PE as part of the intervention probably resulted in improvements in physical fitness (MD 1.99 mL/kg/min, 95% CI 0.76 to 3.21; 4 studies; Analysis 1.9 moderate-certainty evidence); however high heterogeneity was found across studies (I^2 = 82%).

Multi-component interventions

Multi-component interventions in the school setting probably do not change physical fitness (MD -0.33 mL/kg/min, 95% CI -0.73 to 0.08; 3 studies; Analysis 1.9 moderate-certainty evidence); however results should be interpreted with caution due to the small number of studies. No heterogeneity was noted (I^2 = 0%).

Schooltime PA

Only one study that used schooltime PA to increase fitness was included in the meta-analysis (MD 2.70, 95% CI 1.04 to 4.36; 1 study; Analysis 1.9); thus, results should be interpreted with caution.

Body mass index

Overall, evidence suggests that school-based physical activity programmes may result in a very small decrease in BMI z-score among children and adolescents (MD -0.06, 95% CI -0.09 to -0.02; 21 studies; Analysis 1.11 low-certainty evidence) and may not decrease BMI (MD -0.07 kg/m², 95% CI -0.15 to 0.01; 50 studies; Analysis 1.13 low-certainty evidence). These results should be considered with caution, as substantial heterogeneity and risk of bias were found across studies.

Nine additional studies provided data that could not be included in the meta-analysis. Findings were mixed. After a 9-month multi-component intervention, study authors reported that BMI decreased among boys in the intervention group versus the control group, but not among girls; values were not reported (Burke 1998). After 3 years of a physical activity or physical activity and nutrition wellness policy, study authors found no differences in children's BMI; however values were not reported (Ickovics 2019). Between-group differences were reported in children's BMI/age-sex population median values following an intervention targeting behavioural modification (MD -0.40, 95% CI -1.11 to 0.30), fundamental movement skills (MD -0.50, 95% CI -1.25 to 0.25), or both (MD -1.30, 95% CI -2.29 to -0.31) (Salmon 2008). After 3 years of physically active lessons, the difference in BMI percentile between intervention and control groups was MD -2.3 (95% CI -4.8 to 0.2) (Donnelly 2017). After 1 year of active breaks during class time, the between-group difference in BMI percentile was 0.5 (95% CI -0.5 to 1.5) (Kobel 2014). A 2-year intervention to increase schooltime PA also yielded a between-group difference in BMI that was not statistically significant, and effect estimates were not reported (Williamson 2007). A 12-week brisk walking intervention for adolescents produced no difference, but effect estimates were not reported (Carlin 2018). A 16-week intervention consisting of enhanced PE or enhanced PE with a focus on increasing intensity had no impact on BMI in adolescents, with no values reported (Ardoy 2011). Last, a 1-year multi-component intervention for adolescents resulted in a mean difference in BMI percentile of MD 1.09 (95% CI -0.64 to 2.82) (Suchert 2015).

In subgroup analyses, no differences in effects were found between children and adolescents for BMI z-scores (test for subgroup differences, P = 0.23; Analysis 1.11) nor for BMI (test for subgroup differences, P = 0.19; Analysis 1.13). In subgroup analyses by intervention type, no differences in effects were found between intervention types for BMI z-scores (test for subgroup differences, P = 0.61; Analysis 1.12) nor for BMI (test for subgroup differences, P = 0.80; Analysis 1.14).

Children

School-based physical activity interventions for children may decrease BMI z-scores; MD -0.06 (95% CI -0.11 to -0.01; 16 studies; substantial heterogeneity of 88%; Analysis 1.11; low-certainty evidence). These interventions may also result in a small decrease in BMI (MD -0.11 kg/m², 95% CI -0.19 to -0.02; 38 studies; substantial heterogeneity of 84%; Analysis 1.13; low-certainty evidence).

Adolescents

School-based physical activity interventions for adolescents may not decrease BMI z-scores (MD -0.03, 95% CI -0.05 to -0.00; 5 studies; I^2 = 0%; Analysis 1.11 low-certainty evidence) nor BMI (MD 0.05 kg/m², 95% CI -0.16 to 0.25; 12 studies; I^2 =88%; Analysis 1.13 low-certainty evidence).

Before and after school programmes

Before and after school programmes in the school setting may not decrease BMI z-scores (MD -0.02, 95% CI -0.05 to 0.01; 2 studies; Analysis 1.12 low-certainty evidence) nor BMI (MD -0.12 kg/m², 95% CI -0.25 to 0.01; 9 studies; Analysis 1.14 low-certainty evidence). Very little heterogeneity was found across studies (I^2 = 0%, 7%, respectively).

Enhanced PE

Studies that enhanced PE as part of the intervention may not decrease BMI z-scores (MD -0.08, 95% CI -0.29 to 0.13; 1 study; Analysis 1.12 low-certainty evidence) nor BMI (MD -0.04 kg/m², 95% CI -0.32 to 0.24; 10 studies; Analysis 1.14 low-certainty evidence). Results should be interpreted with caution, as only one study reported changes in BMI z-scores, and high heterogeneity was found across studies for BMI (I^2 = 92%).

Multi-component interventions

Multi-component interventions in the school setting may result in small decreases in BMI z-scores (MD -0.06, 95% CI -0.11 to -0.01; 17 studies; Analysis 1.12 low-certainty evidence) but not in BMI (MD

-0.10 kg/m², 95% CI -0.24 to 0.03; 20 studies; Analysis 1.14 low-certainty evidence). In both analyses, high heterogeneity was found across studies (I^2 = 87%, 93%, respectively).

Schooltime PA

Only one study reported on the effect of schooltime PA on BMI z-score (MD -0.03, 95% CI -0.08 to 0.02; 1 study; Analysis 1.12 low-certainty evidence). Schooltime PA may not decrease BMI (MD -0.05 kg/m², 95% CI -0.14 to 0.04; 11 studies; Analysis 1.14 low-certainty evidence). Low heterogeneity was found across studies.

Health-related quality of life

Seven included studies reported on health-related quality of life (Analysis 1.16). Given the limited data reported across heterogeneous interventions and populations, as well as the risk of bias in included studies and possible reporting bias in studies that did not report results for this outcome, we are very uncertain about the effects of school-based physical activity interventions on health-related quality of life. A full description of the scales used to assess health-related quality of life can be found in Appendix 5.

One study reported a decrease in perceived psychological difficulties among adolescents after 14 weeks of high-intensity interval training compared to those in a control group (MD -2.1 points, 95% CI -4.0 to -0.3) as measured by the Strengths and Difficulties Questionnaire (Leahy 2019). A school-based physical activity and healthy eating programme noted a mean difference of 1.248 (95% CI -2.301 to 4.796) in paediatric quality of life as measured by the Pediatric Quality of Life inventory (Adab 2018). An after school dance programme noted a mean difference in health-related quality of life of 0.0 points (P = 0.667) when using the European Quality of Life 5 Dimensions Youth Survey (Jago 2015). The Daily Mile intervention resulted in a between-group difference of 0.010 points (95% CI -0.002 to 0.04) after 12 months on the Child Health Utility 9D, where higher scores indicate poorer health (Breheny 2020). The remaining three studies reported no statistically significant differences between groups and provided no data (Harrington 2018; Jago 2019; Resaland 2016).

Adverse events

Of the 89 trials included, only 16 reported anything related to adverse events (Analysis 1.17). Based on limited data on adverse events reported, including inconsistency between studies, high risk of bias, and the possibility of reporting bias in studies that did not report results for this outcome, the evidence is of very low certainty; we cannot confidently conclude whether there are or are not potential safety concerns related to school-based physical activity interventions. Of the studies that noted adverse events, 13 simply stated that no adverse events occurred as part of the intervention. Often minimal detail was given as to how adverse events were tracked or recorded. Adverse events were reported in three studies. In one study, a minor adverse event occurred when an intervention participant made contact with another participant while doing a handstand (Nogueira 2014). Another study reported adverse event rates across both study groups of 2.4% at baseline and 1.7% at end of study related to a blood draw for data collection (Jago 2011). The most commonly reported adverse event was dizziness and was not deemed to be related to the intervention itself. Finally, one study reported 24 adverse events such as musculoskeletal injuries; 20 were deemed to be mild, three moderate, and one serious, for an overall adverse event rate of 0.0006 events per programme hour (Wang 2008).

Assessment of reporting bias

To assess the potential for reporting bias, we created funnel plots for MVPA, sedentary time, fitness, and BMI reported in kg/m² and z-scores (Figure 4, Figure 5, Figure 6, Figure 7, Figure 8). Because we used a random-effects meta-analysis, 95% confidence intervals are not calculated via RevMan 5.4. Based on our interpretation of the funnel plots, it appears there may be some degree of reporting bias in studies that report on minutes per week of MVPA. This reporting bias may lead to overestimation of the magnitude of the effect; however given the overall null findings of the meta-analysis, this does not change our conclusions.

Figure 4. Funnel plot of comparison: 1.2 Physical activity duration: meta-analysis.

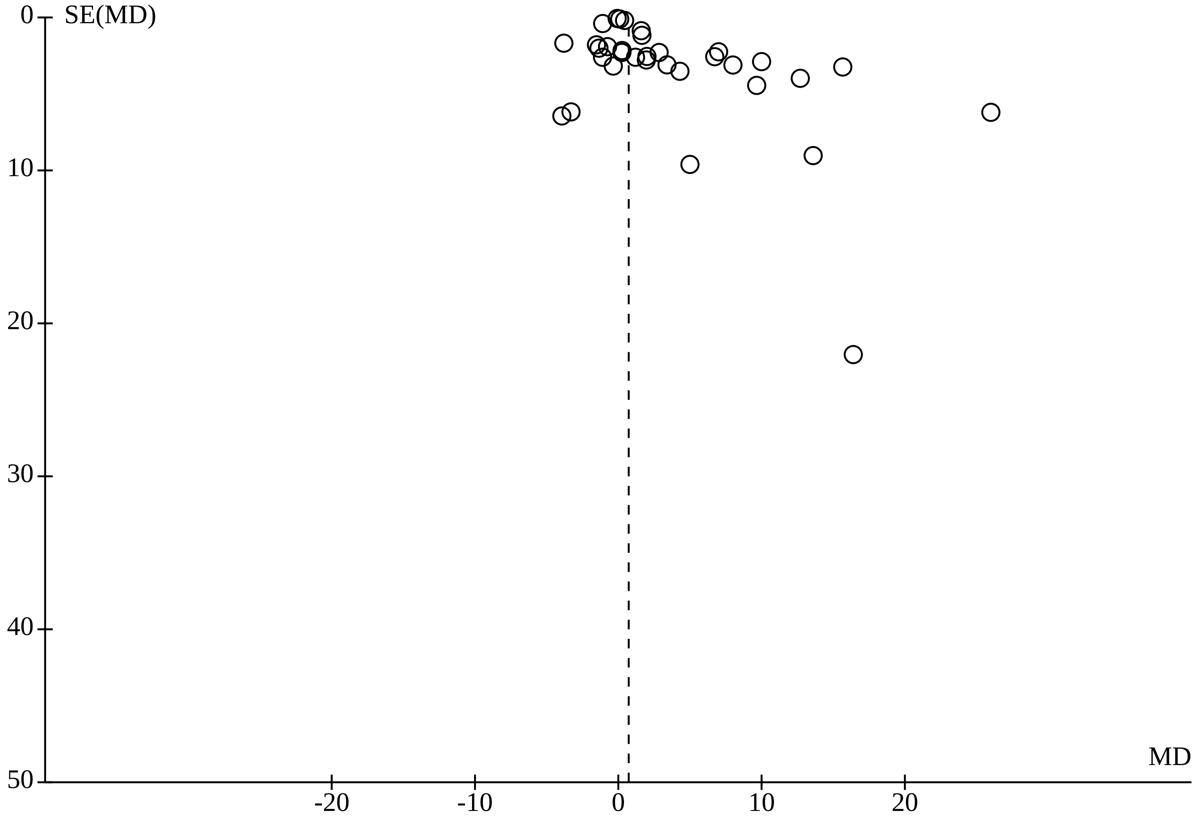


Figure 5. Funnel plot of comparison: 1.5 Sedentary time: meta-analysis.

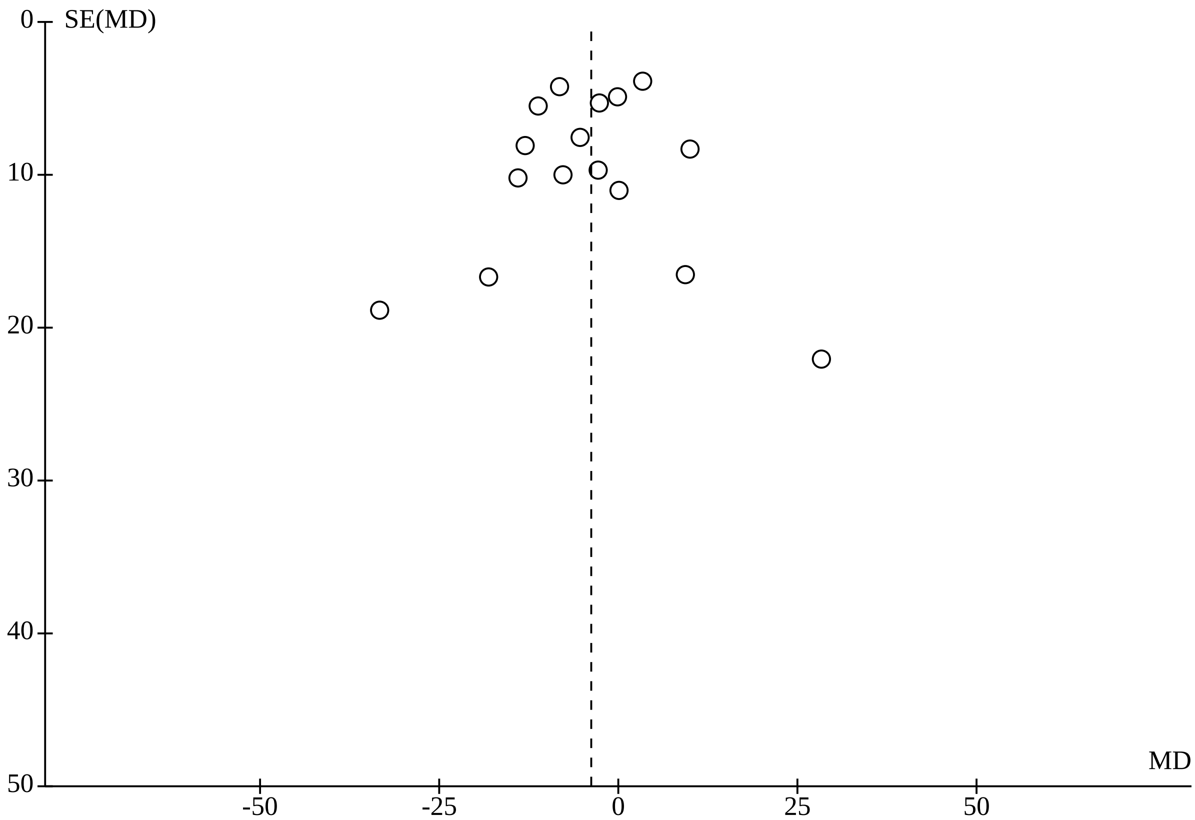


Figure 6. Funnel plot of comparison: 1.8 Physical fitness: meta-analysis.

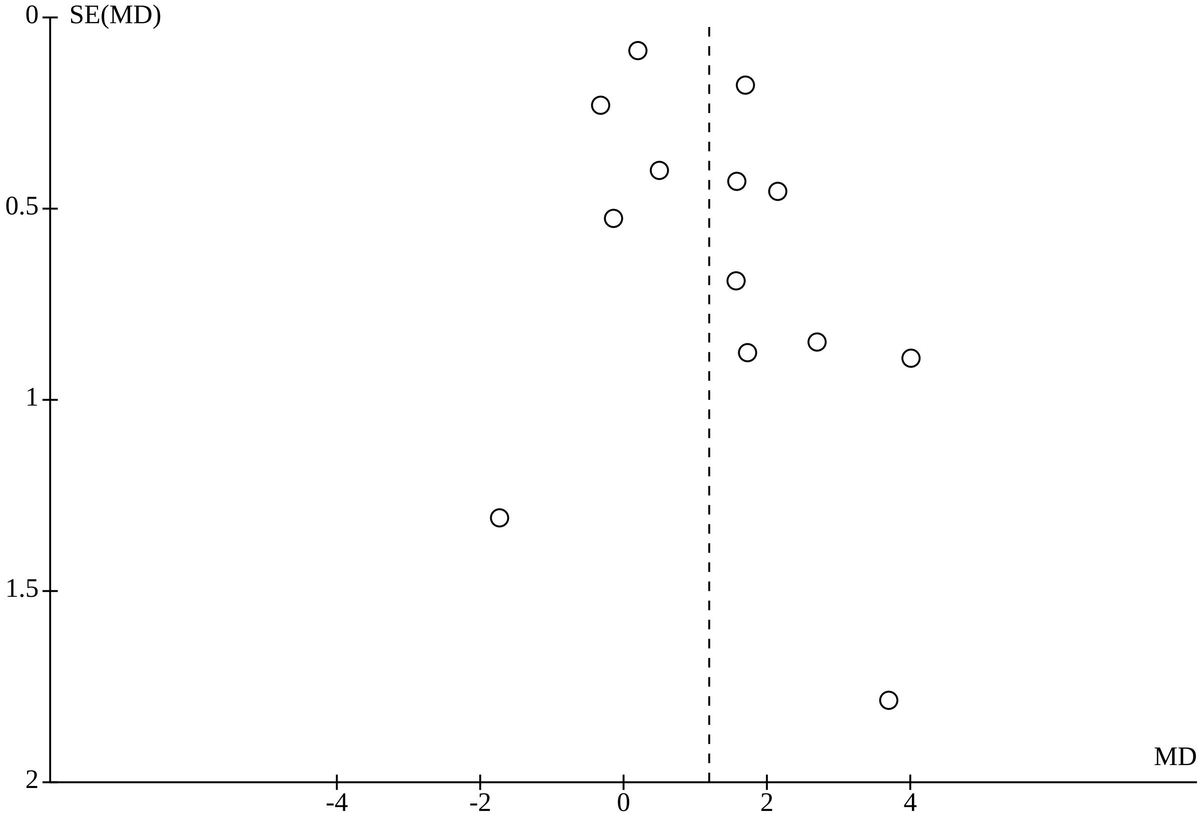


Figure 7. Funnel plot of comparison: 1.11 BMI: meta-analysis [z-scores].

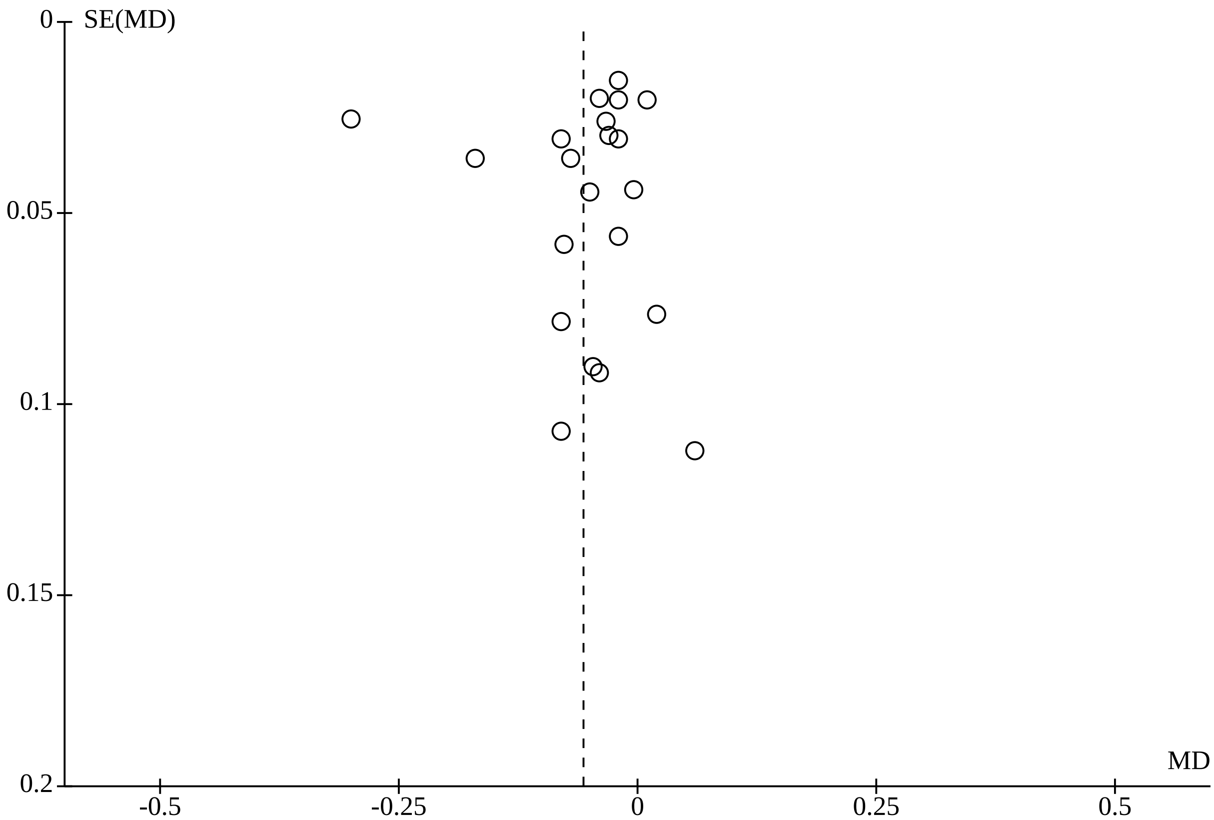
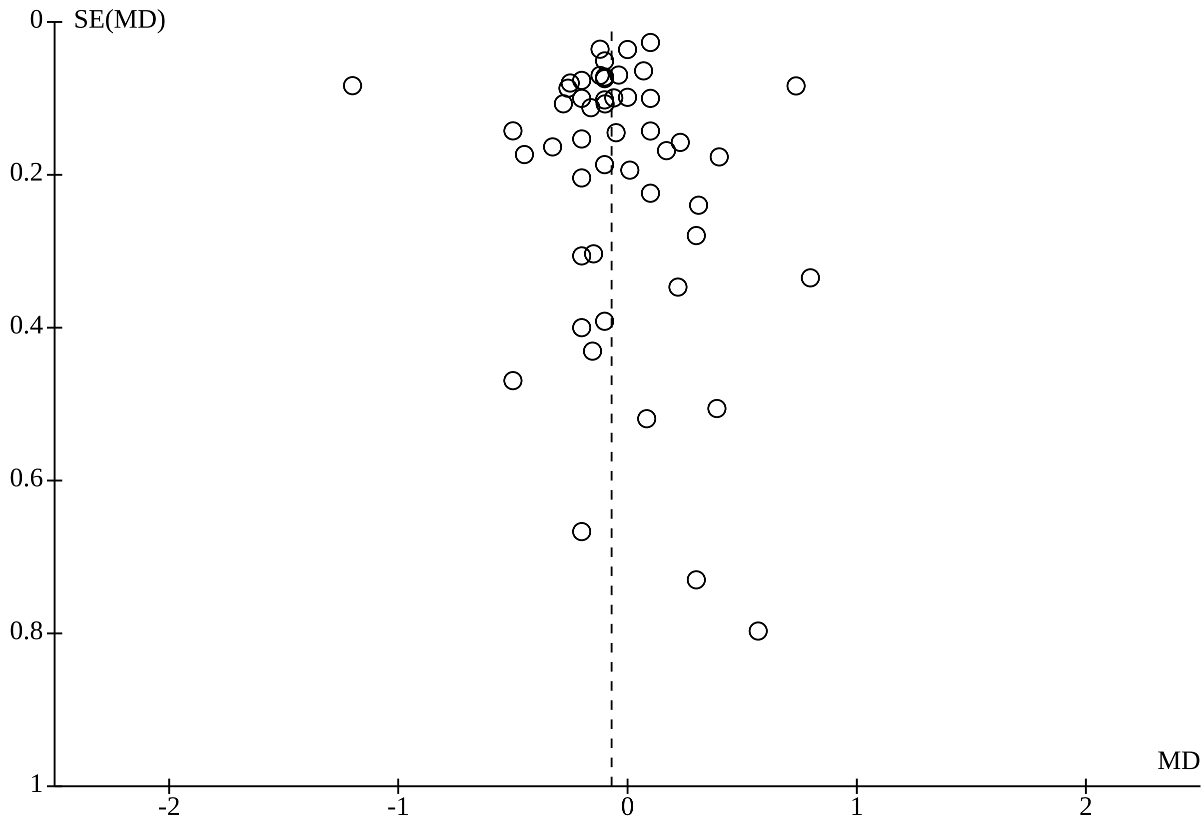


Figure 8. Funnel plot of comparison: 1.13 BMI: meta-analysis [kg/m2].



Trials ongoing and awaiting classification

Within our search, we identified 16 trials that are awaiting classification (Characteristics of studies awaiting classification), as well as 12 studies that are ongoing (Characteristics of ongoing studies). Within the studies awaiting classification, 12 are marked as 'complete' in the clinical trials registry, but no publications can be found; one has been published only as a protocol paper (Friedrich 2015); two have published conference abstracts but with insufficient information to determine eligibility (O'Malley 2011; Telford 2019); and one has published baseline results only (Salmon 2011a). Within the 9 ongoing studies, trial start dates ranged from 2014 to 2018, with planned end dates from 2020 to 2022. Three studies did not indicate a planned end date.

DISCUSSION

Summary of main results

The objective of this updated review was to assess, analyse, and draw conclusions about the effectiveness of school-based interventions in promoting physical activity and fitness among school-attending children and adolescents aged 6 to 18 years. Our primary outcomes were physical activity and sedentary time, with secondary outcomes of fitness, body composition, health-related quality of life, and adverse effects. Finally, through subgroup analyses, we sought to identify which types of interventions may be most effective for improving physical activity, fitness, and body mass index (BMI) in this population.

The results of this update do not differ greatly from those reported in the original review in 2009 and in the update in 2013. Overall, school-based physical activity interventions may improve physical fitness (low-certainty evidence) but probably have minimal impact on time engaged in moderate to vigorous physical activity (MVPA) (moderate-certainty evidence) and may result in little to no decrease in sedentary time (low-certainty evidence). Although school-based physical activity interventions may result in a small decrease in BMI z-scores (low-certainty evidence), they may not impact BMI measured as kg/m^2 (low-certainty evidence). In this version of the review, only objective measures of physical activity, sedentary time, fitness, and BMI were included. This is important progress, as the advantages of objectively measured physical activity and sedentary time outweigh the advantages of self-report measures of these outcomes. In addition, the commercialisation of these devices means the costs of these devices are no longer as prohibitive as they once were. The original review and the 2013 update found that school-based physical activity interventions had a small positive impact on duration of MVPA and television viewing; however, these systematic reviews primarily measured activity using self-report measures completed by children, parents, or teachers, which may have introduced substantial bias into the results.

We are uncertain as to the effects of school-based physical activity interventions on the proportion of children or adolescents who met the physical activity guidelines recommendation of 60 minutes of daily MVPA. Some studies report that multi-component interventions increase the proportion of adolescents meeting guidelines; however, only 2 studies reported on this outcome, and more work is needed to increase the certainty of these findings. When MVPA was reported in minutes/d, little to no difference was seen in the duration of MVPA among children and adolescents. When separated by the type of intervention implemented, some evidence suggests that schooltime physical activity programmes and multi-component interventions may result in larger increases in MVPA. This is a new finding from our 2013 review, which did not examine effects separately by the type of intervention implemented due to the smaller number of studies. Except for multi-component interventions, which may result in a small decrease in sedentary time, school-based physical activity programmes do not appear to be effective in reducing sedentary time among both children and adolescents.

In contrast, school-based physical activity interventions may have a small to moderate effect on physical fitness among both children and adolescents. In particular, enhanced physical education (PE) and before and after school programmes may result in the largest gains in fitness. Interventions that focused specifically on increased exercise intensity (such as high-intensity interval training - Leahy 2019 - and an enhanced PE intervention with a specific focus on increased exercise intensity - Ardoy 2011) led to the largest effect sizes.

Although BMI was the most reported outcome, school-based physical activity interventions may result in a small decrease when measured as z-scores, and little to no difference when measured as kg/m². Although many of the multi-component interventions did include additional components such as nutrition education or changes to the school food environment, a more specific focus on diet and nutrition both inside and outside the school environment may be needed to change body weight trajectories (Ho 2012; Ho 2013). Notably, in this update, interventions that were targeted primarily at improving body composition without an explicit focus on physical activity or physical fitness were excluded.

The 2013 review found limited evidence that positive effects are maintained in the longer term, although only a small number of studies measured outcomes beyond the end of the intervention. In this version, several studies reported long-term follow-up, but evidence to suggest that changes were maintained long term remains limited. One limitation of this update is that we explored impact only at the immediate post-intervention time period due to wide heterogeneity in follow-up times across interventions. The wide variety of study designs, lengths of intervention, and lengths of follow-up make it challenging to further comment on sustainable effects of the interventions. As more data become available, future updates may have access to sufficient data to pool effects from studies with longer follow-up time periods.

Very few studies reported on differences in response to interventions between boys and girls, and these results were mixed in with results of studies that did report these differences. As such, we did not seek to carry out a subgroup analysis on differential effects in boys versus girls. Recent estimates suggest there are meaningful differences in physical activity levels between boys and girls, and that although prevalence of insufficient physical activity decreased from 2001 to 2016 in boys, no such change occurred among girls (Guthold 2020). Future studies in this field should examine results separately for boys and girls to determine if interventions have similar effects in individuals of both genders.

Finally, few studies reported information about adverse events, or how these were identified and captured. Adverse events reported were generally muscle soreness or injury related to physical activity and bruising related to a data collection blood draw, for example. One systematic review on physical activity and health outcomes related to physical activity interventions overall reported that no included studies reported any harm or injury associated with physical activity participation (Poitras 2016). These types of potential harms should be explored and reported clearly in future school-based trials.

One aspect not often considered is the potential for adverse effects on quality of life or harms related to the stigma of participating in physical activity with their peers at school. Also missing from most studies was consideration of factors related to health equity. If physical activity or physical education programming does not meet the needs of individual students or certain subgroups of students, participation may be limited, which may be reflected in variation in findings across studies. In a review of studies about meaningful experiences in physical education and sport, identified themes were social interaction, fun, challenge, competition, motor competence, and personally relevant experiences (Beni 2017). Negative experiences reported in physical education classes in childhood were related to embarrassment and lack of enjoyment of fitness testing and sport, and positive memories of school physical education, such as enjoyment of class activities, time spent with friends or outside, or being allowed to move more after sitting in class all day, were associated with positive attitudes and intentions to be physically active in adulthood in another study (Ladwig 2018). These studies suggest that students need to identify personal meaning in their school physical activity opportunities; a "one-size-fits-all" approach may not be appropriate to encourage physical activity participation.

Most studies did not comment on aspects related to implementation of interventions, such as uptake or adherence to the interventions and fidelity of delivery. It is unknown if interventions were successfully delivered within the schools, which can often be challenging. Without an understanding of fidelity of delivery, any additional minutes of MVPA that resulted from taking part in the school-based intervention could be compensated for by a decrease in MVPA outside of school time; thus, no overall change in full-day MVPA was observed. Also, failure to properly implement the programme and poor adherence to the intervention at the student level may occur. Finally, although patient-oriented research and community engagement initiatives are becoming increasingly prevalent in adult research literature, youth engagement in both design and implementation of these interventions may prove to be a useful strategy to promote uptake and adherence. This could in turn result in not only more meaningful improvements in these short-term behaviours but also a long-term commitment to physical activity to improve health and reduce chronic disease risk into adulthood.

Overall completeness and applicability of evidence

A comprehensive search of randomised controlled trials (RCTs) and cluster-RCTs was conducted, and it is unlikely that many studies were missed by our search strategy. Studies included in this review are applicable to public health and education in high-income countries, as most studies were conducted in the USA, the UK, and Australia; different strategies may be needed and different effects may be found in low- to middle-income countries. Most studies included in this review were conducted in school-age children (ages 6 to 12); a smaller number were conducted in adolescents. Although ten trials were conducted exclusively in female students, only one study was conducted among boys only, and few trials explored the effects of sex and gender in the analysis.

The types of interventions included varied widely, and no two studies implemented the same interventions. This makes it very challenging to draw conclusions as to the most effective components of interventions that can elicit changes in the outcomes of interest. The benefit of the wide variety of interventions is that researchers and policy makers can search a variety of protocols to determine what might be effective for future interventions or programming.

Although RCTs are considered the gold standard design for exploring efficacy, it is possible that inclusion of non-randomised intervention studies may have provided more information on outcomes that were important to this review, namely, health-related quality of life and adverse events. Given the large number of included trials, it is not feasible to include non-randomised evidence in this update. However, we wish to acknowledge the potential for this information to be included in studies that were not captured in this review.

Quality of the evidence

As outlined, several factors limited the certainty of results in this review. The most common reason why certainty was downgraded was inconsistency, assessed through visual inspection of forest plots and I^2 values from the meta-analysis. This criterion for downgrading was applied to all outcome measures except for sedentary time. Inconsistency in findings is not surprising, given the large differences in target populations, components of interventions studied (including dose and type of physical activity), ways in which outcomes were assessed, and time periods of follow-up. Nonetheless, this inconsistency limits our confidence in the effects of school-based physical activity interventions overall.

The quality of the evidence was also limited by high or uncertain risk of bias in the included studies. Although all included trials were individually randomised or cluster-randomised trials, a number of methodological limitations were present. In particular, blinding of participants and personnel and of outcome assessors often was not reported, introducing the potential for performance and detection bias in assessment of results. Due to the nature of school-based physical activity interventions, it is near impossible to blind participants and personnel to the assigned intervention. However, blinding of outcome assessors and data analysts is important and could be improved upon in future studies. Attrition bias was also prevalent across studies, particularly for measures of physical activity and sedentary time. Some loss to follow-up is unavoidable in school-based interventions, and study authors often reported the proportion of students lost to follow-up due to moving and changing schools. However, often a greater proportion of missing data was related to physical activity or sedentary time measured by accelerometers. Adherence to wear time protocols for these devices may be poor within some populations, and data loss or technical issues were possible. When there is differential incomplete outcome data by intervention group within trials, these findings are particularly susceptible to bias.

Although this review included only objectively measured physical activity and sedentary time, accelerometers and pedometers are not without limitations. When accelerometers are used to measure physical activity and sedentary time, the accelerometer model, epoch length, non-wear time, definition of a valid day, wear time criteria, and cut points can differ, causing wide variation between studies and limiting the precision of the effect estimate (as was seen in studies of proportions of participants physically active and sedentary time). For example, a longer epoch length will underestimate MVPA. When studies have minimum wear-time criteria, the data may be more indicative of habitual physical activity, but sample size will be reduced. The cut points used will also have an impact on physical activity and sedentary time duration (Cain 2013).

Very few of the included studies measured maximal oxygen uptake (VO_2max) directly using gas exchange; this was most often predicted by field tests. This resulted in downgrading of the certainty of evidence for physical fitness due to indirectness. For the most part, studies did use reliable, valid, field-based measures of aerobic fitness; however the usefulness of these tests is largely determined by participants' motivation to try their hardest, thus reducing the change that a true measure of fitness was achieved.

Our confidence in the evidence related to both health-related quality of life and adverse events was limited by potential publication bias, with overall certainty of findings downgraded accordingly. Although many studies reported that no adverse events were reported, most studies did not adequately describe the approach taken to monitor for any adverse events. Although 7 studies reported on health-related quality of life, others listed these outcomes in protocol papers or in trial registries but did not publish the findings; thus the potential of publication bias remains.

Finally, very few studies reported on the extent to which interventions were implemented as specified. Without adequate process evaluation data, it is not known to what degree students participated in the intervention, and this could have an influence on the impact of the intervention on our outcomes of interest. Information about implementation is important, to understand trial fidelity and for scaling up of interventions in the future. About half of the trials were informed by various theoretical models, including social cognitive theory, socioecological model, self-determination theory, and the theory of planned behaviour. These theories are intended to promote physical activity at the individual level and may not be as relevant to public health interventions, such as the school-based studies included in this review (King 2002).

Potential biases in the review process

It is possible that biases were introduced in the review process; however, several steps were taken to minimise this. A comprehensive search strategy, with updates from our previous search strategy to include new terms (such as sedentary time), was used to identify over 9000 citations from 2011 to the present. We did not place limitations by language or publication status. Although efforts were undertaken to minimise this bias (multiple review authors were involved in interpreting results and provided comments on drafts of this update), it is possible that we have interpreted the results to be more positive than they actually are. Readers of this review are cautioned therefore to carefully examine results across studies.

Agreements and disagreements with other studies or reviews

Overall, our findings are similar to those of other systematic reviews and meta-analyses that have addressed similar questions. A recent systematic review and meta-analysis examined effects of school-based physical activity interventions on physical activity and sedentary time, including only cluster-randomised controlled trials (Love 2019). When studies measured changes in MVPA during the actual intervention period (i.e. during PE class only in an intervention of enhanced PE), there was moderate evidence of effect, whereas when changes in MVPA were examined over the whole school day, effects were inconclusive, and when changes in MVPA were examined across the entire day (both in and out of school time), no effect was seen (Love 2019). It is interesting to note that these study authors also explored the effectiveness of interventions by gender and socioeconomic status and found no difference in effect in terms of either of these variables.

Other reviews have focused more closely on specific intervention types, with similar findings to those presented in this review. A 2019 review of 22 studies that implemented active breaks within the classroom found a small but not significant increase in minutes of MVPA compared to a control group (+3.29 minutes/d, 95% CI -0.15 to 8.75) (Masini 2020). However, in this review, only physical activity during class time was included, as opposed to full-day physical activity measures that were included in this review. Bedard and colleagues found a small reduction in sedentary time when schools took part in an active classroom intervention; however all studies were found to have moderate to high risk of bias (Bedard 2019). A review of active transport interventions found low-quality evidence to suggest that active transportation can increase transportation-related MVPA, but with no associated change in physical fitness among children aged 4 to 11 years (Jones 2019).

AUTHORS' CONCLUSIONS

Implications for practice

Following are suggestions for public health practitioners, decision-makers, and policy makers. School-based physical activity interventions as they have been designed and delivered to date probably have little to no impact on overall time spent in MVPA and may have little to no impact on time spent sedentary. Some evidence suggests that multi-component interventions that address the whole-school environment and incorporate physical activity throughout the school day (e.g. physically active lessons, physical activity breaks) may have the strongest impact on time spent in MVPA. Although not the focus of this review, an additional focus on physical activity outside the school environment may help to increase overall physical activity levels. Public health organisations can support schools in providing implementation, assessment, and evaluation.

Although school-based physical activity interventions may improve physical fitness, specific focus on targeting higher-intensity activity is warranted.

Finally, school-based physical activity programmes may have only a very small impact on BMI z-scores and little to no impact on BMI in kg/m^2. If the primary goal is to promote healthy body weight, it is likely that another type of intervention may be needed to attain meaningful improvements.

Implications for research

Across outcomes, the certainty of evidence was downgraded due to inconsistency of findings across interventions. This may be attributed to (1) variability in strategies used and in the frequency, intensity, and duration of interventions; (2) use of various theoretical models to guide the intervention; (3) use of a variety of instruments and tools to assess physical activity or physical fitness (or both); and (4) follow-up periods of different durations. Full reporting on components of the interventions delivered (e.g. by using the Template for Intervention Description and Replication (TIDieR)) may be helpful in further understanding heterogeneity across studies to identify critical components of success (Hoffmann 2014).

Lack of change in leisure-time physical activity or physical fitness, in turn, has been attributed most often to issues of (1) inadequate dose (Tolfrey 2000); (2) poor compliance (Baranowski 1990); (3) inattention to the multiplicity of risk factors for physical inactivity and subsequent overly simplistic, uni-dimensional interventions; (4) methodological errors in measuring fitness (e.g. assessing heart rate only after, as opposed to during, activity); and (5) failure to control for potentially confounding variables (Tolfrey 2000), particularly in cluster-randomised trials. Future studies should ensure that each of these aspects has been carefully considered in both design and delivery of interventions, which may help to enhance understanding and explain heterogeneity across trials.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

Characteristics of included studies [author-defined order]

Breheny 2020

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** UK schools with at least 20 pupils in school years 3 and 5 **School exclusion criteria:** none **Student inclusion criteria:** students in Years 3 (aged 7 to 8 years) and 5 (aged 9 to 10 years) **Student exclusion criteria:** pupils that had a disability preventing them from running or walking for 15 minutes and those who were unable to have their height and/or weight measured at baseline **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** UK
Interventions	**Intervention:** The Daily Mile. Each day, the teacher leads the class on a run or walk as fast as they can go in 15 minutes **Comparator:** usual practice **Duration of intervention:** 12 months **Duration of follow-up: -** **Number of schools:** 40 **Theoretical framework:** -
Outcomes	Fitness BMI Health-related quality of life
Study registration	ISRCTN 12698269
Publication details	**Language of publication:** English **Funding:** Birmingham City Council **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of this pragmatic cluster RCT is to assess the clinical and cost-effectiveness of The Daily Mile in Birmingham primary schools for the purpose of improving health and well being"
Notes	

Breheny 2020 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "an independent statistician used a constrained randomisation based algorithm in a statistical package"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "an independent statistician used a constrained randomisation based algorithm in a statistical package"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "it was not possible to mask school staff, children, family members and project staff"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "all research staff undertaking the physical measurements were blinded"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Quote from publication:** "There was a large amount of missing data for the other secondary outcomes. For fitness and academic attainment this exceeded 56% at certain time points and therefore multiple imputation was performed and both complete case and imputed variables are reported"
Selective reporting (reporting bias)	Low risk	**Comment:** all applicable outcomes reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** schools enrolled and baseline data collected prior to randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no baseline differences
Cluster RCT - Loss of clusters	High risk	**Comment:** 1 cluster lost from control arm
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Ketelhut 2020

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** within a pool of project schools from another study **School exclusion criteria:** - **Student inclusion criteria:** third grade, written parental/guardian consent **Student exclusion criteria:** health conditions that did not allow unrestricted physical activity **Setting:** school **Age group:** children

Ketelhut 2020 *(Continued)*

	Gender distribution: females and males **Country where trial was performed:** Germany
Interventions	**Intervention:** high-intensity interval training incorporated into the first 20 minutes of regular PE classes (1 × 45 minutes and 1 × 90 minutes per week) **Comparator:** regular PE classes (1 × 45 minutes and 1 × 90 minutes per week) **Duration of intervention:** 12 weeks **Duration of follow-up:** - **Number of schools:** 1 **Theoretical framework:** -
Outcomes	Fitness
Study registration	-
Publication details	**Language of publication:** English **Funding:** - **Publication status:** peer-reviewed journal
Stated aim for study	"the aim of the present study was to examine the effects of a regular school-based and child-specific high intensity interval training intervention not only on aerobic fitness and peripheral blood pressure but moreover on different parameters of arterial stiffness"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "randomisation was carried out by the principal investigator using a computer-generated random number table"
Allocation concealment (selection bias)	Unclear risk	**Comment:** not described
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** not described; not likely done
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** not described
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Unclear risk	**Comment:** not described
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol or registry document available.

Ketelhut 2020 *(Continued)*

Cluster RCT - Recruitment bias	Unclear risk	**Comment:** not described
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no baseline differences
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** analyses not adjusted for clustered nature of data

Belton 2019

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** (a) schools have a qualified PE teacher on staff, (b) first year students attending the school were time tabled for a minimum of 70 minutes of PE weekly, (c) schools were mixed gender and were situated in the greater area of a large Irish city **School exclusion criteria:** — **Student inclusion criteria:** first year post primary students (12 to 13 years old) attending post primary education within a particular Irish geographical region **Student exclusion criteria:** — **Setting:** school **Age group:** adolescent **Gender distribution:** females and males **Country/Countries where trial was performed:** Ireland
Interventions	**Intervention:** a whole-school multi-component intervention programme, aimed at reducing the age-related decline of MVPA among adolescents. Key features include 1. PE component: PE teachers received 4 hours of Y-PATH professional development including 6 targeted lesson plans focusing heavily on motivational climate, integrating health-related activity core knowledge through fun and engaging practical lessons, with an emphasis on functional movement skill proficiency. Resource cards were used to prompt teachers to enable them to integrate a health-related activity and fundamental movement skill focus within other core PE content areas. Students were given a PA journal to learn to track PA behaviours and identify ways to increase PA levels, and a PA directory containing information and contact details for local youth sport and PA clubs 2. Whole-school teacher component: PA promotion workshops for teachers, and development and implementation of a school 'charter' for PA. Teachers were encouraged to be 'active role models' 3. Parent component: information evening for parents and information leaflets distributed through the school newsletter to highlight key strategies for promoting PA beyond the school environment **Comparator:** usual care, consisting of regular delivery of the Irish Junior Cycle PE curriculum, and the broader school curricula **Duration of intervention:** 2 years **Duration of follow-up:** 2 years

Belton 2019 *(Continued)*

	Number of schools: 20 **Theoretical framework:** social-ecological framework, self-determination theory
Outcomes	PA duration
Study registration	ISRCTN20495704
Publication details	**Language of publication:** English **Funding:** Dublin Local Sports Partnerships, Dublin City University Career Start grant **Publication status:** peer-reviewed journal
Stated aim for study	"to investigate the effect of participation in the Y-PATH intervention over a two-year period on objectively measured MVPA levels of young people"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	**Quote from publication:** "one school from each pair was then randomly allocated by the study principal investigator to the control group (and the other to the intervention group) using a manual number generator in blocks of 1:1, prior to the commencement of baseline testing"
Allocation concealment (selection bias)	High risk	**Quote from publication:** "one school from each pair was then randomly allocated by the study principal investigator to the control group (and the other to the intervention group) using a manual number generator in blocks of 1:1, prior to the commencement of baseline testing"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "not possible given the nature of the intervention"
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Quote from publication:** "not possible given the nature of the intervention"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** BMI data missing > 10%
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** Large % missing data
Selective reporting (reporting bias)	High risk	**Comment:** BMI data not reported, stated in methods; secondary outcomes listed in clinical trials registry not reported
Cluster RCT - Recruitment bias	High risk	**Comment:** baseline data collected after randomisation of schools
Cluster RCT - Baseline imbalance	Low risk	**Comment:** groups balanced at baseline [author communication]

Belton 2019 *(Continued)*

Cluster RCT - Loss of clusters	High risk	**Comment:** 50% of clusters lost at 24 months
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "a three level multilevel structure was proposed with random intercepts, where time (Level one), pupils (Level two) and schools (Level three) served as the grouping variables, where time was treated as a fixed effect in the model but was also incorporated as a random slope effect (repeated measure) in the residual component"

Corepal 2019

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** post-primary schools in Belfast that had previously participated in research projects with the university **School exclusion criteria:** - **Student inclusion criteria:** Year 9 classes **Student exclusion criteria:** advised by a general practitioner not to undertake MVPA, did not provide assent, or parents completed parental opt-out consent form **Setting:** school **Age group:** adolescents **Gender distribution:** females and males **Country where trial was performed:** North Ireland
Interventions	**Intervention:** StepSmart Challenge used gamification and self-determination theory to encourage and support PA behaviour change. During phase 1, competitions were held between schools, between classes, and between students using material and social incentives. FitBit Zips were provided to track progress towards challenges. Phase 2 included a within-student pedometer competition using the StepSmart Challenge website **Comparator:** no intervention or incentives **Duration of intervention:** 22 weeks **Duration of follow-up:** 52 weeks **Number of schools:** 5 **Theoretical framework:** self-determination theory
Outcomes	PA duration Sedentary time
Study registration	NCT02455986
Publication details	**Language of publication:** English **Funding:** HSC R&D Enabling Research Award

Corepal 2019 *(Continued)*

	Publication status: peer-reviewed journal
Stated aim for study	"This study investigated the feasibility of implementing and evaluating a school-based gamified pedometer competition designed to promote physical activity among 12–14-year-olds, known as 'The StepSmart Challenge', which integrates core gamification strategies with self-determination theory"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "stratified randomisation process (stratified by socioeconomic status, and whether schools were single-sex or co-educational) was undertaken by an independent statistician to assign schools to the intervention or control group using software available at http://www.randomization.com"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "stratified randomisation process (stratified by socioeconomic status, and whether schools were single-sex or co-educational) was undertaken by an independent statistician to assign schools to the intervention or control group using software available at http://www.randomization.com"
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** not described
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** not described
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** only 57.4% of returned accelerometers had data valid for analysis
Selective reporting (reporting bias)	Low risk	**Comment:** all relevant outcomes reported
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** not described
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** not described
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Comment:** feasibility trial, thus only descriptive values reported

Ickovics 2019

Study characteristics

Ickovics 2019 *(Continued)*

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** K through 8 district schools New Haven, Connecticut **School exclusion criteria:** — **Student inclusion criteria:** students enrolled in Grade 5 when the study began or began attending a target school in Grade 6 **Student exclusion criteria:** — **Setting:** school, urban **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** USA
Interventions	**Intervention 1:** PA only **Intervention 2:** Nutrition + PA All schools received $500/y to establish a School Wellness team, focused on written policy implementation relevant to randomised condition. Research staff supported schools with 1 to 2 visits per month to provide workshops ***PA*** **:** high-quality PE class at least 90 minutes/week to foster a lifelong appreciation for physical fitness and to participate in fitness activities; promotion of active transport; integration of PA into the classroom; fitness challenges. PA will not be used as a form of punishment (e.g. running laps, withholding recess), distribution of activity monitors, use of online tracking software, family-targeted newsletters ***Nutrition*** **:** appealing and attractive meals, clean and pleasant setting, no fried vegetables, only low-fat, non-flavoured milk, whole-grain cereals. Schools will not use food or beverages as rewards or punishments, and will limit celebrations involving food to once per month and with only 1 food or beverage that does not meet school nutrition standards. Nutrition education provided through parent workshops, student materials, school menus, and bulletins. Schools asked to engage parents and students in thorough taste testing of new menu options and to assist with selecting food **Comparator 1:** nutrition intervention only **Comparator 2:** delayed control; schools received other health-relevant training (e.g. oral health, cold or influenza prevention) during the study period, with obesity-related materials delivered at study completion **Duration of intervention:** 3 years **Duration of follow-up:** annually for 3 years **Number of schools:** 12 **Theoretical Framework:** —
Outcomes	BMI
Study registration	NCT02043626 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal

Ickovics 2019 *(Continued)*

Stated aim for study	"The objective of this cluster randomised trial is to assess whether implementation of specific nutrition and PA components of the written school wellness policies lead to healthier student outcomes, including BMI trajectories and behavioral correlates"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "randomisation was achieved using a computer-generated sequence"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "to minimize selection bias, all schools were recruited before randomisation"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "neither schools nor researchers could be blinded to study condition"
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Quote from publication:** "neither schools nor researchers could be blinded to study condition"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** most missing data due to students moving
Selective reporting (reporting bias)	High risk	**Comment:** mental health and standardised test scores not reported
Cluster RCT - Recruitment bias	Unclear risk	**Quote from publication:** "schools were recruited before randomisation" **Comment:** unclear when baseline data were collected
Cluster RCT - Baseline imbalance	Low risk	**Comment:** there were no notable school-level differences in size or relevant socioeconomic characteristics
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "multivariable analyses accounted for multilevel nature of data, adjusting for intra-cluster correlation among repeated measures within students and schools, and allowed use of all study time points"

Jago 2019

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** primary schools from South Gloucestershire and North Somerset local authority **School exclusion criteria:** —

Jago 2019 *(Continued)*

	Student inclusion criteria: pupils in Year 3 or 4 (aged 7 to 9) at baseline **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** UK
Interventions	**Intervention:** Action 3:30R after-school clubs, scheduled to run twice per week for 15 weeks and last 60 minutes per session. Sessions were designed to promote maximal participation, skill development, cooperation, problem-solving, PA, and choice. Sessions began with fun warm-up activities and moved through a series of small sided games and activities with a focus on fun and participation while improving fundamental movement skills such as running, catching, throwing, and using space in invasion games. Teaching assistants took part in 5 days (25 hours) of training to promote and foster aspects of motivation drawn within the club, with focus on creating a club climate that supported autonomy, relatedness, and competence. Teaching assistants completed a log book to indicate whether sessions were delivered fully, partially, or not at all and a register of attendance **Comparator:** — **Duration of intervention:** 15 weeks **Duration of follow-up:** 15 weeks **Number of schools:** 12 **Theoretical framework:** self-determination theory
Outcomes	PA duration Sedentary time BMI Health-related quality of life
Study registration	ISRCTN34001941
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of this study is to test the feasibility of the revised version of Action 3:30 which has been reworked to more successfully appeal to and engage girls and recruit less active children"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "computer generated"

Jago 2019 *(Continued)*

Allocation concealment (selection bias)	Low risk	**Quote from publication:** "allocation will be performed (computer-generated allocation) by an independent member of the Bristol Randomised Trials Collaboration who will be blind to the school identity"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "randomisation will take place after baseline data collection has been completed. School is the unit of randomisation"
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** attempted to blind staff, but unsuccessful [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** low loss to follow-up at student level
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** low loss to follow-up at student level
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes in protocol paper reported
Cluster RCT - Recruitment bias	Low risk	**Quote from publication:** "all measures will be taken at baseline prior to randomisation"
Cluster RCT - Baseline imbalance	Low risk	**Comment:** Control and intervention groups did not differ by demographics, PA, or psychosocial outcomes at baseline
Cluster RCT - Loss of clusters	High risk	**Comment:** 2 schools dropped out after randomisation
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "multivariable mixed effects linear regression that took account of the clustering of pupils in schools was conducted"

Leahy 2019

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** — **School exclusion criteria:** — **Student inclusion criteria:** students in Grade 11 at study schools who did not have an injury or illness that would preclude their participation in high-intensity activity as outlined in the participant information and consent form (e.g. existing physical injury) **Student exclusion criteria:** — **Setting:** school **Age group:** adolescents **Gender distribution:** females and males

Leahy 2019 *(Continued)*

	Country where trial was performed: Australia
Interventions	**Intervention:** Burn2Learn, a 14-week multi-component high-intensity interval training intervention to improve older adolescents' physical and mental health. Participants were prescribed 3 high-intensity interval training sessions/week, for 14 weeks. Teachers were asked to offer at least 2 opportunities/week for high-intensity interval training during class time, with the ultimate target of students performing 3 sessions/week (i.e. 1 self-directed session outside of class). Any additional high-intensity interval training sessions performed by participants were reported individually to the school champion to monitor session adherence. High-intensity interval training sessions comprised a brief 2-minute warm-up, followed by 8 to 16 minutes of high-intensity interval training, followed by a 2-minute cool-down (12 to 20 minutes total). Sessions were performed individually, in pairs, or in small groups. Participants were provided with pre-designed high-intensity interval training workouts that included a combination of aerobic-based (e.g. shuttle runs) and resistance-based (e.g. push-ups) exercises designed to be performed using minimal space and equipment. Participants were able to select from the following high-intensity interval training theme workouts: gym high-intensity interval training, sport high-intensity interval training, class high-intensity interval training, dance high-intensity interval training, combat high-intensity interval training, and brain high-intensity interval training. A full-day professional learning workshop was provided for a school champion (i.e. teacher) and another member of staff to facilitate the Burn2Learn programme. The intervention included an introductory seminar for students, school-based high-intensity interval training sessions, parental videos, and an equipment and resource pack (including high-intensity interval training task cards). Technique cards reinforcing correct technique were also provided to the intervention school and were used by the school champion during early weeks of the intervention. To encourage maintenance of the appropriate exercise intensity (i.e. > 85% maximum heart rate), participants were provided with heart rate monitors (Wahoo TICKR) during high-intensity interval training sessions. Participants' heart rates during sessions were viewed on smartphones utilising a commercially available group heart rate monitoring application (OnBeat) **Comparator:** a wait-list control group participated in usual school activities and received the intervention following the post-test assessment period **Duration of intervention:** 14 weeks **Duration of follow-up:** 14 weeks **Number of schools:** 2 **Theoretical framework:** self-determination theory
Outcomes	Fitness BMI Health-related quality of life
Study registration	ACTRN12617000544370
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"the objective of this study was to evaluate the impact of a teacher-facilitated high intensity interval training program for older adolescents, embedded within the school day in regard to 4 domains of feasibility (i.e. recruitment, retention, adherence, and program satisfaction). Preliminary efficacy was evaluated by testing the effect of the high intensity interval training program on cardiorespiratory fitness, muscular fitness, and psychological health"
Notes	

Risk of bias

Leahy 2019 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "the 2 schools were randomised to the Burn2Learn intervention group, or a wait-list control group using a coin flip by an independent researcher not involved in the project following baseline assessments"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "the 2 schools were randomised to the Burn2Learn intervention group, or a wait-list control group using a coin flip by an independent researcher not involved in the project following baseline assessments"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** not possible
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Quote from publication:** "trained research assistants, who were blinded to group allocation, conducted assessments for the primary outcome. Assessors responsible for the collection of secondary outcomes were not blinded to group allocation"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** reasons for dropout not reported
Selective reporting (reporting bias)	High risk	**Comment:** PA not reported
Cluster RCT - Recruitment bias	Low risk	**Quote from publication:** "the 2 schools were randomised to the Burn2Learn intervention group, or a wait-list control group using a coin flip by an independent researcher not involved in the project following baseline assessments"
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline demographics were compared, and all groups were similar [author communication]
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** no clustering accounted for in analysis

Lonsdale 2019a

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** (1) school with students enrolled in Grades 8 and 9; (2) funded by the New Sout Wales Department of Education; (3) permission granted by the principal, the head PE teacher, and at least 1 Grade 8 PE teacher; (4) located in Western Sydney; (5) in a postal code with a mean decile rank that was below the median on the Australian Bureau of Statistics' Index of Relative Socioeconomic Disadvantage **School exclusion criteria:** — **Student inclusion criteria:** students physically able to take part in Grade 8 PE **Student exclusion criteria:** —

Lonsdale 2019a *(Continued)*

	Setting: school **Age group:** adolescent **Gender distribution:** females and males **Country/Countries where trial was performed:** Australia
Interventions	**Intervention:** the 'Activity and Motivation in Physical Education' (AMPED) intervention had 2 aims: (1) to help teachers deliver lessons that maximised opportunities for MVPA; and (2) to help teachers enhance their students' motivation towards PE. Teachers' learnt strategies that were categorised under 2 headings: (A) 'Maximising Movement and Skill Development' and (B) 'Reducing Transition Time'. Strategies to enhance student motivation were organised under 2 further headings: (C) 'Building Competence' and (D) 'Supporting Students'. Face-to-face workshops included brief presentations by the research team, but many of these teachers worked independently on the project's website. This independent work was designed to help ensure teachers were comfortable working on the website, to facilitate later use. Throughout the entire intervention, teachers had access to online resources, a discussion forum, videos of good/poor practice, and the project's mobile phone application, which included implementation and self-reflection prompts **Comparator:** standard teaching, wait-list control **Duration of intervention:** 7 to 8 months **Duration of follow-up:** 14 to 15 months **Number of schools:** 14 **Theoretical framework:** self-determination theory,
Outcomes	PA duration Sedentary time
Study registration	ACTRN12614000184673
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The purpose of this study is to evaluate an intervention designed to increase the amount of health-enhancing PA that secondary school students accumulate during their school-based PE lessons"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "using a computer-based randomisation plan generator...a researcher not associated with recruitment or data collection, and who will be blind to school identity, will carry out randomisation procedures"
Allocation concealment (selection bias)	Low risk	**Comment:** All 14 eligible schools randomised at 1 time point
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Quote from publication:** "students participating in the study will also be blinded to hypotheses and school allocation. Teachers will be aware of their allocation to the intervention or control condition"

Lonsdale 2019a *(Continued)*

		Comment: using only objective physical activity assessment, teacher's knowledge unlikely to bias results
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "trained research assistants who will be blinded to school allocation will conduct baseline, post-intervention and maintenance phase assessments"
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** 34% and 44% of physical activity data missing in intervention and control groups, respectively, at end of study
Selective reporting (reporting bias)	Low risk	**Comment:** all relevant outcomes reported
Cluster RCT - Recruitment bias	High risk	**Comment:** teachers and students enrolled after schools randomised; teachers aware of allocation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline characteristics balanced between 2 groups
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "we included four random intercept effects for: (1) lesson; (2) student; (3) teacher; and (4) class. When preliminary analyses suggested clustering at the school level, we included a fifth random intercept effect for this level"

Müller 2019

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** quintile 3 schools selected based on geographic location, representation of various target communities, and commitment to support project activities **School exclusion criteria:** < 100 learners in Grade 4 **Student inclusion criteria** • Willingness to participate • Written informed consent by a parent or guardian • No participation in other clinical trials during the study period • Not suffering from medical conditions preventing participation in a maximum exercise test, as determined by qualified medical personnel **Student exclusion criteria:** — **Setting:** school **Age group:** children/adolescents **Gender distribution:** females and males **Country where trial was performed:** South Africa

Müller 2019 *(Continued)*

Interventions	**Intervention 1:** PA: a multi-dimensional PA intervention during school time developed in collaboration with education authorities, teachers, and students. 4 key components included: • two 40-minute PE lessons/week; • one 40-minute moving-to-music lesson/week led by students from Nelson Mandela University; • in-class activity breaks; and • low-cost school environment adaptations (e.g. activity stations, painted games) **Intervention 2:** PA + Health education: health education lessons were held to increase children's awareness of intestinal parasite infections **Intervention 3:** PA + Health education + Nutrition: a nutrition intervention consisting of classroom-based lessons to help increase awareness of the importance of healthy nutrition were held **Comparator 1:** Health education + Nutrition **Comparator 2:** no intervention **Duration of intervention:** 2 × 10-week blocks **Duration of follow-up:** 15 months **Number of schools:** 8 **Theoretical framework:** —
Outcomes	Fitness BMI
Study registration	ISRCTN68411960(retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The overarching purpose of the Disease, Activity and Schoolchildren's Health study was to investigate the dual disease burden (i.e. non-communicable diseases and infectious diseases) among children in primary schools in disadvantaged neighbourhoods"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "generating the allocation sequence by a simple randomisation of the schools was carried out by the research team on the basis of a computer-generated random number list"
Allocation concealment (selection bias)	High risk	**Quote from publication:** "research team allocated schools, concealment and blinding were not possible in our study design"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "concealment and blinding were not possible in our study design"

Müller 2019 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	High risk	**Quote from publication:** "concealment and blinding were not possible in our study design"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** 281 lost to follow-up
Selective reporting (reporting bias)	High risk	**Comment:** different primary outcome reported in trial registry
Cluster RCT - Recruitment bias	Low risk	**Comment:** individual learners were enrolled and baseline data collected before randomisation at the cluster level (of schools) [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Quote from publication:** "no significant differences in primary outcome measures, such as obesity, skin-folds and cardiorespiratory fitness at baseline were detected, when comparing schools with and without PA intervention"
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "separate mixed linear regression models were employed with random intercepts for school classes, in order to adjust for cluster effects"

Ordóñez Dios 2019

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** bilingual public schools **School exclusion criteria:** — **Student inclusion criteria:** children aged 11 to 12 years in their last year of primary school **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** Spain
Interventions	**Intervention:** two 45-minute sessions of PE per week plus a daily run (starting at 250 m and progressing to 750 m) **Comparator:** two 45-minute sessions of PE per week as stipulated by law **Duration of intervention:** 12 weeks **Duration of follow-up:** 12 weeks **Number of schools:** 2

Ordóñez Dios 2019 *(Continued)*

	Theoretical framework: —
Outcomes	Fitness BMI
Study registration	—
Publication details	**Language of publication:** English/Spanish **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The objective of this study is to examine the possible effects of a daily physical activity intervention on physical fitness, coordination and attention"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** not described
Allocation concealment (selection bias)	Unclear risk	**Comment:** not described
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** not described
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** not described
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Unclear risk	**Comment:** number of participants enrolled or randomised not described; only number analysed
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** unclear when baseline data were collected
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** demographic characteristics not compared
Cluster RCT - Loss of clusters	Low risk	**Comment:** no loss of clusters
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustered nature of data not accounted for in analysis

Seibert 2019

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** 40% or more of students qualifying for free or reduced lunch **School exclusion criteria:** — **Student inclusion criteria:** Grades 3 to 8 **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** USA
Interventions	**Intervention:** implementation of 3 Centre for Disease Control-recommended evidence-based strategies: (1) increasing the amount of time spent in MVPA during PE classes, (2) encouraging active classroom breaks, (3) providing organised PA opportunities during recess, and (4) providing organised PA opportunities before and after school **Comparator:** continued with prior routine PA programming **Duration of intervention:** 1 school year **Duration of follow-up:** 1 school year **Number of schools:** 49 **Theoretical framework:** —
Outcomes	Fitness
Study registration	NCT02411552 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** University of Wisconsin-MadisonWisconsin Partnership Program and NIH T32 DK077586 **Publication status:** peer-reviewed journal
Stated aim for study	"In this study we evaluated the feasibility and effects of a large-scale implementation program for CDC-recommended school based physical activity strategies on cardiovascular fitness measured by the Progressive Aerobic Cardiovascular Endurance Run in low SES Wisconsin schools"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	**Comment:** not described
Allocation concealment (selection bias)	Unclear risk	**Comment:** not described

Seibert 2019 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** principals and PE educators informed of intervention status
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** schools completed PACER as part of their regular PE class and submitted data to researchers
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Unclear risk	**Comment:** not described
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes listed in clinical trials registry reported
Cluster RCT - Recruitment bias	High risk	**Comment:** data collected after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** between-group differences at baseline adjusted for in analysis
Cluster RCT - Loss of clusters	Unclear risk	**Comment:** not described
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "linear mixed effects modelling with school-specific random effects were conducted to perform the comparisons of outcome measures at baseline between the 2 study arms"

Seljebotn 2019

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** all primary schools in the municipality of Stavanger, Norway **School exclusion criteria:** — **Student inclusion criteria:** Grade 5 - 9 to 10 years old **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** Norway
Interventions	**Intervention:** physically active lessons (45 minutes) 2 to 3 days/week on days without PE. Lessons were held mainly outdoors and included games, relays, and quizzes with curricular questions from theoretical subjects. Physically active lessons included at least 15 minutes of MVPA, were easily organised and adapted, included competitive and non-competitive elements, and were enjoyable activities that included all children. Secondary components included physically active homework (10 minutes/d) and physically active recess (10 minutes/d). The intervention was intended to increase the amount of PA by 190 minutes/week, giving a total of 325 minutes/week of PA. To further improve the quality of the phys-

Seljebotn 2019 *(Continued)*

	ically active lessons, a quality framework was stated at the back of the physically active lesson form and included tips of how differentiation, autonomy, collaboration, enjoyment, and high activity level could be ensured. To assist and support intervention teachers, 1 primary and 1 secondary contact person from the Active School project team was assigned to each intervention school. Contact persons attended meetings and regularly visited participating teachers and classes throughout the school year (1 to 4 visits/month, depending on requests from the schools). 1 pre-intervention seminar and 1 midway seminar were arranged for the teachers to give information about the programme and to provide support. New physically active lessons were shared between intervention schools through a website **Comparator:** control schools were asked to continue their normal routine, which included approximately 135 minutes/week of PA **Duration of intervention:** 10 months **Duration of follow-up:** 10 months **Number of schools:** 9 **Theoretical framework:** —
Outcomes	PA duration Sedentary time Fitness BMI
Study registration	NCT03436355
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"Based on current knowledge, the research question of this study is as follows: to what extent will increased PA in school affect children's executive function and aerobic fitness?"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "the computer program 'Researcher Randomizer' was used to randomise the 2 groups into intervention and control groups"
Allocation concealment (selection bias)	Unclear risk	**Comment:** not stated
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants and study staff were not randomised [author communication]
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** outcome assessors were not blinded [author communication]

Seljebotn 2019 *(Continued)*

Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** low loss to follow-up; unrelated to intervention
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** low loss to follow-up; unrelated to intervention
Selective reporting (reporting bias)	High risk	**Comment:** composite measure of executive function reported rather than individual components listed as primary outcomes
Cluster RCT - Recruitment bias	High risk	**Comment:** randomisation before participant enrolment
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** not stated
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Quote from publication:** "due to low variance between schools in these outcomes, multilevel analysis was not considered necessary"

Zhou 2019

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** middles schools from large, medium, and small metropolitan regions in China with similar student enrolment numbers, student-teacher ratios, and outdoor facilities; having 80 to 100 students of both genders enrolled in seventh grade; located at least 5 kilometres apart from other study schools; agreed to randomisation of treatment; agreed to implement policy and curriculum modifications **School exclusion criteria:** – **Student inclusion criteria:** junior high school healthy students; current enrolment, parental consent, and no physical disability **Student exclusion criteria:** students who cannot exercise; members of varsity sports teams **Setting:** school **Age group:** adolescent **Gender distribution:** females and males **Country where trial was performed:** China
Interventions	**Intervention 1:** school physical education - minimum of 3 PE classes/week and daily 15-minute recess, portable exercise equipment, redesign of PE curriculum, recess rhythmic aerobic routine, use of fitness and health handbook for knowledge and skills to be used on inclement weather days, bi-weekly text messages to students

Zhou 2019 *(Continued)*

	Intervention 2: after school programme - bi-weekly 45-minute after school PA programme, portable exercise equipment, use of fitness and health handbook for knowledge and skills to be used on inclement weather days, bi-weekly text messages to students **Intervention 3:** school physical education + after school programme **Comparator:** two 45-minute PE classes per week **Duration of intervention:** 32 weeks **Duration of follow-up: -** **Number of schools:** 12 **Theoretical framework:** socioecological model, competence motivation theory
Outcomes	PA duration Sedentary time Fitness
Study registration	
Publication details	**Language of publication:** English **Funding:** serving National Special Needs in Doctoral Talents Development Program—Performance Training and Health Promotion for Adolescents; the support programme for High-level Teacher Team Development of BeijingMunicipal Institutions (IDHT20170515); Beijing Social Science Funding Project (No. 16YTB018); Scientific Research Project of Beijing Educational Committee (No. KM201710029002) **Publication status:** peer-reviewed journal
Stated aim for study	"The purpose of the 4-arm study was to examine the incremental effect of adding moderate physical activity and vigorous physical activity on the physical fitness among the children that were assigned to Arm 1-school physical education intervention, Arm 2-afterschool program intervention, Arm 3-school physical education and after school program and Arm 4-control condition"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	**Comment:** not described
Allocation concealment (selection bias)	Unclear risk	**Comment:** not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students and staff not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** data collectors trained and blinded to allocation
Incomplete outcome data (attrition bias)	Low risk	**Comment:** very small quantity of missing data

Zhou 2019 *(Continued)*

Anthropometrics, Fitness		
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Unclear risk	**Comment:** only some participants wore accelerometers; no indication of completion rate
Selective reporting (reporting bias)	Low risk	**Comment:** all relevant outcomes reported
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** not described
Cluster RCT - Baseline imbalance	Low risk	**Comment:** some baseline differences across groups, but adjusted for in analysis
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** not all analyses presented; unclear which tests were used

Adab 2018

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** all state primary schools in the West Midlands (UK), which included school years 1 to 5 (children aged 5 to 10 years) and were within a 35-mile radius of the University of Birmingham **School exclusion criteria:** schools with fewer than 17 pupils in the relevant year group (minimum cluster size) or those who were in special measures (status applied by the Office for Standards in Education when it considers that a school fails to supply an acceptable level of education and appears to lack the leadership capacity necessary to secure improvements) **Student inclusion criteria:** all Year 1 pupils (aged 5 to 6 years) in participating schools **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** UK
Interventions	**Intervention:** 4 overlapping components • 30 minutes of additional MVPA on each school day—at least 15 minutes to be outside of break times • Term cooking workshops during school time, which parents were invited to attend to participate with their child and that were preceded by short classroom sessions for the children • 6-week programme (Villa Vitality) developed to encourage healthy eating and increase PA and delivered by staff from an iconic sporting institution. School classes spent 2 days undertaking activities (indoor-based movement routines, use of dance mats, ball skills session, interactive nutritional sessions, and opportunity to practise cooking skills) at an English premier league football club, separated

Adab 2018 *(Continued)*

	by a 6-week period during which teachers were asked to spend curriculum time working on a class project and involving children and their parents with weekly health challenges • Information sheets sign posting children and their families on ways to be active over the summer (identical for all schools) and PA opportunities in their local area (school-specific sheets produced by the study team and checked before distribution by the school) **Comparator:** continued with ongoing Year 2 health-related activities plus citizenship education resources, excluding topics related to healthy eating and PA **Duration of intervention:** 12 months **Duration of follow-up:** 15 and 18 months **Number of schools:** 54 **Theoretical framework:** —
Outcomes	PA participation PA duration Sedentary time BMI Health-related quality of life
Study registration	ISRCTN97000586
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The main aim is to assess the clinical and cost-effectiveness of the 12-month childhood obesity prevention intervention programme, developed and refined in the Birmingham healthy Eating and Active lifestyle for CHildren Study, using usual practice in primary schools as the comparator"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "a blocked balancing algorithm was used to randomise participating schools to intervention or comparator arms. Schools were randomly allocated according to a randomisation scheme, which minimized imbalance on several characteristics"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "to ensure concealment of allocation we carried out randomisation after baseline measurements. Sessional researchers blind to arm allocation mainly undertook further data collection"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded
Blinding of outcome assessment (detection bias)	Low risk	**Quote from publication:** "researchers blind to arm allocation mainly undertook further data collection"

Adab 2018 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** most loss to follow-up due to children changing schools
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** most loss to follow-up due to children changing schools
Selective reporting (reporting bias)	Low risk	**Comment:** protocol published; all stated outcomes reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** schools and participants recruited before randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** clusters balanced at baseline
Cluster RCT - Loss of clusters	Low risk	**Quote from publication:** 1 school lost at first follow-up (N = 20 students) but retained in analysis
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "adjusted model included the baseline measurement and treatment arm as the independent variables, and to account for the clustered nature of the sample, school as the random effect"

Carlin 2018

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** a convenience sample of schools in Northern Ireland **School exclusion criteria:** — **Student inclusion criteria:** all female pupils aged 11 to 13 years attending 6 post-primary schools in Northern Ireland who were free from any medical condition that would limit their participation in a brisk walking intervention **Student exclusion criteria:** — **Setting:** school **Age group:** children/adolescents **Gender distribution:** females **Country where trial was performed:** Northern Ireland
Interventions	**Intervention:** brisk walking intervention consisting of structured 10– to 15-minute walks spread across the school week before the first bell, at mid-morning break, and at lunch time. Participants were instructed to attend at least 3 walking sessions/week and to increase the number of sessions that they attended to at least 5 walking sessions/week by Week 12 of the intervention. Walks were led by older pupils trained as walk leaders to ensure safety and intensity (i.e. at a pace sufficient to elicit moderate-intensity PA). Walk leader training was facilitated by the research team at a lunchtime session and was informed by a PA coordinator from a local Health and Social Care Trust. Training was facilitated by

Carlin 2018 *(Continued)*

	a member of the research team and was delivered to walk leaders at a lunchtime session. Participants were provided with timetables of planned group walks, detailing start time and meeting location for each walk, and were given weekly verbal reminders by school staff and walk leaders to attend the walking sessions. Participants were provided with prompt cards from the research team containing general tips and advice in relation to brisk walking and information on setting goals. Schools were instructed to provide at least 2 walking sessions for participants to attend each day **Comparator:** continued with normal PA habits. Following completion of the intervention, all control schools were provided study resources to implement their own school-based brisk walking programme **Duration of intervention:** 12 weeks **Duration of follow-up:** 6 months **Number of schools:** 6 **Theoretical framework:** social cognitive theory
Outcomes	Fitness BMI
Study registration	NCT02871830 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** — **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of this pilot study was to investigate the feasibility of peer-led brisk Walking In ScHools intervention (the WISH study) and to investigate the impact of participating in a 12-week school-based walking programme on schooltime PA and sedentary behaviour post-intervention (week 12) and at follow-up (6 months). The secondary aim was to examine the effects of the intervention on a range of health-related outcome measures"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "participants were randomly allocated by school, using a computer-based random number generator to either receive the intervention or to act as controls"
Allocation concealment (selection bias)	Low risk	**Comment:** randomisation completed after baseline measurement
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "blinding of schools and participants was not possible"
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Quote from publication:** "researcher responsible for data collection and analysis was not blinded to group allocation"
Incomplete outcome data (attrition bias)	Low risk	**Comment:** very few missing data due to student absence on measurement day

Carlin 2018 *(Continued)*

Anthropometrics, Fitness		
Selective reporting (reporting bias)	High risk	**Comment:** protocol specifies total weekly PA as the primary outcome; only schooltime PA was reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** schools and students recruited before randomisation
Cluster RCT - Baseline imbalance	High risk	**Comment:** no statistical comparison between groups [author communication]
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustering not accounted for in analysis

Harrington 2018

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** all state (government-funded) secondary schools in Leicester City, Leicestershire, and Rutland, UK, with a Key Stage 3 (students age 11 to 14 years), and state schools that were geographically close to Leicester City, Leicestershire, and Rutland but in neighbouring counties **School exclusion criteria:** — **Student inclusion criteria:** girls between the ages of 11 and 14 years and in Years 7, 8, and 9 **Student exclusion criteria:** — **Setting:** school **Age group:** children/adolescents **Gender distribution:** females **Country where trial was performed:** UK
Interventions	**Intervention:** Girls Active, a support framework for schools to review and change their PA, PE, and school sport culture and practices with support of the Youth Sport Trust and a hub school to develop a school action plan. Core components include submission of self-review and action plans; attendance of lead teacher at initial training; use of package of resources or use of an alternative; engagement of young people as peer leaders; use of online, in-person, or phone support of hub and/or development coach; lead teacher attendance at peer review day; and submission of mission analysis. Schools were provided with two £500 capacity funding instalments to coincide with action plan submission **Comparator:** schools were not given any specific guidance or advice and were assumed to carry on with their usual practice of PE and sport provision **Duration of intervention:** 14 months **Duration of follow-up:** 14 months **Number of schools:** 20 **Theoretical framework:** social cognitive theory

Harrington 2018 *(Continued)*

Outcomes	PA participation PA duration Sedentary time BMI Health-related quality of life
Study registration	ISRCTN10688342
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of this study was to assess the effectiveness of the Girls Active PA programme in UK secondary schools"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	**Quote from publication:** "sequentially numbered sections within a folder were used to implement the group allocations"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "following baseline measurements, schools were randomised by an independent statistician. The investigator team were not aware of the sequence until after randomisation"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "the trial statistician was not blinded"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "measurement team members, except the team lead for the day, were blinded to group randomisation"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** only per protocol utilised; large missing data from control schools **Quote from publication:** "the per protocol population included schools that engaged with 70% of the seven core components (as detailed above) of the programme over the 14 months and had complete data for the analysis concerned on 'by analysis' basis. In the control arm, the per protocol population included all schools/pupils randomised to that arm"
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** only per protocol utilised; large missing data from control schools **Quote from publication:** "the per protocol population included schools that engaged with 70% of the seven core components (as detailed above) of the programme over the 14 months and had complete data for the analysis concerned on 'by analysis' basis. In the control arm, the per protocol population included all schools/pupils randomised to that arm"

Harrington 2018 *(Continued)*

Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes in trial registry reported
Cluster RCT - Recruitment bias	Low risk	**Quote from publication:** "randomisation will occur after baseline assessments and will be carried out by the Leicester Clinical Trials Unit"
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline differences at cluster level accounted for **Quote from publication:** "generalized estimating equations, accounting for school level clustering, and adjusting for baseline MVPA, stratification factors of school size (< 850, ≥ 850) and percent of non-White pupils (< 20%, ≥ 20%), percent free school meals and participant year group, were employed"
Cluster RCT - Loss of clusters	High risk	**Comment:** 2 control schools lost to follow-up
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "generalized estimating equations, accounting for school level clustering, and adjusting for baseline MVPA, stratification factors of school size (< 850, ≥ 850) and percent of non-White pupils (< 20%, ≥ 20%), percent free school meals and participant year group, were employed"

Have 2018

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** schools in Danish municipalities that did not have a structured programme that incorporated PA in the classroom **School exclusion criteria:** — **Student inclusion criteria:** — **Student exclusion criteria:** physical disability, no written parental consent **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** Denmark
Interventions	**Intervention:** classroom-based PA incorporated into math lessons for 1 school year. Subjects received an average of 6 math lessons of 45 minutes/week. Each lesson included at least 15 minutes of PA, with limited sedentary time. Teachers attended a series of workshops to provide them with the skills to implement task-relevant physical activity into math teaching **Comparator:** children in control schools received regular classroom instruction, also with an average of 6 math lessons of 45 minutes/week. Math teachers in the control schools were asked not to make any changes to their usual teaching methods before study endpoint measurements **Duration of intervention:** 10 months **Duration of follow-up:** 10 months **Number of schools:** 12

Have 2018 *(Continued)*

	Theoretical framework: theory of embodied cognition
Outcomes	PA duration BMI
Study registration	NCT02488460 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (charitable trust) **Publication status:** peer-reviewed journal
Stated aim for study	"We designed a randomised controlled trial with the primary objective of investigating how math achievement was affected by task-relevant PA incorporated into math teaching for 7-year-old school children"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "randomisation was performed by random selection of sealed envelopes containing the intervention allocation stratified by municipality, in the presence of school leaders, municipality representatives and study researchers"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "randomisation was performed by random selection of sealed envelopes containing the intervention allocation stratified by municipality, in the presence of school leaders, municipality representatives and study researchers"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** not possible
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "the research assistants were blinded to the randomisation result for measurement of the outcomes and for data entry"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Quote from publication:** "during the 9-month intervention period, the dropout rate was 13.7% in the control group and 8.8% in the intervention group, which was not statistically significant. Dropouts were mainly attributed to subjects not present at follow-up trials due to sickness or moving to a different city as well as subjects not being able to complete the test due to injury (e.g. the fitness test)"
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Quote from publication:** "during the 9-month intervention period, the dropout rate was 13.7% in the control group and 8.8% in the intervention group, which was not statistically significant. Dropouts were mainly attributed to subjects not present at follow-up trials due to sickness or moving to a different city as well as subjects not being able to complete the test due to injury (e.g. the fitness test)"
Selective reporting (reporting bias)	Low risk	**Comment:** all main outcomes reported

Have 2018 *(Continued)*

Cluster RCT - Recruitment bias	Low risk	**Comment:** all baseline data were measured prior to randomisation [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Quote from publication:** "there were no significant differences at baseline between intervention and control group in any descriptive characteristics except height"
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "because of the clustered nature of the data, schools were included as random effects in the analyses and the Kenward-Roger degrees of freedom approximation was used"

Pablos 2018

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** public (government-funded) schools in urban areas **School exclusion criteria:** — **Student inclusion criteria:** in Grade 5 or 6 and not enrolled in any other research study **Student exclusion criteria:** — **Setting:** school, urban **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** Spain
Interventions	**Intervention:** Healthy Habits Program included free lunchtime extracurricular activities 2 times/week- beginning with a brief 10-minute talk about healthy habits (diet, PA, sleep, and hygiene) followed by a PE session consisting of a 15-minute warm-up, a 40-minute main section (theme games for the first 22 sessions and modified sports for remaining sessions), and a 10-minute calming down section involving another theme game led by a trained teacher. Total PA was 150 minutes/week, with intensity and duration increasing gradually throughout the intervention. Students also received a take-home worksheet to reinforce session topics to be signed by parents or guardians. The programme was accompanied by three 45-minute talks for parents and teachers about health habits for children **Comparator:** continued with daily activities without participating in the Healthy Habits Program **Duration of intervention:** 8 months **Duration of follow-up:** 8 months **Number of schools:** 4 **Theoretical framework:** —
Outcomes	Fitness BMI

Pablos 2018 *(Continued)*

Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"Its purpose is to bring health and education together within the school setting, with the involvement of the family, to achieve healthy lifestyle habits in the short and long term"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "each school was designated as a control or intervention group using 4 opaque envelopes containing the assigned treatment, which was handled by someone who was not involved in the study"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "each school was designated as a control or intervention group using 4 opaque envelopes containing the assigned treatment, which was handled by someone who was not involved in the study"
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Comment:** participants were not blinded [author communication]
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** outcome assessors blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Quote from publication:** "30 children were excluded because of missing administrative data or absence from school when the measurements were taken. Complete data were collected for 158 of the 190 children"
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published or trial registry; cannot determine
Cluster RCT - Recruitment bias	High risk	**Comment:** randomisation prior to student enrolment [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** BMI used to balance groups statistically at baseline [author communication]
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustering not accounted for in analysis

Robbins 2018

Study characteristics

Robbins 2018 *(Continued)*

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** located in urban community setting; enrolment greater than 100 girls in each school or more than double the number of girls needed for the study site (N = 50/school) in any combination of Grades 5, 6, 7, and/or 8; student body comprising at least 50% minority versus non-minority race or ethnicity and including a similar percentage enrolled in the free and reduced lunch programme **School exclusion criteria:** administrators not interested in participating, did not agree to random assignment, could not guarantee their availability at post-intervention follow-up **Student inclusion criteria:** girls in Grades 5 through 7 (ages 10 to 14; 8th graders if needed in schools having only Grades 7 and 8); available and willing to participate in the PA club 3 days/week for 17 weeks; available for follow-up (9 months after intervention ends); agree to school random assignment; able to read, understand, and speak English **Student exclusion criteria:** involved in or planning to be involved in school or community sports or other organised PAs, such as dance lessons, that involve MVPA and require participation 3 or more days/week after school; a health condition precluding safe MVPA **Setting:** school, urban **Age group:** children/adolescents **Gender distribution:** females **Country where trial was performed:** USA
Interventions	**Intervention** • An after-school PA club 3 days/week at each school conducted by a club manager (1 of whom was male) and 3 to 4 female instructors, all of whom had recent experience conducting school- or community-based PA programmes that involved girls whose ages were similar to those in this study • Two face-to-face 15- to 20-minute motivational, individually tailored counselling sessions (1 at the beginning, the other at the end of the intervention) with a female health professional having experience with adolescents (e.g. registered or school nurse) • Interactive Internet-based session via iPad (midpoint of intervention) set up by researchers at each school **Comparator:** students did not receive any after-school programming other than the programming currently offered by the school and community **Duration of intervention:** 17 weeks **Duration of follow-up:** 13 months **Number of schools:** 8 **Theoretical framework:** health promotion model and self-determination theory
Outcomes	PA duration Fitness BMI
Study registration	NCT01503333 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation)

Robbins 2018 *(Continued)*

	Publication status: peer-reviewed journal
Stated aim for study	"The primary aim was to evaluate the effect of a Girls on the Move school-based intervention on minutes of MVPA among fifth- to eighth-grade girls"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** a statistician used a computer programme to randomly assign the 2 schools in each pair to receive either intervention or control [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** schools were registered, paired, and randomised by an independent statistician [author communication]
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Quote from publication:** "girls, parents or guardians, principals, nurses, and school staff are not told about hypotheses"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "the measurement and intervention teams function independently so as to blind members of the former group to each school's randomisation status throughout the entire study"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Quote from publication:** "we determined data to be missing at random, and multiple imputation was employed. Based on recommendations and the complexity of the process, 20 imputations were conducted at the individual level"
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Quote from publication:** "we determined data to be missing at random, and multiple imputation was employed. Based on recommendations and the complexity of the process, 20 imputations were conducted at the individual level"
Selective reporting (reporting bias)	Low risk	**Comment:** outcomes listed in protocol appear to have been reported on
Cluster RCT - Recruitment bias	High risk	**Quote from publication:** "prior to the start of the school year, the PI and project manager inform each principal regarding the randomisation status of his or her respective school to assist each principal with future planning. Principals are told that the randomisation information must remain confidential until completion of baseline data collection in the fall"
Cluster RCT - Baseline imbalance	Low risk	**Quote from publication:** "both groups of girls (N = 1519) were similar for most baseline characteristics. However, the control group had a higher proportion of Black girls (P = .001) and higher BMI (P = .035) than the intervention group. The intervention group had a higher proportion of healthy weight girls, but a lower proportion of obese girls than the control group (P = .046)"
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost [author communication]
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "models included the group variable, cluster random effect of school, and the following fixed effects: age, BMI z-score, race, socioeconomic status, ethnicity, pubertal stage, and study year"

Siegrist 2018

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** all secondary schools in the greater district of a city in Southern Germany that were willing to take part over 4 years and to be randomised to an intervention school with a lifestyle intervention programme or a control school **School exclusion criteria:** outside of the study area (distance > 30 km) **Student inclusion criteria:** Grade 5, parental consent **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** Germany
Interventions	**Intervention:** school prevention programme aimed at increasing PA inside and outside of school through regular exercise in sports lessons and additional PA in school (active breaks during lessons, active school breaks). Weekly lifestyle lessons were taught by school teachers and were reinforced by worksheets, homework, and practical instructions. The programme also intended to improve eating patterns and other health behaviours (reduction in media use and inactivity). Teachers took part in 4 to 6 annual training sessions. Parents received regular newsletters and were invited to a parental training programme 2 to 3 times per year, which included coaching parents to lead a more active lifestyle and providing nutritional counselling regarding family dinners. **Comparator:** control schools were asked to continue their usual activities **Duration of intervention:** 18 months **Duration of follow-up:** 18 months **Number of schools:** 15 **Theoretical framework:** social cognitive theory
Outcomes	BMI
Study registration	NCT00988754 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"we implemented a comprehensive cluster-randomised school- and family based lifestyle-intervention trial in secondary schools with aim to improve PA, physical fitness and cardio metabolic risk factors in children"
Notes	
Risk of bias	

Siegrist 2018 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "randomisation of schools was conducted by sealed envelopes (1:1) in 8 intervention and 7 control schools"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "randomisation of schools was conducted by sealed envelopes (1:1) in 8 intervention and 7 control schools"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "a limitation of our study is that the main coordinator of the study was not blinded to the group assignments of the schools"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "we tried to eliminate this bias by blinding medical examiners who were not aware of the group allocation of the participating children"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** most loss to follow-up due to moving schools
Selective reporting (reporting bias)	High risk	**Comment:** quality of life and anthropometry not reported
Cluster RCT - Recruitment bias	High risk	**Comment:** randomisation at school level before enrolment of students
Cluster RCT - Baseline imbalance	Low risk	**Comment:** models adjusted for key baseline differences [author communication]
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "data were aggregated per cluster to account for the cluster-randomised design in the statistical analysis"

Ten Hoor 2018

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** Dutch secondary schools **School exclusion criteria:** — **Student inclusion criteria:** — **Student exclusion criteria:** — **Setting:** school **Age group:** children/adolescents **Gender distribution:** females and males **Country where trial was performed:** The Netherlands

Ten Hoor 2018 *(Continued)*

Interventions	**Intervention:** strength training exercises during at least 30% of regular PE lessons, ~ 5 to 30 minutes/lesson. Teachers were instructed about the programme and specific strength exercises and safety guidelines, participated in workshops to improve their motivational speaking skills, were provided with materials (medicine balls, elastic bands, and free weights), and received a book with strength exercises and games. Once a month, a 1-hour lesson based on motivational interviewing and facilitated by a trained mentor or PE teacher was used to increase motivation to be more physically active **Comparator:** continued with usual curriculum **Duration of intervention:** 1 year **Duration of follow-up:** 1 year **Number of schools:** 9 **Theoretical framework:** theory of planned behaviour or reasoned action approach, self-determination theory, social comparison theory, intervention mapping
Outcomes	PA duration Sedentary time
Study registration	NTR5676
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"In this cluster RCT, we investigated the 1-year efficacy of incorporating strength exercises into gym classes, in combination with monthly motivational lessons (to engage in PAs after school) on the body composition and activity level of adolescents"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "randomised (stratified on education level; by flip of a coin by the first author under supervision of the fourth author) into an intervention condition (4 schools) or a standard curriculum control condition (5 schools)"
Allocation concealment (selection bias)	Low risk	**Comment:** allocation concealed from schools or directors; informed that they may or may not receive the intervention immediately [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** not possible [author communication]
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** not possible [author communication]
Incomplete outcome data (attrition bias)	High risk	**Comment:** 26% to 28% loss to follow-up

Ten Hoor 2018 *(Continued)*

Physical activity and sedentary time		
Selective reporting (reporting bias)	High risk	**Comment:** strengths listed in clinical trials registry but not reported
Cluster RCT - Recruitment bias	High risk	**Comment:** students were enrolled and baseline data collected after school randomisation [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Quote from publication:** "no baseline differences were found between the 2 conditions in age, height, weight, BMI (Z-score), body composition, or PA outcomes (including wear time of the accelerometer)"
Cluster RCT - Loss of clusters	Low risk	**Comment:** no loss of clusters
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "the random (variance) model part consisted of an unstructured covariance matrix for the within-school variances and covariance of the 2 repeated measures plus a random intercept for the between-school outcome variance"

Donnelly 2017

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** elementary schools within a 25-mile radius of Lawrence, Kansas, including Grades 2 through 5, with at least 40 students in Grades 2 and 3, not participating in other classroom-based PA interventions, and agreeing to be randomised **School exclusion criteria:** — **Student inclusion criteria:** a random sample of Grade 2 and 3 students in each school from those who provided parental consent or child assent **Student exclusion criteria:** students with physical or intellectual disabilities or learning disorders were part of the intervention or control group as a function of attending the school; however, some were ineligible to complete the outcome assessment due to their disability (i.e. blind, severe intellectual disability, etc.) **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** USA
Interventions	**Intervention:** teacher-delivered 10-minute Academic Achievement and Physical Activity Across the Curriculum lessons twice per day (1 morning and 1 afternoon) 5 days/week plus 60 minutes of PE to total 160 minutes/week of MVPA **Comparator:** teachers were asked to continue to use traditional classroom instruction and to continue with their typical PE schedule (2- to 30-minute classes/week) **Duration of intervention:** 3 years **Duration of follow-up:** —

Donnelly 2017 *(Continued)*

	Number of schools: 17 **Theoretical framework:** —
Outcomes	BMI Fitness
Study registration	NCT01699295 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The primary aim of this study is to assess differences in academic achievement in students who receive physically active lessons and students in control schools who receive regular academic lessons. Secondary aims include determining potential mediators of any association between Academic Achievement and Physical Activity Across the Curriculum and academic achievement, including changes in cognitive function, cardiovascular fitness, daily PA, BMI and attention-to-task. An extensive process analysis will also be performed to document the fidelity of the intervention"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "computer randomised by study statistician"
Allocation concealment (selection bias)	Unclear risk	**Comment:** not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students and teachers not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "staff completing assessments, other than those obtained in the classroom, and staff performing data entry, were blinded to condition"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** large loss to follow-up; no imputation for secondary outcomes
Selective reporting (reporting bias)	High risk	**Comment:** PA not reported
Cluster RCT - Recruitment bias	High risk	**Comment:** students recruited after randomisation
Cluster RCT - Baseline imbalance	High risk	**Comment:** baseline differences not controlled for
Cluster RCT - Loss of clusters	High risk	**Comment:** loss of clusters from both groups

Donnelly 2017 *(Continued)*

Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Farmer 2017

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** state primary schools (Years 1 to 8 that are fully funded by the state and are co-educational) with at least 150 pupils and a school decile ranking of 1 to 6 **School exclusion criteria:** — **Student inclusion criteria:** children in school years 2 and 4 **Student exclusion criteria:** no exclusion criteria **Setting:** school **Age group:** children **Gender distribution:** females and males **Country where trial was performed:** New Zealand
Interventions	**Intervention:** researchers, play worker, and school community worked together and received funding over the course of 1 year to develop a playground action plan tailored for each intervention school (e.g. addition of more interactive play equipment, alterations to school rules and policies). The majority of recommendations involved no to little cost, such as leaving trees that had been cut down in pieces or letting the grass grow long to encourage imaginative play, re-purposing real estate signs for sledding down hills, purchasing raincoats and gumboots to allow outside play when wet, and using plastic piping and sand for water play **Comparator:** asked not to change anything in school play spaces **Duration of intervention:** 2 years **Duration of follow-up:** 2 years **Number of schools:** 16 **Theoretical framework:** —
Outcomes	PA duration BMI
Study registration	ACTRN12612000675820 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of our 2-year cluster RCT (PLAY) was to determine whether providing greater opportunities for risk and challenge in primary schools increased PA and reduced relative body weight over the long

Farmer 2017 *(Continued)*

	term. A secondary aim considered the effect of the intervention on how children interacted with 1 another which forms the basis of a separate paper"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "pairs of schools were created by matching for region, school roll and decile ranking, and were randomly assigned to intervention or control by tossing a coin"
Allocation concealment (selection bias)	Low risk	**Comment:** coin toss used
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "measurements were obtained … by researchers blinded to group allocation"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Quote from publication:** "the missing data were imputed using chained equations assuming that the data were missing at random"
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Quote from publication:** "the missing data were imputed using chained equations assuming that the data were missing at random"
Selective reporting (reporting bias)	High risk	**Comment:** bullying, steps/d, nutrition not reported
Cluster RCT - Recruitment bias	High risk	**Comment:** students enrolled after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** clusters similar; models adjusted
Cluster RCT - Loss of clusters	Low risk	**Comment:** no loss of clusters
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Sutherland 2017

Study characteristics

Methods	**Study design:** cluster-RCT

Sutherland 2017 *(Continued)*

Participants	**School inclusion criteria:** government or Catholic elementary schools; located within Hunter New England Local Health District; socioeconomic score ≤ 5 (lower 50% of New South Wales) based on school post code; not participating in other PA studies **School exclusion criteria:** — **Student inclusion criteria:** Grades 3 to 6 **Student exclusion criteria:** major physical or intellectual conditions impeding engagement in PA **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Australia
Interventions	**Intervention:** a modified version of the Supporting Children's Outcomes using Rewards, Exercise and Skills programme consisting of school committees and policy review, quality PE lessons, recess and lunchtime activity via student leadership, provision of equipment, and linkage with parents and community sporting organisations **Comparator:** measurement components of the trial only; school PA practices according to curriculum **Duration of intervention:** 6 months **Duration of follow-up:** 6 months **Number of schools:** 46 **Theoretical framework:** social-ecological theory and health promoting schools framework
Outcomes	PA duration
Study registration	ACTRN12615000437561 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The primary aim of this paper is to report the effectiveness of an adapted version of an evidence based school PA program known as Supporting Children's Outcomes using Rewards, Exercise and Skills on children's MVPA. Secondary trial outcomes describe the impact on school implementation of practices including PE teaching quality and school PA practices"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "schools underwent stratified randomisation based on SES, allocated in a 1:1 ratio to intervention or control by an independent statistician using computerized random number function in Microsoft Excel"
Allocation concealment (selection bias)	High risk	**Comment:** random allocation of schools to group occurred post recruitment but before data collection

Sutherland 2017 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Comment:** personnel delivering intervention blinded; primary outcome assessment concealed from participants, so lack of blinding of participants unlikely to affect outcome
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** outcome assessors blinded
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Unclear risk	**Comment:** no mention of missing data at end of study
Selective reporting (reporting bias)	Low risk	**Comment:** trial protocol referenced
Cluster RCT - Recruitment bias	Low risk	**Comment:** participants recruited before cluster randomisation
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** no analysis of clusters for similarity
Cluster RCT - Loss of clusters	High risk	**Comment:** 1 cluster lost after randomisation; no reason given
Cluster RCT - Incorrect analysis	Low risk	**Comment:** statistical analysis accounted for clustering

Torbeyns 2017

Study characteristics	
Methods	**Study design:** RCT
Participants	**Student inclusion criteria:** Grades 3 and 4 of high school in Ninove, Belgium **Student exclusion criteria:** — **Setting:** school **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Belgium
Interventions	**Intervention:** students were instructed to cycle on a height-adjustable cycling desk (LifeSpan C3-DT5 Bike Desk) for 4 class hours/week (4 × 50 min). Participants were free to adjust the cycling intensity to their preference. All participants were asked to not change their lifestyle during the study (e.g. PA levels outside the classroom) **Comparator:** asked to not change their lifestyle during the study (e.g. PA levels outside the classroom) **Duration of intervention:** 22 weeks **Duration of follow-up:** 22 weeks

Torbeyns 2017 *(Continued)*

	Number of schools: 1 **Theoretical framework:** —
Outcomes	Fitness BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** other funding (no sources of funding received) **Publication status:** peer-reviewed journal
Stated aim for study	"Thus, the purpose of this study was to examine the impact of providing cycling desks in a classroom for 5 months on energy expenditure, physical health parameters, cognitive performance, brain functioning and educational measures in an adolescent population"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** not stated
Allocation concealment (selection bias)	Unclear risk	**Comment:** not stated
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** not stated
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Quote from publication:** "7 more participants (4 intervention, 3 control) were excluded because they were absent for more than 1 week during the intervention period"
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol referenced

Daly 2016

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** suburb primary schools in Canberra, where the average household income approximates the mean for Australian city dwellers

Daly 2016 *(Continued)*

	School exclusion criteria: — **Student inclusion criteria:** all Grade 2 children in good health, able to participate freely in PE, willing to undertake a series of venous blood collections **Student exclusion criteria:** — **Setting:** school **Age group:** children/adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Australia
Interventions	**Intervention:** specialist PE teacher to replace general classroom teacher programme. An all-inclusive, enjoyable, challenging yet non-threatening environment for PA that encouraged students to discover answers to a range of physical movement problems and game strategies themselves, through experimentation and self-discovery. Lesson plans included game play, fitness activities, skill practice, and core movements **Comparator:** continued with usual PE programme (traditional fitness and stretching exercise, including running and walking around the oval) conducted by the generalist classroom teachers, none of whom were formally trained in PE. Teachers rarely participated in activities **Duration of intervention:** 4 years **Duration of follow-up:** 4 years **Number of schools:** 29 **Theoretical framework:** —
Outcomes	PA duration Sedentary time
Study registration	ACTRN12612000027819
Publication details	**Language of publication:** English **Funding:** other funding (charitable trust) **Publication status:** peer-reviewed journal
Stated aim for study	"The primary aim of the Lifestyle of Our Kids project is to investigate relationships of (a) PA in general, and (b) an externally provided specialist PE program in schools, with physiological and psychological health and development in young children. This study is intended to provide a range of integrated scientific evidence upon which conclusions may be drawn in regard to optimising childhood health and development"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "after acceptance, the allocation of schools to the intervention or control groups was determined randomly, 2 members of the research team drawing from a shuffled set of 29 envelopes, each of which contained a school name"

Daly 2016 *(Continued)*

Allocation concealment (selection bias)	Low risk	**Comment:** allocation concealed until after enrolment
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** research staff blinded to group only for some measures
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** large loss to follow-up but unrelated to intervention (i.e. relocation)
Selective reporting (reporting bias)	High risk	**Comment:** academic performance and hand-eye coordination not reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** students enrolled after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no baseline imbalance
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "school, year, and subject were included in the model as random effects to account for the sample design and hence possible dependence structure in the data"

de Greeff 2016

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** primary schools in the Northern part of The Netherlands **School exclusion criteria:** — **Student inclusion criteria:** Grade 2 or 3; all children from that class participated in the intervention programme **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** The Netherlands
Interventions	**Intervention:** physically active mathematics and language lessons that were taught in the classroom. During each lesson, the children stood behind or beside their school desk. In each lesson, 10 to

de Greeff 2016 *(Continued)*

	15 minutes was spent on mathematics and 10 to 15 minutes on language. Physical exercises were relatively easy to perform and were aimed at exercising at moderate to vigorous intensity level. During the lessons, all children performed basic exercises and specific exercises simultaneously. Specific exercises were performed when children solved an academic task. For example, the word 'dog' must be spelled by jumping in place for every mentioned letter, or children had to jump 6 times to solve the multiplication '2 × 3'. Basic exercises (marching, jogging, or hopping in place) were performed during the remaining part of the lesson (e.g. when children were thinking about a sum) **Comparator:** — **Duration of intervention:** 2 × 22 weeks **Duration of follow-up:** 3 years **Number of schools:** 12 **Theoretical framework:** —
Outcomes	Fitness BMI
Study registration	ISRCTN17021806
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"This study is part of the project ''Fit en Vaardig op school'' (fit and academically proficient at school), which is a RCT including a school-based intervention program for primary school children with the primary aim to improve academic performance"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** not described
Allocation concealment (selection bias)	Low risk	**Comment:** performed by the National Bureau for Economic Policy Analysis - not involved with the study
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students not blinded
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** not described
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Unclear risk	**Comment:** unclear where different sample sizes come from across papers

de Greeff 2016 *(Continued)*

Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes from clinical trials registry reported on
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** not described
Cluster RCT - Baseline imbalance	Low risk	**Comment:** adjusted for in analysis
Cluster RCT - Loss of clusters	High risk	**Comment:** 2 schools did not start the second intervention period
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "a random intercept was considered for each child (level 1) and for each school (level 2), to account for the common experience the children share within each school"

Drummy 2016

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** convenience sample of primary schools **School exclusion criteria:** — **Student inclusion criteria:** students aged 9 and 10 **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Northern Ireland
Interventions	**Intervention:** teachers in the intervention group were asked to lead a 5-minute activity break 3 times/d for 12 weeks. The activity break began with gentle jogging on the spot as a warm-up for less than 1 minute, followed by moderate to vigorous intensity exercises such as hopping, jumping, and running on the spot, scissor kicks, etc. Teachers could select which exercises to include in each activity break. They were encouraged to vary activities each day. Children participated in the activity break in the classroom beside their desks **Comparator:** control groups continued with their normal daily routine throughout the 12-week period **Duration of intervention:** 12 weeks **Duration of follow-up:** 12 weeks **Number of schools:** 7 **Theoretical framework:** —
Outcomes	PA duration BMI

Drummy 2016 *(Continued)*

Study registration	—
Publication details	**Language of publication:** English **Funding:** — **Publication status:** peer-reviewed journal
Stated aim for study	"Thus, the present study examined the effect of a classroom-based activity break on accelerometer-determined MVPA and anthropometric variables in a sample of children attending primary schools in Northern Ireland"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	**Comment:** stratified by rural/urban location and given alternate numbers by researcher [author communication]
Allocation concealment (selection bias)	Unclear risk	**Comment:** concealed from participants but investigator could have foreseen assignment [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants could not be blinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** no blinding [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** > 10% loss to follow-up; reasons not collected [author communication]
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** > 10% loss to follow-up; reasons not collected [author communication]
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol; appears all outcomes reported
Cluster RCT - Recruitment bias	High risk	**Comment:** baseline data collected after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no baseline differences
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustering not accounted for in analysis

Jarani 2016

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** elementary schools in Tirana that were not engaged in any PA programme or intervention, had gym space larger than 180 m, and a typical indoor air investigation, which included observation of conditions in the area of the gym and comfort parameters such as humidity and temperature **School exclusion criteria:** — **Student inclusion criteria:** Grades 1 and 4 **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Albania
Interventions	**Intervention 1:** exercise group intervention programme emphasised PA exercises (e.g. gait exercises to improve speed). PE lessons were organised to allow maximum participation of children using station or circuit teaching framework to provide opportunities for continuous practice on different exercises at the same time. The exercise group programme was structured in 4 different modules: movement awareness, object or manipulative skills, rhythm, tumbling or gymnastics for Grade 1; and throwing or catching, rhythm, fitness, tumbling or gymnastics for Grade 4, respectively. PE structures station or circuit activities were orientated on an individual school child **Intervention 2:** games group intervention programme was focused on fun games. PE lessons were organised to allow maximum participation of children using station or circuit teaching framework to provide opportunities for continuous practice on different exercises or games at the same time. The programme was structured in 4 different modules: movement awareness, object or manipulative skills, rhythm, tumbling or gymnastics for grade 1 and throwing or catching, rhythm, fitness, tumbling or gymnastics for grade 4, respectively. The games group-based PE focused on involving more than 3 or 4 children in a game organised to address each of the 4 modules **Comparator:** traditional PE school curriculum given by classroom teachers using traditional PE programmes including mainly typical sports **Duration of intervention:** 5 months **Duration of follow-up:** 5 months **Number of schools:** 4 **Theoretical framework:** —
Outcomes	Fitness BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal

Jarani 2016 *(Continued)*

Stated aim for study	"The aim of this study was to examine the effectiveness of 2 new PE programmes on skill- and health-related fitness among elementary school children aged 7 and 10 years in Tirana, Albania, without changing the traditional frequency and duration of the current PE in Albanian schools. Another aim of the study was to compare 2 PE programme approaches to improve children's physical fitness: 1 with the emphasis on exercises and the other on games using station circuit teaching framework during PE lessons"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** random numbers table
Allocation concealment (selection bias)	Low risk	**Comment:** allocation was concealed [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** blinding of students not possible
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Quote from publication:** "...not able to conduct the collection of data blinded to what group the children were randomly allocated"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** high completion rates; no differences between groups; no differences between completers and non-completers
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published
Cluster RCT - Recruitment bias	High risk	**Comment:** classes were randomised before students enrolled [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** accounted for in analysis
Cluster RCT - Loss of clusters	Low risk	**Comment:** no loss of classes or schools
Cluster RCT - Incorrect analysis	Low risk	**Comment:** school and class as random effects in model

Kocken 2016

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** — **School exclusion criteria:** —

Kocken 2016 *(Continued)*

	Student inclusion criteria: 9 to 11 years **Student exclusion criteria:** — **Setting:** school, mix **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** The Netherlands
Interventions	**Intervention:** the intervention Extra Fit! comprised a variety of theory and practical lessons on nutrition and PA to provide an attractive programme for children. The intervention was focused on the main behavioural changes: decreasing consumption of high-energy or high-fat foods and sugar-sweetened drinks; promoting a healthy breakfast; increasing consumption of fruits and vegetables; reducing television viewing and computer gaming or browsing; and increasing PAs at school and outside school hours. Behavioural determinants of the Theory of Planned Behaviour that were targeted were knowledge (theory lessons and practical assignments), attitude (group discussions and food diaries), social norm (group discussions and homework assignments), and perceived behavioural control (modelling through assignments, e.g. preparing a healthy meal and PA games) **Comparator:** regular school programme or curriculum on nutrition and PA **Duration of intervention:** 2 × 16 weeks **Duration of follow-up:** 24 months **Number of schools:** 45 **Theoretical framework:** theory of planned behaviour
Outcomes	PA duration Sedentary time BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of Extra Fit! was to improve dietary habits, PA and inactivity behavior in order to prevent overweightness"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** not described
Allocation concealment (selection bias)	Unclear risk	**Comment:** not described

Kocken 2016 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants could not be blinded to intervention
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** interviewers were blinded with respect to group status of the child's school (intervention or control) for nutrition interviews, not other measures
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** large loss to follow-up
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** large loss to follow-up
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol
Cluster RCT - Recruitment bias	Low risk	**Comment:** all students within randomised schools enrolled
Cluster RCT - Baseline imbalance	Low risk	**Comment:** hip-waist ratio was significantly higher in the control group at time 0 (t-test, P < 0.01). There were no other significant differences in baseline characteristics between intervention and control groups
Cluster RCT - Loss of clusters	High risk	**Comment:** 20/65 schools dropped out after randomisation; 7 schools lost to follow-up after intervention began
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "outcome analyses were conducted using multilevel regression models, with schools included as a random effect"

Lau 2016

Study characteristics	
Methods	**Study design:** RCT
Participants	**Student inclusion criteria:** all students in Grade 4 **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** China
Interventions	**Intervention:** children participated in two 60-minute Xbox 260 Kinect gaming sessions/week after school for 12 school weeks. Children were free to choose games from the 12 offered sports in Season 1 or Season 2 within a play session. This approach was chosen to encourage children's autonomy and to enhance attractiveness and the challenge of game play. Children and their partners with consensus of opinion had their own choice on the order of games, what they wanted to play, and the duration of

Lau 2016 *(Continued)*

	each game play. Participants could get awarded based on degree and speed of movement and level of difficulty **Comparator:** adopted regular PA and PE class and received no additional intervention **Duration of intervention:** 12 weeks **Duration of follow-up:** 12 weeks **Number of schools:** 1 **Theoretical framework:** —
Outcomes	PA duration Fitness BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"Thus, besides the effect of an active video games intervention on children's aerobic fitness and PA level, this study also sought to explore the active video games impact on players' psychological correlates, including PA task efficacy, barrier efficacy, and enjoyment"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** random numbers table [author communication]
Allocation concealment (selection bias)	High risk	**Comment:** allocation not concealed from investigators [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** no blinding of participants
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** outcome assessors were blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** no loss to follow up
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** no loss to follow up

Lau 2016 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published

Resaland 2016

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** schools had ≥ 7 pupils in Grade 5 **School exclusion criteria:** — **Student inclusion criteria:** children were healthy (with no serious or chronic illness) and able to participate in daily PA and PE. Participants had to be able to complete standard academic performance tests (our primary outcome) **Student exclusion criteria:** — **Setting:** school, mix **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Norway
Interventions	**Intervention:** comprised 3 components aimed at providing children with the opportunity to engage in 165 minutes of PA/week more than the control group • Physically active lessons for 90 minutes/week, conducted in the playground; physically active educational lessons were delivered in 3 core subjects – Norwegian, mathematics, and English • PA breaks (5 minutes/d) implemented in the classroom during academic lessons • PA homework (10 minutes/d) prepared by teachers In addition, pupils participated in the curriculum-prescribed 90 minutes/week of PE and the curriculum-prescribed 45 minutes/week of PA. Thus, PA (165 minutes/week) and PE or PA (135 minutes/week) components provided children opportunities to engage in school-based PAs 300 minutes/week. The intervention was designed so activities could be varied and enjoyable for the children. Teachers were encouraged to motivate children during active lessons, to stimulate their positive feelings and attitudes towards PA. The intervention was designed so approximately 25% of daily PA was of vigorous intensity, defined as “children sweating and being out of breath.” Teachers achieved the vigorous-PA-intensity component through selecting a variety of high-intensity activities such as running, relay racing, obstacle courses, and various forms of high-activity play **Comparator:** curriculum-prescribed 90 minutes/week of PE and 45 minutes/week of PA (total 135 minutes/week). It was specified to control schools that they should carry out the amount of PA and PE that they would have done regardless of the study **Duration of intervention:** 7 months **Duration of follow-up:** 7 months **Number of schools:** 60 **Theoretical framework:** socioecological conceptual framework
Outcomes	PA duration Sedentary time

Resaland 2016 *(Continued)*

	Fitness Health-related quality of life
Study registration	NCT02132494
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"Our primary objective is to investigate the effect of a 1-year school-based PA intervention (Active Smarter Kids; ASK) on academic performance on a sample of 10-year-old boys and girls attending elementary school in Norway"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** a neutral third party (Centre for Clinical Research, Haukeland University Hospital, Norway) performed the randomisation
Allocation concealment (selection bias)	Low risk	**Quote from publication:** a neutral third party (Centre for Clinical Research, Haukeland University Hospital, Norway) performed the randomisation
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** groups not blinded to intervention
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** only data manager and statisticians blinded to group allocation
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** low loss to follow-up
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** low loss to follow-up
Selective reporting (reporting bias)	Low risk	**Comment:** outcomes listed in protocol appear to have been reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** > 97% recruitment
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no differences
Cluster RCT - Loss of clusters	High risk	**Comment:** N = 3 clusters withdrew after randomisation

Resaland 2016 *(Continued)*

Cluster RCT - Incorrect analysis	Low risk	**Quote from publication: "**analyses were performed using a mixed-effect model with school as a random effect"

Sutherland 2016

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** government and Catholic schools; schools with post codes ranked in the bottom 50% of New South Wales post codes based on the Socio-Economic Indexes for Australia; between 120 and 200 Year 7 students (to meet sample size requirements); and not participating in other major PA or health intervention studies **School exclusion criteria:** — **Student inclusion criteria:** all Year 7 students in participating schools will be eligible to participate in the study measurement **Student exclusion criteria:** classes catering for students with severe physical and mental disabilities will be excluded **Setting:** school **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Australia
Interventions	**Intervention:** intervention involved implementation of 7 PA intervention strategies and 6 strategies to support implementation of the intervention. PA intervention strategies included: • teaching strategies to maximise students' PA in health and PE lessons; • development and monitoring of student PA plans within PE lessons; • enhanced school sport program; • development or modification of school policies; • PA programmes during school break; • promotion of community PA providers; and • parent engagement The intervention implementation strategies included • in-school PA consultant (change agent) • establishing leadership and support • teacher training • school resources • teacher prompts • intervention implementation performance feedback **Comparator:** schools allocated to control group participated in measurement components of the trial only and delivered PA teaching and promotion practices according to PE curriculum and school-based initiatives **Duration of intervention:** 24 months **Duration of follow-up:** 24 months

Sutherland 2016 *(Continued)*

	Number of schools: 10 **Theoretical framework**: socioecological theory and health-promoting schools framework
Outcomes	PA duration BMI
Study registration	ACTRN12612000382875
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of this study is to determine whether a multi-component PA intervention implemented in disadvantaged secondary schools can reduce the decline in PA associated with adolescence"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** block randomisation using random numbers function
Allocation concealment (selection bias)	Low risk	**Comment:** independent statistician conducted randomisation after data were collected
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** data were collected by trained research assistants blind to group allocation
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Quote from publication:** "2 sensitivity analyses were conducted, first using only those that provided complete adiposity outcomes at all 3 time points (complete cases), and second using multiple imputation to fill in the missing data. The multiple imputation model used the method of chained regression equations, including variables that were prognostic of missing data and additional demographic and outcome data to create 5 imputed data sets. The results from fitting the model were pooled over the 5 data sets using Rubin's method"
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Quote from publication:** "PA outcome data were analysed assuming data were "missing at random." Sensitivity analyses were undertaken for the primary outcome, initially adjusting for any variables on which students with and without 24-month follow-up accelerometer data were significantly different, and secondly, using multiple imputation"
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes in protocol reported

Sutherland 2016 *(Continued)*

Cluster RCT - Recruitment bias	Low risk	**Comment:** randomisation occurred after baseline data collected
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** did not assess
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication: "**a 3-level hierarchical model was used to capture correlations in the data with random intercepts for repeated measures on individuals clustered within schools"

Tarp 2016

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** all schools participating in a primary school project about PA and health **School exclusion criteria:** — **Student inclusion criteria:** all students in Grade 6 and 7 classes **Student exclusion criteria:** — **Setting:** school, mix **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Denmark
Interventions	**Intervention:** 60 minutes of PA during school time on all school days including scheduled activities during recess were initiated by teachers and volunteer students. PA homework consisted of a booklet containing suggestions for various daily activities of 5 to 10 minutes, and students were instructed to perform at least 1 activity on all days. It was emphasised that these activities were in addition to usual daily activities. A 2-week cycling campaign was launched in the middle of the intervention to facilitate active transportation by cycling. A custom-made “activity watch” was used as a shared tool by teachers and students to serve as motivation and to sum up the amount of time the class had engaged in PA during academic subjects and scheduled recess activities **Comparator:** schools were asked to continue with their normal practice **Duration of intervention:** 20 weeks **Duration of follow-up:** 20 weeks **Number of schools:** 14 **Theoretical framework:** social cognitive theory, socioecological theory, health promoting schools framework from WHO
Outcomes	PA duration Fitness

Tarp 2016 *(Continued)*

	BMI
Study registration	NCT02012881
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The primary aim of the present paper is to describe the effectiveness of a school-based PA intervention in enhancing executive functions and academic performance in adolescents. Furthermore, the effect of the intervention on PA levels, cardiorespiratory fitness and adiposity were assessed as these are potential explanatory variables"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "the randomisation process was conducted by the principal investigator as draws of folded paper with school names from a bowl in the presence of other senior researchers"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "the randomisation process was conducted by the principal investigator as draws of folded paper with school names from a bowl in the presence of other senior researchers"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "baseline measures were carried out after the randomisation with schools aware of the randomisation results. This was also known to the staff conducting the tests"
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Quote from publication:** "baseline measures were carried out after the randomisation with schools aware of the randomisation results. This was also known to the staff conducting the tests"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** large loss to follow-up on some outcome measures. Significant differences at baseline between students and those lost to follow-up included in analyses
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** large loss to follow-up on some outcome measures. Significant differences at baseline between students and those lost to follow-up included in analyses
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes listed in protocol paper reported
Cluster RCT - Recruitment bias	High risk	**Comment:** schools randomised before participants recruited
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline imbalance accounted for in analysis
Cluster RCT - Loss of clusters	High risk	**Quote from publication:** "2 intervention schools withdrew the acceptance before the start of the study, but after the randomisation. Additionally, 3 schools

Tarp 2016 *(Continued)*

		not originally enrolled in the study were invited from local networks and randomised"
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "as the units of randomisation were schools a “random effect” was added by using mixed models (maximum likelihood based) to accommodate the clustering of students within these units"

Cohen 2015

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** 16 government primary schools located within 30 minutes' drive from the University of Newcastle, with a Socio-Economic Indexes for Areas ≤ 5 (lowest 50%) **School exclusion criteria:** — **Student inclusion criteria:** all students in Grades 3 and 4 (stage 2) at study schools **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Australia
Interventions	**Intervention:** implemented in 3 phases. Phase 1 focused on teacher professional learning, student leadership workshops, and PA promotion tasks to achieve awards. Examples of tasks included acting as equipment monitor, organising games during recess and lunch, and writing a PA promotion article for the school newsletter. Equipment was provided to the school during this phase, and the school committee was established. In phase 2, schools were encouraged to implement 6 PA policies to support the promotion of PA and fundamental movement skill competency within the school. A member of the research team met with the principal at the intervention schools to explain the policies. The member of the research team then conducted a meeting with all staff members to explain the policies and to provide strategies for implementation of the policies. In addition, the research team used a range of strategies targeting the home environment (newsletters, parent evening, and fundamental movement skill homework) to engage parents and encourage them to support their children’s PA. Phase 3 addressed strategies to improve school–community links (e.g. inviting local sporting organisations to assist with school sport programmes) **Comparator:** control group followed the usual PE and school sport programmes. The New South Wales Department of Education and Communities requires by policy that all schools provide students with 120 minutes/week of planned PA. In government primary schools, sports programmes are similar among schools **Duration of intervention:** 12 months **Duration of follow-up:** 12 months **Number of schools:** 8 **Theoretical framework:** socioecological model
Outcomes	PA duration Fitness

Cohen 2015 *(Continued)*

Study registration	ACTRN12611001080910
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"Supporting Children's Outcomes using Rewards, Exercise, and Skills is a multi-component school-based intervention that combines a range of evidence-based behavior change strategies to promote PA and fundamental movement skills competency among primary school aged children from low-income communities"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "randomly allocated to the intervention or control group using a computer-based random number producing algorithm by a researcher not involved in the current study"
Allocation concealment (selection bias)	Low risk	**Comment:** randomisation occurred after baseline assessment [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded to intervention
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** assessors were blind to treatment allocation at baseline but not at follow-up assessments
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** large loss to follow-up; different by group
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** large loss to follow-up; different by group
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes in protocol reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** baseline assessments were conducted prior to randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline imbalance adjusted for statistically
Cluster RCT - Loss of clusters	Low risk	**Comment:** no loss of clusters reported
Cluster RCT - Incorrect analysis	Low risk	**Comment:** analysis accounted for clustered design

Jago 2015

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** state secondary schools operating within 3 local authorities: Bristol City Council, North Somerset Council, Bath and North East Somerset Council **School exclusion criteria:** excluding special educational needs, dance academies, and privately or independently funded schools **Student inclusion criteria:** Year 7 girls who are able to engage in PE class **Student exclusion criteria:** — **Setting:** school **Age group:** children/adolescents **Gender distribution:** females **Country/Countries where trial was performed:** UK
Interventions	**Intervention:** intervention consisted of up to 40, 75-minute dance sessions provided twice per week after school. Session plans included guidance on how to reinforce the underpinning self-determination theory principles as well as advice on activities, group work, and dance skill development. To reflect a 'normal' dance session, instructors were able to decide on the genre of dance used, after consultation with the girls at their school **Comparator:** provided data only **Duration of intervention:** 20 weeks **Duration of follow-up:** 52 weeks **Number of schools:** 18 **Theoretical framework:** self-determination theory
Outcomes	PA participation PA duration Sedentary time Health-related quality of life
Study registration	ISRCTN52882523(retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"Determine the effectiveness of the Bristol Girls Dance Project intervention to improve the objectively-assessed (accelerometer) mean weekday min of MVPA accumulated by Year 7 girls 1 year after the baseline measurement (Time 2 = time 0 + 52 weeks)"
Notes	

Jago 2015 *(Continued)*

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** using Stata to balance arms by minimisation
Allocation concealment (selection bias)	Low risk	**Comment:** 1 investigator conducted randomisation; 1 notified schools of allocation after randomisation completed
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** trained field workers; blinded to intervention allocation; collected data
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** minimal missing data
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes in protocol reported in results
Cluster RCT - Recruitment bias	Low risk	**Comment:** randomisation after baseline data collection
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline imbalances adjusted for
Cluster RCT - Loss of clusters	Low risk	**Comment:** no loss of clusters
Cluster RCT - Incorrect analysis	Low risk	**Comment:** all models adjusted for clustering of girls in schools

Madsen 2015

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** > 50% of students eligible for free or reduced-price lunch; average of at least 60 students/grade; no exposure to Playworks in the past 5 years **School exclusion criteria:** — **Student inclusion criteria:** all Grade 3, 4, and 5 students from the 6 participating schools **Student exclusion criteria:** — **Setting:** school, urban **Age group:** —

Madsen 2015 *(Continued)*

	Gender distribution: females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** each intervention school received 1 part-time registered dietician coach and 1 full-time Playworks coach for 2 school years. Each year, the registered dietician coach delivered a 12-week nutrition and energy balance education curriculum that included food tasting, PA games to reinforce nutrition messages, and strategies to help students meet their nutrition and PA goals. Registered dietician coaches also worked with a team of school staff and parents to implement classroom wellness policies and to make improvements in school food, including increased offerings of fruits and vegetables to meet the Bronze-level Healthier USA School Challenge criteria. The Playworks coach structured recess activities before and during school hours to encourage active participation by all students. The Playworks coach also led a PA session with individual classes every other week. Classroom teachers were trained to implement Playworks games and classroom management strategies in their PE sessions with students. Last, Playworks coaches led after-school sports leagues throughout each year **Comparator:** — **Duration of intervention:** 2 years **Duration of follow-up:** 2 years **Number of schools:** 6 **Theoretical framework:** social cognitive theory
Outcomes	Fitness BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (charitable trust) **Publication status:** peer-reviewed journal
Stated aim for study	"The current study was designed to test the impact of Energy Balance 4 Kids with Play on students' nutrition and PA knowledge and behaviours, fitness, and BMI z-score over a 2-year period beginning in the fall of 2011"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** random number generator [author communication]
Allocation concealment (selection bias)	High risk	**Comment:** 1 school knowingly assigned to intervention group
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment**: students not blinded
Blinding of outcome assessment (detection bias)	High risk	**Comment:** no blinding [author communication]

Madsen 2015 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** missing data explained; similar between groups
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes reported in protocol paper
Cluster RCT - Recruitment bias	High risk	**Comment:** baseline data collected after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** differences adjusted for in analyses
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters were lost [author communication]
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "mixed-effects linear regression models were used ... [with] school as a random effect to account for clustering"

Muros 2015

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** rural environment and similar socioeconomic status **School exclusion criteria:** — **Student inclusion criteria:** 10 to 11 years old **Student exclusion criteria:** — **Setting:** school, rural **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Spain
Interventions	**Intervention 1:** intervention consisted of 60-minute sessions of PA held twice per week. PA was controlled by means of heart rate monitoring. The aim of the training sessions was to improve aerobic capacity using PAs specifically targeted for health gains such as motor skills, games, and sports. Play was used in all activities to motivate students and achieve the desired level of PA. All games and tasks were designed and developed by a group of experts in education and sports science and were directed by the same supervisor **Intervention 2:** PA and nutritional educational interventions combined **Intervention 3:** the same intervention as PA and nutritional educational intervention group and replaced the oil that they normally consumed with extra virgin olive oil during the final month of the intervention **Compartor 1:** nutritional educational sessions informed participants about the benefits of a Mediterranean diet (high fruit, vegetables, legumes, fish, cereals, and unsaturated-to-saturated fat ratio, and low meat, meat products, and dairy products) and lifestyle. Nutritional education involved both par-

Muros 2015 *(Continued)*

	ents and students. One or both parents could attend the sessions. It was compulsory for pupils to attend both nutrition sessions held during school time **Comparator 2:** continued with their usual activities **Duration of intervention:** 6 months **Duration of follow-up:** 6 months **Number of schools:** 5 **Theoretical framework:** —
Outcomes	Fitness BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (charitable trust) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of our study was to investigate the effects of 4 experimental conditions and 1 no intervention control group on health-related parameters, such as the lipid, physiological and anthropometric profiles of children"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** computer-generated random numbers [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** researchers could not know the intervention assignment [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** for all outcomes, investigators were blinded to grouping
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** only 56% of participants have end of study measures; reasons not reported
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published
Cluster RCT - Recruitment bias	Low risk	**Comment:** students and parents enrolled before randomisation

Muros 2015 *(Continued)*

Cluster RCT - Baseline imbalance	High risk	**Comment:** groups imbalanced at baseline; not controlled for
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost (only 1/group)
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustering not accounted for in analysis

Suchert 2015

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** schools selected from a complete list of all secondary schools in Schleswig Holstein obtained from the Ministry of Education **School exclusion criteria:** schools for disabled students **Student inclusion criteria:** all students in participating classes **Student exclusion criteria:** — **Setting:** school **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Germany
Interventions	**Intervention:** the intervention operates at 4 levels: individual, class, school, and parents • Student: pedometer use, interactive user account on the "läuft" homepage • Class: competitions, educational and practical resources • School: informational material, introductory seminar for participating teachers • Parent: informational material, parent-teacher conference **Comparator:** no further intervention **Duration of intervention:** 12 weeks **Duration of follow-up:** 1 year **Number of schools:** 29 **Theoretical framework:** —
Outcomes	Fitness BMI
Study registration	ISRCTN49482118
Publication details	**Language of publication:** English **Funding:** non-commercial funding (charitable trust)

Suchert 2015 *(Continued)*

	Publication status: peer-reviewed journal
Stated aim for study	"The aim of the study is to evaluate the implementation and effectiveness of the “läuft” PA program among adolescents in grade 8"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "a stratified randomisation was carried out on the school level (according to type of school and number of participating classes) with the computer program Randomization In Treatment Arms"
Allocation concealment (selection bias)	Low risk	**Comment:** randomisation conducted using a computer programme
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded to intervention
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** assessors were not blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Quote from publication:** "students in the study sample engaged in less out-of-school sports activities at baseline than students lost to post-assessment (P = 0.006). Attrition analyses revealed no further differences. There was no selective attrition between groups"
Selective reporting (reporting bias)	High risk	**Comment:** reporting of medical testing listed in protocol missing
Cluster RCT - Recruitment bias	High risk	**Comment:** participants recruited after clusters randomised
Cluster RCT - Baseline imbalance	High risk	**Comment:** clusters not balanced at baseline
Cluster RCT - Loss of clusters	Low risk	**Comment:** there was no dropout on school or class level
Cluster RCT - Incorrect analysis	Low risk	**Comment:** analysis accounted for clustered design

Andrade 2014

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** > 90 students in Grades 8 and 9 and located in the urban area of Cuenca, Ecuador

Andrade 2014 *(Continued)*

	Eligible schools were paired according to 4 criteria • Total number of students of the school • Monthly school fee (as proxy for socioeconomic status of the school) • Gender (male or female only or mixed gender). • Time schedule of classes (morning: 7:00 to 13:00, or afternoon: 12:00 to 18:00) **School exclusion criteria:** schools with no matching pair **Student inclusion criteria:** 2 Grade 8 and 2 Grade 9 classes were randomly selected; all students in those grades were invited to participate **Student exclusion criteria:** pregnant adolescents and those with muscle or bone injury or a concomitant disease **Setting:** school, urban **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Ecuador
Interventions	**Intervention:** ACTIVITAL intervention for PA objectives were to decrease daily screen time (1 hour to 2 hours/d), to increase daily PA levels to reach 60 minutes/d, and to have the school offer more opportunities to be active. Individual-based strategies included delivery of an educational package organised at the classroom level. Persons in charge of delivering the educational package received an introduction to the intervention objectives and a basic workshop on healthy eating and PA. The PA environmental strategy included workshops with parents that were organised at the same time as classes with adolescents and covered similar topics; organisation of social events at school such as an interactive session with famous young athletes; and environmental modification - a walking trail was drawn on the school playground in the second year of the intervention. There was no minimum dose for activities for each of the intervention strategies **Comparator:** standard curriculum as determined by the Ecuadorian government, geared at increasing sport skills and includes and a mandatory 80 minutes of PE/week **Duration of intervention:** 28 months **Duration of follow-up:** 28 months **Number of schools:** 20 **Theoretical framework:** social cognitive theory, information-motivation behavioural skills model, control theory, theory of planned behaviour
Outcomes	PA participation PA duration Sedentary time Fitness BMI
Study registration	NCT01004367
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal

Andrade 2014 *(Continued)*

Stated aim for study	"We implemented a school-based health promotion intervention ACTIVITAL that aimed at improving diet and PA. ACTIVITAL was developed using participatory approaches and tailored to the Ecuadorian school context"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "using a random number generation with random allocation of the intervention within each pair"
Allocation concealment (selection bias)	Unclear risk	**Comment:** no description of allocation concealment
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Quote from publication:** "adolescents were not informed about the existence of a counterfactual school"
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** not described
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** loss to follow-up greater in control school, but data imputed **Quote from publication:** "age, BMI z-score, gender, physical activity knowledge and socioeconomic status were used as predictors in models to impute data in the pairs"
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** loss to follow-up greater in control school, but data imputed **Quote from publication:** "age, BMI z-score, gender, physical activity knowledge and socioeconomic status were used as predictors in models to impute data in the pairs"
Selective reporting (reporting bias)	Low risk	**Comment:** all published outcomes reported
Cluster RCT - Recruitment bias	High risk	**Comment:** students enrolled after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** adjusted for in models
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Comment:** mixed models used to account for effect of clustering

Jago 2014

Study characteristics

Jago 2014 *(Continued)*

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** primary schools in the Greater Bristol area **School exclusion criteria:** — **Student inclusion criteria:** all Year 5 and 6 children who are physically able to engage in PE classes **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** UK
Interventions	**Intervention:** Action 3:30 school PA sessions. The focus of the sessions was to promote children's perceptions of autonomy, belonging, and competence. Amongst a range of techniques, to promote autonomy, teaching assistants were encouraged to provide children with choices within activities, such as leading warm-ups and adapting games, and there were child-led sessions in which children chose the activities. Teaching assistants supported competence by setting progressive activities targeting quick successes balanced with providing optimal challenge and providing specific praise for attempts as well as outcomes. Relatedness was supported through empathic teaching assistant-child interactions, with teaching assistants showing interest in the children's lives outside the intervention and encouraging teamwork **Comparator:** schools provided data at Time 0, Time 1, and Time 2 only; no other contact was made by the research team **Duration of intervention:** 20 weeks **Duration of follow-up:** 9 months **Number of schools:** 20 **Theoretical framework:** self-determination theory
Outcomes	PA duration
Study registration	ISRCTN58502739 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The main research question for a future definitive trial is, 'Is Action 3:30, an after-school PA intervention that is based on behaviour-change theory and delivered by teaching assistants, effective in improving the PA, attitudes and confidence of Year 5 and 6 children?' Specific aims: 1) Estimate the likely recruitment, attendance, and retention rates of pupils to the Action 3:30 after school PA intervention. 2) Estimate the likely impact on PA while the club was still running and 4 months after contact sessions had ended. 3) Develop a reliable costing tool and assess the feasibility of obtaining programme cost data. 4) Estimate the sample size for an adequately powered evaluation of the Action 3:30 intervention"
Notes	
Risk of bias	

Jago 2014 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "randomisation was conducted by an independent statistician in the trials unit with no other involvement in the project"
Allocation concealment (selection bias)	Low risk	**Comment:** conducted by clinical trials unit not involved in the study
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students and staff not blinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** attempted to blind data collectors, but group allocation was often revealed by students or staff [author communication]
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** small loss to follow-up; reasons provided
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes in protocol paper reported
Cluster RCT - Recruitment bias	Low risk	**Quote from publication:** "schools were randomly assigned to intervention or control arms once baseline data had been processed"
Cluster RCT - Baseline imbalance	Low risk	**Comment:** models adjusted for baseline imbalance
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "models [used]... robust standard errors used to take account of the cluster randomised design"

Kipping 2014

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** all state primary and junior schools with children in Years 4 to 6 (aged 8 to 11) in the area covered by Bristol City Council and North Somerset Council **School exclusion criteria:** special schools (i.e. those for children whose additional needs cannot be met in a mainstream setting) because they are unlikely to be teaching the standard national curriculum and children may not be able to take part in all measurements **Student inclusion criteria:** children in Year 4 (age 8 to 9) at the recruitment stage **Student exclusion criteria:** — **Setting:** school, mix **Age group:** children

Kipping 2014 *(Continued)*

	Gender distribution: females and males **Country/Countries where trial was performed:** UK
Interventions	**Intervention:** Active for Life Year 5 is a school-based intervention that aims to increase children's self-efficacy and knowledge, together with motivating parents, to increase children's levels of PA, reduce sedentary behaviour, and increase consumption of fruits and vegetables; a secondary aim is to improve other aspects of healthy activity and diet. The 5 components of the intervention are: • training for Year 5 classroom teachers and learning support assistants; • provision of 16 lesson plans and teaching materials; • provision of 10 parent-child interactive homework activities; • provisions of written information for school newsletters; and • written information for parents **Comparator:** continued standard education provision for the school year, and any involvement in additional health-promoting activities, but no access to intervention teacher training and no known access to teaching materials **Duration of intervention:** 1 school year **Duration of follow-up:** 1 school year **Number of schools:** 60 **Theoretical framework:** social cognitive theory
Outcomes	PA duration Sedentary time BMI
Study registration	ISRCTN50133740
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The aims of Active for Life Year 5 are to determine the effectiveness and cost-effectiveness of the intervention in children aged 9 to 10 years to improve the following primary outcomes: 1) Daily time spent in, and amount of, PA. 2) Daily time spent in sedentary behaviour. 3) Portions of fruit and vegetables consumed/d. And secondary outcomes: 1) Time spent screen-viewing/d. 2) Portions of: snacks, high fat foods, and high energy drinks consumed/d. 3) BMI. 4) Waist circumference. 5) Whether overweight or obese. The aim is to determine whether the intervention affects these outcomes in the short-term (i.e. immediately at the end of the intervention) and in the longer term (i.e. 12 months after the end of the intervention)"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "schools were grouped and randomly allocated them to control or intervention. 1 author (DAL) who was unaware of any characteristics of the schools did the randomisation (identification numbers were used to relate schools to the 2 stratifying variables, and DAL had no knowledge of which schools these numbers linked to)"

Kipping 2014 *(Continued)*

Allocation concealment (selection bias)	Low risk	**Quote from publication: "**randomisation was concealed by using the Bristol Randomised Trials Collaboration's automated (remote) system"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** field workers collecting data were blind to allocation
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** similar missing data at baseline and at end of study
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** similar missing data at baseline and at end of study
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes in protocol paper reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** randomisation after enrolment
Cluster RCT - Baseline imbalance	Low risk	**Comment:** analyses adjusted for baseline values
Cluster RCT - Loss of clusters	Low risk	**Comment:** no loss of clusters
Cluster RCT - Incorrect analysis	Low risk	**Comment:** multi-level regression models accounted for clustering within school

Kobel 2014

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** all primary schools of the state of Baden-Württemberg **School exclusion criteria:** teachers who already took part in the programme in the academic year 2009/2010 were not included in the study **Student inclusion criteria:** pupils at primary school participating in the Baden-Württemberg study, Grades 1 and 2 **Student exclusion criteria:** none **Setting:** school **Age group:** children **Gender distribution:** females and males

Kobel 2014 *(Continued)*

	Country/Countries where trial was performed: Germany
Interventions	**Intervention:** a progressive, teacher-led intervention from Grades 1 to 4 using a spiral curriculum. Each teacher takes part in a 3-part training course led by a colleague or other teacher (not an external expert) to enhance programme acceptance and facilitate translation into the school environment for sustainability. The intervention consists of 20 units/school year of lessons on “beverages”, “PAs”, and “recreational activities”. These units are spread over the whole academic year. Furthermore, the intervention consists of 2 PA exercises that are performed every school day ("active breaks”, each exercise takes between 5 and 7 minutes). Additionally, “family homework” exercises are given, which are small tasks related to the lesson’s topics to involve parents. Further, samples for parents’ evenings and templates for letters to parents in 3 languages (i.e. German, Turkish, and Russian) are included **Comparator:** in the academic year 2010/2011, there was no intervention in the control group; although interested, class teachers belonging to the control group received no local training and no materials for the intervention; they were registered for participation in the academic year 2011/2012. In the academic year 2011/2012, these class teachers started with the 3-part local training course **Duration of intervention:** 1 year **Duration of follow-up:** 1 year **Number of schools:** 91 **Theoretical framework:** social cognitive theory, saluto-genetic competence, action-oriented approach
Outcomes	PA participation PA duration BMI
Study registration	DRKS00000494
Publication details	**Language of publication:** English **Funding:** — **Publication status:** peer-reviewed journal
Stated aim for study	"The purpose of this study, therefore, is to investigate the children’s behaviours after a 1-year intervention in respect of the programme’s key aspects: an increase of PA, a decrease in time spent with screen media as well as more regular breakfast, and a reduction of the consumption of sugar-sweetened beverages"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Comment:** the randomisation list was generated by an independent person in the Institute of Epidemiology and Medical Biometry Ulm University, using a validated system, which involves a pseudo-random number generator to ensure that the resulting treatment sequence will be both reproducible and non-predictable [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** allocation was concealed by using an independent statistician

Kobel 2014 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students and teachers knew group assignment
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** outcome assessors at schools were blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** > 10% loss to follow-up; no explanation given
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** > 10% loss to follow-up; no explanation given
Selective reporting (reporting bias)	High risk	**Comment:** skin-fold thickness reported in protocol but not in article
Cluster RCT - Recruitment bias	High risk	**Comment:** students enrolled after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline demographics similar
Cluster RCT - Loss of clusters	High risk	**Comment:** N = 6 classes withdrew because of randomisation to control group
Cluster RCT - Incorrect analysis	High risk	**Comment:** statistical analysis does not account for clustering

Martinez-Vizcaino 2014

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** schools in different municipalities in the province of Cuenca, Spain **School exclusion criteria:** — **Student inclusion criteria:** literate in Castilian Spanish, no physical or mental disorder identified by parents or teachers that would prevent student from doing PA, no chronic disease that paediatrician or family doctor considered would prevent student from participating in MOVI-2, collaboration of a family member who would respond to questionnaires on lifestyle **Student exclusion criteria:** — **Setting:** school, mix **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Spain

Martinez-Vizcaino 2014 *(Continued)*

Interventions	**Intervention:** MOVI-2 consisted of an extracurricular play-based and non-competitive PA programme. The primary objective of MOVI-2 was to increase weekly PA while improving health-related fitness. MOVI-2 included basic sports games, traditional games, and other outdoor activities such as cycling or gymkhanas. The programme included two 90-minute PA sessions during weekdays in the evening from 4:00 to 5:30 PM and one 150-minute session on Saturday morning each week **Comparator:** standard PE curriculum (2 hours/week of PA at low to moderate intensity) **Duration of intervention:** 8 months **Duration of follow-up:** 8 months **Number of schools:** 20 **Theoretical framework:** socioecological model
Outcomes	BMI
Study registration	NCT01277224 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"Our study assessed the impact of a standardized PA program on adiposity and cardio metabolic risk in grades 4 and 5 schoolchildren. The program consisted of noncompetitive recreational activities focused on developing aerobic and muscular fitness"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** computer-generated procedure
Allocation concealment (selection bias)	Low risk	**Comment:** opaque envelopes
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "it was impossible to blind parents, children, and teachers to the existence of the intervention group program"
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Quote from publication:** "although it was not possible to blind the investigators who measured other study variables at baseline and at the conclusion of the study as to trial group allocation, the analysts who processed and analysed the study data were blinded in this respect"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** > 10% loss to follow-up; reason not provided
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes reported in protocol described

Martinez-Vizcaino 2014 *(Continued)*

Cluster RCT - Recruitment bias	High risk	**Comment:** students recruited after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Quote from publication:** "there were no statistically significant differences between intervention and control participants in any baseline characteristics"
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost [author communication]
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Nogueira 2014

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** 2 local independent primary schools (Gold Coast, Australia) of essentially identical size and demographic (ethnicity and socioeconomic profile), with comparable school fees, school hours, curricula, and time devoted to PE and other PAs **School exclusion criteria:** — **Student inclusion criteria:** students who were of sound general health, fully ambulatory, and gave their consent to participate **Student exclusion criteria:** students taking medications known to affect bone, muscle, or metabolism; recovering from a limb fracture or other immobilising injury in the past 6 months; affected by any condition not compatible with PA; parents declined to consent **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Australia
Interventions	**Intervention:** instructor-led exercise bouts comprising 10 minutes of continuous high-intensity movement intended to improve musculoskeletal and metabolic health. Programme was largely based on capoeira, a Brazilian sport that combines martial arts with dance, and a broad range of continuous movements of medium to high impact, applied at varying speeds and directions to increase heart rate and to load a variety of muscle groups and skeletal regions in upper and lower body. Occasional small prizes (e.g. balls, game vouchers) were provided to reward participation and improvement **Comparator:** control school children continued to undertake usual school activities over the course of the intervention year **Duration of intervention:** 9 months **Duration of follow-up:** 21 months **Number of schools:** 2 **Theoretical framework:** —
Outcomes	BMI

Nogueira 2014 *(Continued)*

	Fitness
Study registration	—
Publication details	**Language of publication:** English **Funding:** — **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of the current study then, was to test the efficacy of a brief, novel, and enjoyable bone- and fat-targeted exercise program on parameters of bone, muscle and fat in healthy pre-and peri-pubertal boys over the course of a school year. The aim of the CAPO Kids intervention trial then was to determine the effect of a brief, simple, enjoyable, musculoskeletal- and fat-targeted exercise programme on quantitative-ultrasound-derived bone quality, fat and metabolic health in pre- and early-pubertal girls over the course of a school year"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** coin toss used
Allocation concealment (selection bias)	Low risk	**Comment:** group allocation concealed from participants and investigators prior to randomisation [author communication]
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Quote from publication:** "control school participants were aware of neither the intervention activity nor the overall purpose of the study"
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** testers were not blinded to intervention
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** overall loss to follow-up was 9% and was related mainly to student relocation or absence from school on the days of testing
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published
Cluster RCT - Recruitment bias	Low risk	**Comment:** students enrolled after randomisation, but almost complete enrolment
Cluster RCT - Baseline imbalance	Low risk	**Comment:** adjusted for in analysis
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustering not accounted for in analysis

Santos 2014

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** within the provincial jurisdiction, minimum of 200 students/school, and offering Grades 1 through 6 **School exclusion criteria:** — **Student inclusion criteria:** — **Student exclusion criteria:** consent not received or condition that limited participation in PA **Setting:** school, mix **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Canada
Interventions	**Intervention:** an older class was paired with a younger class. Each week, older students received a 45-minute healthy living lesson from their classroom teacher. Later that week, older students acted as peer mentors, teaching a 30-minute lesson to their younger “buddies”. The “Go Move!” aspect included two 30-minute structured aerobic fitness sessions/week, called fitness loops, with student pairs. Students were encouraged to complete the fitness loops at a vigorous intensity using perceived exertion scales. The “Go Fuel!” component included lessons about distinguishing nutritious from unhealthy (nutrient poor, energy-rich) foods and beverages. As part of the “Go Feel Good!” component, students were taught to value themselves and classmates based on individual traits rather than on peer influence. The peer-led model facilitated social skills, self-esteem, and social responsibility **Comparator:** standard curriculum **Duration of intervention:** 7 months **Duration of follow-up:** 7 months **Number of schools:** 20 **Theoretical framework:** —
Outcomes	BMI
Study registration	NCT01979978 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The present study was designed to overcome these limitations by using a cluster-randomised effectiveness trial to test the hypothesis that a school-based, peer-led healthy living program would reduce adiposity and increase PA among children"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Santos 2014 *(Continued)*

Random sequence generation (selection bias)	Low risk	**Quote from publication:** "schools were randomised in a computer-generated random selection process and blocked to ensure equal representation from rural and First Nations (i.e. Indigenous) schools in both intervention and control arms"
Allocation concealment (selection bias)	Unclear risk	**Comment:** randomisation completed by investigator not involved in data collection; concealment unclear
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students and teachers not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** research assistants blinded to study assignment
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** low loss to follow-up; no differences in outcome measures were noted between completers and non-completers
Selective reporting (reporting bias)	Low risk	**Comment:** outcomes match clinical trial registry
Cluster RCT - Recruitment bias	High risk	**Comment:** students enrolled after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline differences controlled for
Cluster RCT - Loss of clusters	High risk	**Comment:** 1 intervention school withdrew from the study
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "all analyses were adjusted for random effect of student and within-school clustering using a compound symmetry structure for the within-student correlations"

Toftager 2014

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** all municipalities in the Region of Southern Denmark were invited; 5 municipalities (Esbjerg, Nordfyn, Varde, Vejle, and Sønderborg) accepted the invitation and were asked to enrol public schools that contained Grade 8 **School exclusion criteria:** schools that were placed in the countryside and had more than 50% of all students living farther than 2 km Euclidian distance from the school, had a majority of students that were non-native Danish **Student inclusion criteria:** — **Student exclusion criteria:** — **Setting:** school, mix

Toftager 2014 *(Continued)*

	Age group: children/adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Denmark
Interventions	**Intervention:** intervention consisted of 11 intervention components changing the physical and organisational environment of schools. The multi-component intervention was developed according to socioecological models of behavioural change and was constructed in accordance with existing knowledge-based research and practical experiences from Danish school settings. A detailed written description of intervention components was delivered to all participating schools and included 4 physical environment changes and 7 organisational environment changes. Required physical environment changes included the following components: • upgrade existing outdoor areas at the school for PA, including unfixed equipment; • develop and build playgrounds specially designed for adolescents: play spots; • improve safety for active transport to and from school; and • establish an after-school fitness programme Organisational environment changes included: • formulate and implement school PA policy; • educate teachers as ‘‘kick-starters’’, who facilitate and motivate PA during recess; • establish school play patrol: older students trained to initiate play and games for minors during school recess; • mandatory outdoor recess and/or free access to gym or sports hall; • school traffic patrol: older students helping minors cross the streets near the school; • educate and train students in safe cycling; and • present school project or theme week once per year focused on learning about and doing PA during school lessons http://www.forebyggelsescenter.dk **Comparator:** — **Duration of intervention:** 2 years **Duration of follow-up:** 2 years **Number of schools:** 14 **Theoretical framework:** socioecological model of behavioural change
Outcomes	PA duration Sedentary time Fitness
Study registration	ISRCTN79122411
Publication details	**Language of publication:** English **Funding:** other funding (funded by a non-profit organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of the School site, Play Spot, Active transport, Club fitness and Environment Study was to develop, document, and assess a comprehensive intervention in local school districts that promote everyday PA among 11- to 15-year-old adolescents"

Toftager 2014 *(Continued)*

Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** drew lots [author communication]
Allocation concealment (selection bias)	High risk	**Comment:** allocation not concealed [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded to intervention group
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** outcome assessors not blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Quote from publication:** "out of the participating adolescents at baseline 13% (N = 162) had moved to another school at follow-up, and 2% (N = 27) withdrew consent"
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Quote from publication:** "out of the participating adolescents at baseline 13% (N = 162) had moved to another school at follow-up, and 2% (N = 27) withdrew consent"
Selective reporting (reporting bias)	Low risk	**Comment:** all main outcomes in protocol reported
Cluster RCT - Recruitment bias	High risk	**Comment:** individuals recruited and baseline measures taken after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no baseline differences between groups
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering of students within schools was accounted for by including schools as a random effect in analyses

Fairclough 2013

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** within pre-defined geographical units known as Neighbourhood Management Areas, 1 high and 1 low socioeconomic status school (defined as percentage of students per school eligible to receive free school meals) were randomly selected **School exclusion criteria:** —

Fairclough 2013 *(Continued)*

	Student inclusion criteria: all children within Year 6 (10 to 11 years old) **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** UK
Interventions	**Intervention:** Children's Health, Activity and Nutrition: Get Educated! curriculum consisted of 20 weekly lesson plans, worksheets, homework tasks, lesson resources, and a CD-ROM. Lessons provided an opportunity for children to discuss, explore, and understand the meaning and practicalities of PA and nutrition as key elements of healthy lifestyles. The core message of the PA and sedentary behaviour components was "move more, sit less" with no specific prescription given as to what forms of PA the children should do. Nutrition components focused on topics such as energy balance, macronutrients, and eating behaviours. Homework tasks involved the whole family because formative work emphasised the importance of family support **Comparator:** classes in the comparison schools received normal instruction. This did not involve a specific unit of Personal, Social, and Health Education focused on healthy eating and PA, but concepts related to these areas may have been touched on informally during other lessons **Duration of intervention:** 20 weeks **Duration of follow-up:** 8 months **Number of schools:** 12 **Theoretical framework:** social cognitive theory
Outcomes	PA duration Sedentary time Fitness BMI
Study registration	ISRCTN03863885 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** — **Publication status:** peer-reviewed journal
Stated aim for study	"The Children's Health, Activity and Nutrition: Get Educated! intervention was designed to promote healthy weight in primary school children through a teacher-delivered curriculum-based intervention with family involvement, focused on PA and dietary behaviour. The aim of this pragmatic evaluation was to assess the effectiveness of the Children's Health, Activity and Nutrition: Get Educated! intervention on measures of body size, PA, and food intake"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement

Fairclough 2013 *(Continued)*

Random sequence generation (selection bias)	Low risk	**Comment:** random number generator used
Allocation concealment (selection bias)	High risk	**Comment:** not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students not blinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** outcome assessors not blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** large loss to follow-up, bigger in intervention group
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** large loss to follow-up, bigger in intervention group
Selective reporting (reporting bias)	Low risk	**Comment:** outcomes match with trial registry
Cluster RCT - Recruitment bias	High risk	**Comment:** randomisation conducted prior to baseline measures
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline differences adjusted for in analyses
Cluster RCT - Loss of clusters	High risk	**Comment:** 1 school lost from intervention group
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "multilevel models can analyse the hierarchical nature of non-independent, nested data by taking into account the dependency of observations. Children were defined as the first level unit of analysis, and school was the second level unit of analysis"

Ford 2013

Study characteristics	
Methods	**Study design:** RCT
Participants	**Student inclusion criteria:** aged 5 to 11 years, from 2 primary schools located within the southeast of England **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males

Ford 2013 *(Continued)*

	Country/Countries where trial was performed: UK
Interventions	**Intervention:** accumulated brisk walking programming during school time **Comparator:** normal school lessons during walking sessions, which involved seated literacy work **Duration of intervention:** 15 weeks **Duration of follow-up:** 15 weeks **Number of schools:** 2 **Theoretical framework:** —
Outcomes	PA duration BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** — **Publication status:** peer-reviewed journal
Stated aim for study	"The purpose of this study was to determine whether a 15-week accumulated brisk walking programme, performed within a primary school setting, is effective in eliciting changes in body composition in 5- to 11-year-olds"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "participants were divided into 2 groups using the random number generation function in SPSS"
Allocation concealment (selection bias)	Unclear risk	**Comment:** not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** not described
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Unclear risk	**Comment:** 22 dropped out; study authors do not indicate which group they were from
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Unclear risk	**Comment:** 22 dropped out; study authors do not indicate which group they were from

Ford 2013 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published

Grydeland 2013

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** more than 40 pupils in Grade 6 and located in the 3 or 4 largest towns or municipalities in the 7 counties surrounding the county of Oslo **School exclusion criteria:** — **Student inclusion criteria:** all Grade 6 students in 37 included schools **Student exclusion criteria:** — **Setting:** school **Age group:** children/adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Norway
Interventions	**Intervention:** collaboration with school principals, teachers, school health services, and parent committees to increase students' PA during school hours and leisure time, and to reduce screen time. Teachers held 1 structured lecture on energy balance; initiated 10-minute PA breaks during class at least once/week; hung posters in classrooms; launched active commuting campaigns; distributed fact sheets to parents once per month; and implemented a computer-tailored programme for students. Each school received an “Activity box” with sports equipment and toys to promote PA during recess **Comparator:** — **Duration of intervention:** 20 months **Duration of follow-up:** 32 months **Number of schools:** 37 **Theoretical framework:** social cognitive theory and socioecological framework
Outcomes	PA duration Sedentary time BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The overall goal of the HEalth In Adolescents study was to design, implement, and evaluate a comprehensive, intervention programme to promote healthy weight development among young adolescent schoolchildren (11 to 13 year olds)"

Grydeland 2013 *(Continued)*

Notes		

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "schools were randomised by simple drawing"
Allocation concealment (selection bias)	Low risk	**Quote from publication:** "allocation could not be predetermined"
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "neither participants nor investigators were blinded for condition"
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Quote from publication:** "neither participants nor investigators were blinded for condition"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** < 10% loss to follow-up
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** < 10% loss to follow-up
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes in protocol paper reported
Cluster RCT - Recruitment bias	High risk	**Comment:** schools were randomised prior to baseline data collection [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no baseline differences
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Melnyk 2013

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** 11 high schools from 2 school districts in the southwestern USA. The choice of schools was designed to provide diversity across race or ethnicity as well as socioeconomic status **School exclusion criteria:** —

Melnyk 2013 *(Continued)*

	Student inclusion criteria: teens 14 to 16 years of age enrolled in a health class at 1 of 11 participating high schools, assented to participation, had a custodial parent who consented to the teen's participation in the study and optionally for himself or herself, could speak and read in English, parents could speak and read either Spanish or English **Student exclusion criteria:** a medical condition that would prevent participation in the PA component of the programme **Setting:** school **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** goal-setting to promote engagement in healthy lifestyle behaviours and problem-solving for typical adolescent challenges; educational content to increase teens' knowledge of how to lead a healthy lifestyle; homework to reinforce skills learned in the classroom; 20 minutes of PA within each of the 15 Creating Opportunities for Personal Empowerment components. Teachers chose types of physical activities, which commonly included movement within the classroom, brisk walking, dodge ball, kickball, obstacle courses, "Tank" (a game suggested by the research team), and basketball **Comparator:** Healthy Teens attention control curriculum was intended to promote knowledge of common adolescent health topics and health literacy. Content included pertinent health information for teens **Duration of intervention:** 15 weeks **Duration of follow-up:** 10 months **Number of schools:** 11 **Theoretical framework:** cognitive-behavioural theory
Outcomes	BMI
Study registration	NCT01704768
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The purpose of this study is to test the short and more long-term efficacy of the Creating Opportunities for Personal Empowerment Healthy Lifestyles Thinking, Emotions, Exercise, Nutrition intervention, versus an attention control program (Healthy Teens) on the healthy lifestyle behaviours, BMI and BMI percentile, social skills, depressive or anxiety symptoms and academic performance of 779 culturally diverse high school teens enrolled in the southwest region of the USA for the ultimate purpose of preventing overweight or obesity, mental health disorders and poor academic functioning"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** drawing names from a hat

Melnyk 2013 *(Continued)*

Allocation concealment (selection bias)	Low risk	**Comment:** allocation could not be predetermined
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Comment:** students and teachers were blinded to intervention
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** outcome assessors were blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** large loss to follow-up; no description of handling missing data
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** large loss to follow-up, no description of handling missing data
Selective reporting (reporting bias)	Low risk	**Comment:** all specified outcomes reported on
Cluster RCT - Recruitment bias	Low risk	**Comment:** students blinded to group allocation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline differences adjusted for
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost to follow-up [author communication]
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering was accounted for in analysis as per protocol paper [author communication]

Sacchetti 2013

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** — **School exclusion criteria:** — **Student inclusion criteria:** Grade 3 **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Italy

Sacchetti 2013 *(Continued)*

Interventions	**Intervention:** PA consisted of at least 30 minutes of physical exercise/d, divided between schoolyard (vigorous activity) and classroom (moderate activity). Twice weekly, a further 50 minutes of PE was spent in the gym, according to the standard curriculum of PE. On average, then, during school hours, children were engaged for around 45 minutes in specific PA, which was moderate **Comparator:** control group followed the standard programme of PE involving 2 lessons of around 50 minutes/week in the gym, taught by the ordinary classroom teacher **Duration of intervention:** 2 years **Duration of follow-up:** 2 years **Number of schools:** 26 **Theoretical framework:** —
Outcomes	BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of this study was to assess whether a school-based intervention of PA education was effective in improving physical abilities and influencing physical behavior in a representative group of primary school children. As a second aspect, the possible effect on body weight was considered. In the study, we compared the PA habits, the physical performances, and BMI measurements in an intervention group and a control group of children at baseline (age: 8 to 9 years) and after a 2-year follow-up (age: 10 to 11 years)"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** computerised random number generator [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** allocation was concealed from participants and/or study personnel prior to randomisation [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students not blinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** outcome assessors were not blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Quote from publication:** "any loss to follow-up was due to children who moved to other schools (14.2% and 13.9% respectively in intervention and control groups)"

Sacchetti 2013 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published
Cluster RCT - Recruitment bias	High risk	**Comment:** clusters randomised before individuals recruited
Cluster RCT - Baseline imbalance	Low risk	**Quote from publication:** "both in boys and girls, no significant differences were found between the intervention and control groups in age, BMI, and frequency and duration of the practice of extra scholastic sports"
Cluster RCT - Loss of clusters	Low risk	**Comment:** no loss of clusters reported
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustering not accounted for in analysis

Siegrist 2013

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** primary schools throughout Bavaria, Germany **School exclusion criteria:** none **Student inclusion criteria:** attendance in Grade 2 or 3 and written consent from parents **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Germany
Interventions	**Intervention:** the focus of the multi-faceted JuvenTUM intervention was on directly educating and encouraging children, teachers, and parents to live active and healthy lifestyles. Additionally, school environmental settings (e.g. physical environment, organisation of school breaks, playing during school time, sports facilities) were altered to promote more PA. http://www.juventum.med.tum.de/ **Comparator:** principals were instructed to continue with school activities as usual, without changing policies related to PA or nutrition during the study period **Duration of intervention:** 1 year **Duration of follow-up:** 1 year **Number of schools:** 8 **Theoretical framework:** —
Outcomes	BMI
Study registration	—
Publication details	**Language of publication:** English

Siegrist 2013 *(Continued)*

	Funding: non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of the present project was to evaluate a simple and ubiquitously applicable school-based educational program to increase PA, fitness, and lifestyle awareness and to improve health obesity measures"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Comment:** schools randomised by drawing a lot [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** allocation was concealed, and recruitment was based on willingness to be randomised to either group [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded to intervention
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** outcome assessors were not aware of group allocation [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** children with missing data were ill or were absent from school or had left school
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol available or trial registered
Cluster RCT - Recruitment bias	High risk	**Comment:** individual students enrolled after randomisation at school level [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** intervention and control schools were comparable with regard to socioeconomic status of the population and recreational environments
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** analysis did not account for cluster design

Aburto 2011

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** located in the south of Mexico City, classified by the Secretary of Public Education as low socioeconomic status, received benefits from the Federal School Breakfast Pro-

Aburto 2011 *(Continued)*

	gram, demonstrated minimum facilities necessary for execution of the intervention, possessed the standard Secretary of Public Education–issued set of sports equipment, enrolled at least 350 students, and consisted of 2 or more classrooms/grades **School exclusion criteria:** — **Student inclusion criteria:** all students in Grades 4 and 5 **Student exclusion criteria:** — **Setting:** school, urban **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Mexico
Interventions	**Intervention 1 - Basic:** environmental and policy changes at the school level meant to foster an environment conducive to increased PA. These changes were complemented with an educational campaign to increase students' and school staff's awareness of the importance of PA for health **Intervention 2 - Plus:** all components of the basic intervention plus additional changes requiring more resources such as an added daily exercise session held before classes began, in which all students participated **Comparator:** control group experienced no change to the standard practices of public schools in Mexico City related to PE (once/week) and recess (non-existent) **Duration of intervention:** 6 months **Duration of follow-up:** 6 months **Number of schools:** 27 **Theoretical framework:** reciprocal determinism
Outcomes	BMI Fitness
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The objective of this investigation was to test the effect of a school-based environmental intervention on PA and physical fitness of students attending public primary schools in Mexico City"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "using a statistical program to draw a random sample from the complete list of eligible schools, 27 schools were randomly chosen for inclusion. Using the same program to draw 3 samples from the 27, the 3 intervention groups were randomly generated"

Aburto 2011 *(Continued)*

Allocation concealment (selection bias)	Unclear risk	**Comment:** not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "the nature of the environmental intervention precluded blinding of the participants or field staff"
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Quote from publication:** "data analysts and researchers were blinded to the meaning of all numeric codes until data analyses were complete" **Comment:** outcome assessors not blinded
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** low loss to follow-up for outcome measures
Selective reporting (reporting bias)	High risk	**Comment:** anthropometry not reported; only P value for fitness
Cluster RCT - Recruitment bias	High risk	**Comment:** data collected after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** accounted for in analysis
Cluster RCT - Loss of clusters	High risk	**Comment:** 3 clusters from control group lost to follow up due to time constraints
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "robust standard error accounting for the design effect of school were calculated"

Ardoy 2011

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** — **School exclusion criteria:** — **Student inclusion criteria:** age 12 to 14, enrolled in first year of secondary school **Student exclusion criteria:** partial injury or illness or chronic disease that prevented involvement in PE classes **Setting:** school **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Spain
Interventions	**Intervention 1:** experimental group 1 doubled the academic load stipulated for this subject (4 sessions/week). Experimental group 1 was taught in the same sessions as the control group, doubling the volume of booster sessions with the same objectives, content, and methods. For practical matters and

Ardoy 2011 *(Continued)*

	questions of viability, extra sessions were carried out during the afternoon, under the same conditions, and in the same facilities as the usual sessions (held during the morning). Sessions were carried out in accordance with the established curriculum, with approval of the educational institution and the parents **Intervention 2:** experimental group 2 also received 4 sessions/week in which there was special emphasis on increasing the intensity of sessions. Experimental group 2 objectives and content were the same, but with high intensity across all sessions. For practical matters and questions of viability, extra sessions were carried out during the afternoon, under the same conditions, and in the same facilities as the usual sessions (held during the morning). Sessions were carried out in accordance with the established curriculum, with approval of the educational institution and the parents **Comparator:** control group received 2 sessions of PE/week as established by regulations currently in force in Spain. For all groups, content included the same teaching units (subjects) and sessions on physical fitness and health, games and sports, personal driving qualities, movement, and environmental activities. This intervention was designed to adhere closely to characteristics and context of educational content to obtain results of great application and transfer to national education policies **Duration of intervention:** 16 weeks **Duration of follow-up:** 16 weeks **Number of schools:** 1 **Theoretical framework:** social cognitive theory, information-motivation behavioural skills model, control theory, theory of planned behaviour
Outcomes	BMI Fitness
Study registration	NCT01098968 (retrospectively registered)
Publication details	**Language of publication:** Spanish **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The purpose of the present study is to examine the effect on physical fitness and body composition of: a) doubling the number of sessions of PE/week; b) doubling the number of sessions of PE/week plus increasing their intensity; and c) increasing the intensity of the sessions, while maintaining the same number/week"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	**Comment:** not described
Allocation concealment (selection bias)	Unclear risk	**Comment:** not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students could not be blinded

Ardoy 2011 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** randomisation was blinded for those who performed the outcome assessment
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** minimal missing data and very few dropouts in each group
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes specified in protocol paper reported on
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** unclear when baseline data were collected
Cluster RCT - Baseline imbalance	Low risk	**Comment:** secondary analysis adjusted for age
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustering within classes not accounted for in analysis.

de Heer 2011

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** schools in El Paso, Texas, were selected according to school location (for logistical purposes, half of those chosen were located within 5 miles of the University of Texas at El Paso campus), size, socioeconomic status, and percentage of children with limited English proficiency **School exclusion criteria:** — **Student inclusion criteria:** enrolled in 1 of the target grades (3 to 5) and had no condition that would endanger their own or others' safety **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** a 20- to 30-minute health education component followed by 45 to 60 minutes of PA after-school in the schoolyard or in the multi-purpose room using a bilingual health education curriculum, Bienestar (well-being), that is, culturally targeted to Mexican Americans. The curriculum included modules on healthy eating, exercise, diabetes, and self-esteem. Activities for the programme emphasised cardiovascular activity and aerobic recreational games **Comparator 1:** students received Grade 4 health workbooks and incentives at pretest and follow-up measurements, but they did not attend after-school sessions

de Heer 2011 *(Continued)*

	Comparator 2 (spillover control group): students were in an intervention classroom but declined an invitation to participate in the after-school programme. Students received Grade 4 health workbooks and incentives at pretest and follow-up measurements, but they did not attend after-school sessions **Duration of intervention:** 12 weeks **Duration of follow-up:** 4 months **Number of schools:** 6 **Theoretical framework:** social cognitive theory
Outcomes	BMI Fitness
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"We developed, implemented, and evaluated a culturally tailored health education and PA after-school program for a population of predominantly Hispanic elementary school children"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Comment:** random number generator in excel [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** enrolment and baseline assessment prior to generation of randomisation sequence [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students could not be blinded
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** project staff collected these measurements in collaboration with each school's PE teachers during PE classes (not blinded)
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** differential loss to follow up; did not present imputed analysis
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol paper; appears all outcomes are reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** enrolment and baseline assessment prior to generation of randomisation sequence [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** models adjusted for baseline imbalance

de Heer 2011 *(Continued)*

Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost [author communication]
Cluster RCT - Incorrect analysis	Low risk	**Comment:** analysis accounted for clustering of students within classrooms and classrooms within schools

Jago 2011

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** student body at least 50% minority (African American, Hispanic or Latino, and/or American Indian) and/or greater than 50% eligible for free or reduced lunch; annual student attrition from all causes is ≤ 25%; expected cohort size at end of study is at least 50 per school; school authorities willing to accept randomisation, permit grade-wide data collection, and assist with mass mailings to students' homes; possess Federal Wide Assurance to conduct research and agree to adhere to the protocol; schools must also have at least 1 play area that satisfied intervention requirements **School exclusion criteria:** — **Student inclusion criteria:** enrolled in Grade 6 in fall 2006, able to participate in school's standard PE programme, not previously diagnosed with diabetes, providing parent's or guardian's informed consent and minor child informed assent to participate in data collection and evaluation procedures **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** intervention had 4 integrated components. The first component was change in the total school food environment. The second component was a programme of peer-led, teacher-facilitated learning activities. The third component was a social marketing campaign that had a different theme for each semester of the intervention. The fourth element was a revised, more active PE curriculum. Schools also received around $10,000 of equipment and a teacher assistant to facilitate small-group activities that were intended to increase activity time during sessions **Comparator:** control group activities were limited to recruitment and data collection only **Duration of intervention:** 2.5 years **Duration of follow-up:** 2.5 years **Number of schools:** 42 **Theoretical framework:** developmental learning frameworks
Outcomes	Fitness BMI
Study registration	NCT00458029 (retrospectively registered)
Publication details	**Language of publication:** English

Jago 2011 *(Continued)*

	Funding: non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"HEALTHY was a primary prevention trial with a public health objective of preventing the development of risk factors for type 2 diabetes in adolescents"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** coordinating centre developed randomisation scheme
Allocation concealment (selection bias)	Low risk	**Comment:** randomisation occurred at a coordinating centre
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Comment:** study took measures to mask intervention to both students and parents
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** separate study staff not aware of treatment assignment administered data collection protocols
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** loss to follow-up similar between groups; most often due to transfer to another school
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes reported on
Cluster RCT - Recruitment bias	Low risk	**Comment:** students enrolled after randomisation, but investigators attempted to mask students and parents to school assignment
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline balance; models adjusted for confounders
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Comment:** analyses accounted for clustered design

Jansen 2011

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** schools in more deprived inner-city areas with high proportions of immigrant children in the city of Rotterdam

Jansen 2011 *(Continued)*

	School exclusion criteria: schools that could not be paired based on size, proportion of migrants, and neighbourhood **Student inclusion criteria:** Grades 3 to 8 **Student exclusion criteria:** — **Setting:** school, urban **Age group:** children/adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** The Netherlands
Interventions	**Intervention:** 4 components: (1) implementation of 3 PE sessions/week by a PE teacher; (2) organisation of additional voluntary sport and play activities outside school hours; (3) classroom education with 3 main lessons on healthy nutrition, active living, and healthy lifestyle choices adapted for each grade. Each lesson finishes with joint goal-setting, and individual counselling by the school nurse is offered if needed; (4) health promotion gathering at the beginning of the school year for parents and involvement of local sport clubs **Comparator:** continued with usual curriculum: 2 PE sessions/week by classroom teacher or a PE teacher, dependent on school policy **Duration of intervention:** 1 school year **Duration of follow-up:** 1 school year **Number of schools:** 20 **Theoretical framework:** theory of planned behaviour and ecological model
Outcomes	BMI Fitness
Study registration	ISRCTN84383524 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** — **Publication status:** peer-reviewed journal
Stated aim for study	"The purpose of this study was to evaluate the effect of a school-based intervention program to reduce overweight and improve fitness in primary school children"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "randomisation took place within each pair with the toss of a coin by an officer of the municipal education service"
Allocation concealment (selection bias)	Low risk	**Comment:** randomisation was done with a coin toss; participants could not foresee assignment

Jansen 2011 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** blinding was not feasible based on nature of intervention
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** blinding was not feasible due to the presence of a PE teacher during PE class in intervention schools
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** very low dropout; missing data not described but were imputed in analysis
Selective reporting (reporting bias)	Low risk	**Comment:** all specified outcomes reported
Cluster RCT - Recruitment bias	High risk	**Comment:** schools were randomised prior to baseline data collection [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline differences adjusted for
Cluster RCT - Loss of clusters	High risk	**Comment:** 6 clusters lost after randomisation
Cluster RCT - Incorrect analysis	Low risk	**Comment:** multi-level analyses were used to allow for clustering of observations within schools

Magnusson 2011

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** 3 pairs of schools in the city of Reykjavik were selected and matched for size (i.e. number of students and total number of grades, with at least 30 students entering Grade 2 in 2006) **School exclusion criteria:** — **Student inclusion criteria:** all children attending Grade 2 **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Iceland
Interventions	**Intervention:** students had opportunities to engage in PA during PE lessons, during recess, and during classes where PA was to be integrated into various subjects of the general curriculum. Teachers at intervention schools were provided access to PA equipment intended to be used during regular school lessons. Teaching materials promoting PA, such as books and DVDs on classroom workouts and cooperative activity games, etc., were provided. After the first year of intervention, an additional PE lesson was introduced at the intervention schools. PE teachers at each of the intervention schools carried out

Magnusson 2011 *(Continued)*

	this additional lesson, which was specifically tailored to suit all children while maintaining a high level of intensity **Comparator:** followed general PA curriculum, compulsory on a national level, consisting of two 40-minute PE sessions/week, in addition to 2 swimming lessons/week, taught over the course of a 6-week period any time during the school year **Duration of intervention:** 2 years **Duration of follow-up:** 2 years **Number of schools:** 6 **Theoretical framework:** social cognitive theory
Outcomes	BMI Fitness PA duration
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (research funding body) **Publication status:** peer-reviewed journal
Stated aim for study	"The objectives of this study were to compare changes in volume and intensity of PA among the group of intervention children to PA levels of children who only received general curriculum-based PA (controls) and further, to assess whether the intervention effect on PA was modified by gender or BMI"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** not described
Allocation concealment (selection bias)	Unclear risk	**Comment:** not described
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** blinding not possible
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** not described
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** large quantity of missing data; reasons not provided
Incomplete outcome data (attrition bias)	High risk	**Comment:** large quantity of missing data; reasons not provided

Magnusson 2011 *(Continued)*

Physical activity and sedentary time		
Selective reporting (reporting bias)	Unclear risk	**Comment:** protocol not published
Cluster RCT - Recruitment bias	High risk	**Comment:** schools recruited and randomised 8 months before baseline measurements
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** adjusted for BMI; many others not considered (e.g. only half of participants had data on socioeconomic status)
Cluster RCT - Loss of clusters	Unclear risk	**Comment:** not described
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Okely 2011

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** secondary schools in New South Wales that submitted an expression of interest and completed a profile used to pair-match schools **School exclusion criteria:** — **Student inclusion criteria:** girls, formally enrolled in Grade 8 within participating schools, provided written consent from themselves and their parent(s) or guardian(s) **Student exclusion criteria:** — **Setting:** school **Age group:** adolescents **Gender distribution:** females **Country/Countries where trial was performed:** Australia
Interventions	**Intervention:** schools developed and implemented unique 18-month action plans with a member of the research team. Intervention strategies were designed to prevent a decline in participation in MVPA levels among girls over the course of the intervention. Each school followed an identical process in developing the intervention, which involved developing an action learning team and the school-specific action plan. The action plan addressed formal curriculum, school environment, and links with the community. During intervention, schools participated in monthly meetings with a member of the research team to share their progress towards study outcomes **Comparator:** continuation of their usual programmes **Duration of intervention:** 18 months **Duration of follow-up:** 18 months **Number of schools:** 25 **Theoretical framework:** health-promoting schools framework

Okely 2011 *(Continued)*

Outcomes	PA duration Sedentary time
Study registration	ACTRN12610001077055
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The primary aim of the study was to test if an 18-month school-based intervention targeting school sport and PE (through the formal curriculum), school ethos (including policies and school breaks such as lunchtime), and links with the local community, could prevent the decline in objectively measured PA compared with matched control schools"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** randomisation using a computer-based random number algorithm
Allocation concealment (selection bias)	High risk	**Comment:** not clear, but 1 matched school replaced a lost cluster
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Comment:** teachers and students blinded to matched comparison schools
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** trained data collectors were blinded to group allocation
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** small number lost to end of study testing without reason; similar between groups. Missing accelerometer data imputed
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes reported in protocol paper published
Cluster RCT - Recruitment bias	High risk	**Comment:** randomisation completed prior to baseline data collection
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** not assessed
Cluster RCT - Loss of clusters	High risk	**Comment:** 1 cluster lost from control group
Cluster RCT - Incorrect analysis	Low risk	**Comment:** all analyses accounted for hierarchical structure of data

Thivel 2011

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** local public schools **School exclusion criteria:** — **Student inclusion criteria:** children in Grade 1 or 2, taking part in standard PE classes offered by the school, not participating in more than 3 hours of extracurricular sports activity/week, free of any known disease, not involved in any other study **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** France
Interventions	**Intervention:** PA programme consisted of 120 minutes (2 times for 60 minutes) of supervised physical exercise in addition to 2 hours of PE classes/week. Sessions consisted of a 10-minute warm-up followed by psychometric activities and exercises to improve coordination, flexibility, strength, speed, and endurance. Content of the programme was designed to enhance pleasure and enjoyment during exercise, to encourage children's participation in PA during the intervention, but also to motivate them to maintain an active lifestyle on a long-term basis. The main objectives of sessions were to increase time spent in PA and to minimise inactivity **Comparator:** followed their habitual 2 hours of PE/week **Duration of intervention:** 6 months **Duration of follow-up:** 6 months **Number of schools:** 19 **Theoretical framework:** —
Outcomes	BMI Fitness
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (governmental organisation) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of this study was to explore the effect of a 6-month school-based PA intervention on obese and lean children's body composition and physical fitness"
Notes	
Risk of bias	

Thivel 2011 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** computer-generated [author communication]
Allocation concealment (selection bias)	High risk	**Comment:** allocation not concealed [author communication]
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Quote from publication:** "children in control group were not aware of intervention group"
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** outcome assessors not blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** sample size of 457 from original 650 participants [suthor communication]
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published
Cluster RCT - Recruitment bias	High risk	**Comment:** students were enrolled after randomisation [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no baseline differences between groups [author communication]
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost [author communication]
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustering not accounted for in analysis

Wilson 2011

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** middle schools in South Carolina paired on school size, percentage of minorities, proportion of free and reduced lunches, and urban or rural setting **School exclusion criteria:** — **Student inclusion criteria:** all Grade 6 students in 24 public middle schools with parental consent who agreed to study participation and random assignment **Student exclusion criteria:** a medical condition that interfered with PA, developmentally delayed such that intervention materials were not cognitively appropriate, currently in treatment for a psychiatric disorder **Setting:** grade school, home **Age group:** children

Wilson 2011 *(Continued)*

	Gender distribution: females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** Active by Choice Today, a 17-week programme implemented on Mondays, Tuesdays, and Thursdays for 2 hours after school. On Wednesdays, students practised what they had learned in the after-school programme in their home environment. A trained team leader, with expertise in implementing PAs among youth, provided the structure for implementation of the Active by Choice Today intervention programme. The programme had 3 main components: homework or snack (30 minutes); MVPA (60 minutes) that students selected each week; and a behavioural skills and motivational component (30 minutes) during which intervention staff worked with participants on developing strategies for increasing MVPA in their home environment. The Active by Choice Today intervention specifically targeted development of behavioural skills (communication, reciprocity of social support, group goal-setting, and behavioral competence) for increasing PA outside of programme days. In addition, the Active by Choice Today after-school programme social environment (autonomy, choice, participation, belongingness, fun, enjoyment, and support) was designed to have a positive impact on cognitive mediators (self-confidence, perceived competence) and motivational orientation (intrinsic motivation, commitment, positive self-concept) to promote long-term PA behaviour **Comparator:** General Health Education Programme (comparison programme) focused on nutrition, stress management, drug prevention, and dropout prevention (with no PA component). Programme consisted of homework or a snack (30 minutes) and 3 hands-on activities related to general health (30 minutes each). The comparison programme was held on the same days and times as the Active by Choice Today intervention programme **Duration of intervention:** 17 weeks **Duration of follow-up:** 19 weeks **Number of schools:** 24 **Theoretical framework:** social cognitive theory and self-determination theory
Outcomes	PA duration
Study registration	NCT01028144 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (this article was supported by a grant (R01 HD 045693) funded by the National Institutes of Child Health and Human Development to D. K. W.) **Publication status**: peer-reviewed journal
Stated aim for study	"The primary aim of this study was to determine the efficacy of the motivational and behavioral skills Active by Choice Today intervention (vs a control program – general health education) on increasing PA at 2-week post-intervention (primary outcome) and at mid-intervention (intermediate outcome) in underserved adolescents"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** no description of the randomisation process given
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at 1 point in time following recruitment, so at time of recruitment, allocation was not known

Wilson 2011 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** not described
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "baseline measures were obtained by blinded measurement staff"
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** did intention-to-treat analysis; also provided details on dropouts
Selective reporting (reporting bias)	Low risk	**Comment:** specified primary outcomes reported on
Cluster RCT - Recruitment bias	Low risk	**Comment:** baseline measures were obtained prior to randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** groups similar at baseline
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "mixed ANCOVAs with random effects appropriate for group randomised trials were used"

Kriemler 2010

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** rural or urban localisation, prevalence of 10% to 30% migrants as in the Swiss population, and, for practical reasons, presence of at least a Grade 1 and a Grade 5 class in each school. Intervention; control schools were located in provinces that were comparable as regards socioeconomic status of the population and recreational facilities at school **School exclusion criteria:** — **Student inclusion criteria:** Grades 1 and 5 students in participating schools **Student exclusion criteria:** — **Setting:** schools, urban and rural **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Switzerland
Interventions	**Intervention:** all children participated in 3 mandatory, 45-minute PE lessons/week; intervention group participated in 2 additional 45-minute PE lessons/week. Mandatory PE lessons were given by the usual classroom teachers according to the specified curriculum; additional lessons were taught mostly outdoors by PE teachers. Three to five 2- to 5-minute activity breaks (motor skill tasks - jumping or balanc-

Kriemler 2010 *(Continued)*

	ing on 1 leg, power games, coordinative tasks) were provided each day during academic lessons. Children also received daily PA homework (10 minutes' worth) prepared by PE teachers, including aerobic, strength, or motor skill tasks (e.g. brushing teeth while standing on 1 leg, hopping up and down the stairs, jumping rope comparable activities) **Comparator:** control group continued to participate in the usual, mandatory PE lessons (45 minutes, 3 times/week); they were not informed that an intervention group existed in the other schools (teachers in the control group were aware but did not know the content of the intervention) **Duration of intervention:** 9 months **Duration of follow-up:** 9 months **Number of schools:** 15 **Theoretical framework:** socioecological conceptual model
Outcomes	PA duration Fitness BMI
Study registration	ISRCTN15360785 (registered retrospectively)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (Swiss Federal Office of Sports (grant number SWI05-013), Swiss National Science Foundation (grant number PMPDB-114401), and Diabetes Foundation of the Region of Basel) **Publication status:** peer-reviewed journal
Stated aim for study	"Our goal was to intervene at the level of the school class, so we did a cluster RCT with a school based stringent PA programme versus traditional PE during 1 school year. We aimed to increase aerobic fitness, PA, and quality of life while decreasing body fat and a composite cardiovascular risk factor score in the intervention group compared with the control group"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** randomised using a random numbers table
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at 1 point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Quote from publication:** "children and parents in the control group were not informed about the existence of the intervention programme in other schools. The teachers in the control group knew about the intervention arm but were not informed about its content"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "assessors responsible for the measurements were blinded to the group allocation for all measurements except skin-fold and waist circumference measures" (Kriemler 2010, p2) **Comment:** blinding was in place for relevant outcomes

Kriemler 2010 *(Continued)*

Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** intention-to-treat principle employed
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** intention-to-treat principle employed, but only 82/205 in control group have completed PA data
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	Low risk	**Comment:** baseline measures were obtained prior to randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** groups were similar at baseline
Cluster RCT - Loss of clusters	High risk	**Comment:** high loss to follow-up; no differences between those who completed and those who were missing, but still likely to introduce bias (e.g. only 82/205 in control group have completed PA data)
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Neumark-Sztainer 2010

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** high schools in Minneapolis or St. Paul metropolitan area of Minnesota that agreed to participate as control or intervention sites. Participating schools were in urban and first-ring suburban areas because of their diverse student bodies **School exclusion criteria:** — **Student inclusion criteria:** girls in intervention and control schools were invited to register for an all-girls PE class as an alternative to the regular co-educational class. In participating schools, students were required to take 1 or 2 PE classes to graduate from high school; participation in this class counted toward that requirement **Student exclusion criteria:** girls were screened for PA and eating disorder behaviours. 4 girls were excluded because of high levels of PA (1 hour/d) **Setting:** school, urban **Age group:** adolescents **Gender distribution:** females **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** intervention group continued to participate in the all-girls PE class during the first semester of the school year. Group members also received the New Moves curriculum during their PE class (approximately 16 weeks) and participated in New Moves activities throughout the rest of the school year (maintenance period). This programme included:

Neumark-Sztainer 2010 *(Continued)*

	• New Moves PE class - nutrition and social support or self-empowerment sessions (PA (Be Fit) 4 days/week taught by school PE teachers (3 days) and community guest instructors (1 day) and nutrition (Be Fueled) or social support or self-empowerment (Be Fab) classes 1 day/week); • individual counselling sessions using motivation interviewing techniques (to set personal goals for behavioural change based on 8 New Moves objectives); • lunch get-together ("lunch bunches") once/week during maintenance period, where participants were served healthy food and engaged in informal discussions on New Moves topics; and • minimal parent outreach activities (i.e. 6 postcards sent home to reinforce New Moves messages and a parent-daughter retreat day focused on New Moves messages during the maintenance period). PE teachers attended full-day training before intervention and half-day training during intervention. They received regular, ongoing support from New Moves staff throughout the programme. New Moves intervention staff ran all programme components aside from the PE class. These staff received training and ongoing support in motivational interviewing techniques **Comparator:** control group continued to participate in the all-girls PE class during the first semester of the school year. Teachers were free to conduct PE classes as they desired during the study period and did not receive training on New Moves until after the study period **Duration of intervention:** 16 weeks **Duration of follow-up:** 16 weeks **Number of schools:** 12 **Theoretical framework:** social cognitive theory
Outcomes	BMI
Study registration	NCT00250497
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health) **Publication status:** peer-reviewed journal
Stated aim for study	"This paper describes the main findings from a group-RCT designed to evaluate the impact of a school-based intervention aimed at preventing weight related problems in adolescent girls: New Moves"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Comment:** random numbers table [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at 1 point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** blinding of participants not described
Blinding of outcome assessment (detection bias)	Unclear risk	**Comment:** unclear whether trained staff taking measurements were blinded to intervention allocation

Neumark-Sztainer 2010 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** less than 10% dropout rate in intervention group; no details on reasons for dropout provided
Selective reporting (reporting bias)	Low risk	**Comment:** all main outcomes reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** baseline data collected before randomisation [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** differences adjusted for in analyses
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Angelopoulos 2009

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** from total number of primary schools in the region, a random sample of 26 schools was selected **School exclusion criteria:** — **Student inclusion criteria:** Grade 5 pupils **Student exclusion criteria:** — **Setting:** schools, urban and rural **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Greece
Interventions	**Intervention:** 12-month programme (January 2005 to January 2006) integrated into existing school curriculum in combination with PE and science and environmental classes, providing the least possible disturbance. Programme material included a student's workbook and a teacher's manual, which offered activities for use in class in an appendix. The manual covered the following: self-esteem, body image, nutrition, PA, fitness, and environmental issues; materials were used 1 to 2 hours/week. Motivational methods and strategies were used to increase knowledge (i.e. discussion, active learning, cues), increase skills and self-efficacy (i.e. modelling, guided practice, enactment), achieve better self-monitoring (i.e. problem-solving, goal-setting), improve attitudes and beliefs (i.e. self re-evaluation, environmental re-evaluation, arguments, modelling, direct experience), and modify social influence (i.e. modelling, mobilising social support). School teachers trained by the research team delivered the intervention, and there was a home component for which parental involvement was required to provide reinforcement **Comparator:** —

Angelopoulos 2009 *(Continued)*

	Duration of intervention: 12 months **Duration of follow-up:** 12 months **Number of schools:** 26 **Theoretical framework:** theory of planned behaviour
Outcomes	BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** — **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of the current study was to evaluate the effectiveness of this school-based intervention program, which was developed and implemented based on the Theory of Planned Behavior, on obesity indices and blood pressure in primary school children in the prefecture of Ioannina—a poor area with high obesity rates in Greece"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Comment:** random digits used to develop allocation sequence
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at 1 point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** cannot determine how many students started the study; know only how many finished
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published; cannot assess
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** no indication that participants were registered before randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** participant characteristics balanced at baseline
Cluster RCT - Loss of clusters	Low risk	**Comment:** same N (321/325) reported in all analyses

Angelopoulos 2009 *(Continued)*

Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "inter-school variation was also taken into account by including the random school effect in the models"

Donnelly 2009

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** 26 elementary schools in Northeast Kansas **School exclusion criteria:** — **Student inclusion criteria:** participants were in Grades 2 and 3 at baseline **Student exclusion criteria:** — **Setting:** school, urban **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** Physical Activity Across the Curriculum; provided training for classroom teachers (6-hour in-service session) to deliver existing academic lessons taught thorough PA, using examples from TAKE 10!, a programme of the International Life Sciences Institute Research Foundation/Center for Health Promotion. 90 minutes/week of MVPA academic lessons was delivered intermittently throughout the school day **Comparator:** regular classroom instruction without physically active lessons **Duration of intervention:** 3 years **Duration of follow-up:** 3 years **Number of schools:** 24 **Theoretical framework**: —
Outcomes	BMI PA duration
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Institutes of Health) **Publication status:** peer-reviewed journal
Stated aim for study	"The primary aim of Physical Activity Across the Curriculum was to increase PA sufficiently to reduce gains in BMI for Physical Activity Across the Curriculum compared to control schools"
Notes	
Risk of bias	

Donnelly 2009 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** no description of the randomisation process given
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at 1 point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Quote from publication:** "RA who conducted classroom visitations were not blinded"
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "RA were blinded to condition for measurement of the primary and secondary outcomes, and for data entry"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** 2.5% missing data; not likely to affect results
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Unclear risk	**Comment:** missing data from sub-sample that wore accelerometers not reported
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** no indication participants consented before randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** participant characteristics balanced at baseline
Cluster RCT - Loss of clusters	High risk	**Comment:** 1 school dropped out because of randomisation, another school was lost for another reason that could not be related to the intervention. Overall small number lost, but no comparison of characteristics between those lost and those retained
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Dorgo 2009

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** — **School exclusion criteria:** — **Student inclusion criteria:** high school students enrolled in PE classes at selected high schools **Student exclusion criteria:** cardiovascular problems, spine deformities, pregnancy

Dorgo 2009 *(Continued)*

	Setting: school **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention 1:** PE programme that used manual resistance training in every session. 80-minute class sessions 3 times/week, plus a 10- to 15-minute warm-up segment with light cardiovascular activities and dynamic stretching followed by the manual resistance training-specific segment of approximately 20 to 30 minutes, conducted and supervised by trained research assistants **Intervention 2:** manual resistance training PE programme plus a cardiovascular endurance training segment in every session. 80-minute class sessions, 3 times/week, plus a 20- to 30-minute manual resistance training segment, conducted and supervised by trained research assistants, with an additional 20- to 30-minute period devoted to cardiovascular endurance training. Cardiovascular activities included walking, jogging, step aerobics, and aerobic kickboxing **Comparator:** a regular PE programme that followed the usual school curriculum. 80-minute class sessions. 3 times/week. PE classes focused on skill development for various individual PAs (i.e. bowling, badminton, tennis, table tennis, golf, various track and field events) and team PAs (i.e. soccer, basketball, softball or baseball, volleyball, floor hockey), as well as participation in leisure activities (i.e. hiking) and sport tournaments **Duration of intervention:** 18 weeks **Duration of follow-up:** 18 weeks **Number of schools:** 3 **Theoretical framework:** —
Outcomes	BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Institutes of Health, National Center on Minority Health and Health Disparities through the Hispanic Health Disparities Research Center, and by Grant Number 5G12RR008124 from National Institutes of Health, Research Centers in Minority Institutions) **Publication status:** peer-reviewed journal
Stated aim for study	"The purpose of this study was to document the changes in physical fitness scores and body composition measures of adolescents through the application of manual resistance training and cardiovascular endurance training in school-based PE settings compared with adolescents attending a traditional PE program"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** coin flipping [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known

Dorgo 2009 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Quote from publication:** “24 subjects failed to attend the post-test data collection and were not included in the data analyses” (Dorgo, 2009, p.2291)
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published; cannot assess
Cluster RCT - Recruitment bias	Low risk	**Comment:** baseline data collected before randomisation
Cluster RCT - Baseline imbalance	High risk	**Comment:** baseline differences in some outcomes
Cluster RCT - Loss of clusters	High risk	**Comment:** clusters lost to follow-up
Cluster RCT - Incorrect analysis	High risk	**Comment:** no indication clustering was accounted for in analysis

Gentile 2009

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** all 10 elementary schools in Lakeville, Minnesota, and Cedar Rapids, Iowa, USA **School exclusion criteria:** — **Student inclusion criteria:** Grades 3, 4, and 5 **Student exclusion criteria:** — **Setting:** community, home, school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** 'Switch' programme, promoted healthy active lifestyles by encouraging students to 'Switch what you Do, Chew, and View', including be active for 60 minutes or more/d, limit total screen time to 2 hours or fewer/d, and eat 5 fruits or vegetables or more/d. Community component: promotion of awareness of healthy lifestyles and prevention of childhood obesity included paid advertising (e.g. billboards) and unpaid media emphasising key messages. School component*:* teachers were provided materials and ways to integrate key concepts into their existing curricula. Family component*:* provided parents (and children) with materials and resources to facilitate adoption of healthy target

Gentile 2009 *(Continued)*

	behaviours. Monthly packets containing behavioural tools were provided to assist parents and children in modifying their behaviours **Comparator:** no intentional exposure to the Switch programme; may have been exposed to the community component of the intervention; did not receive any school materials; did not receive materials or resources, other than surveys **Duration of intervention:** 8 months **Duration of follow-up:** 14 months **Number of schools:** 10 **Theoretical framework:** socioecological model
Outcomes	BMI
Study registration	NCT00685555 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** other funding (in Lakeville, Minnesota, Switch was sponsored by Medica Foundation, Healthy and Active America Foundation, and Fairview Health Services; in Cedar Rapids, Iowa, Switch was sponsored by Cargill, Inc, and the Healthy and Active America Foundation) **Publication status:** peer-reviewed journal
Stated aim for study	"The primary objectives of Switch were to: (1) increase the amount of PA; (2) reduce the amount of screen time (television and video game time); and (3) increase fruit and vegetable consumption among children from grade 3 to 5"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** random number generated; Excel [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Comment:** participants did not know about other conditions [author communication]
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** study personnel were not blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** incomplete outcome data; not adequately addressed
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on

Gentile 2009 *(Continued)*

Cluster RCT - Recruitment bias	Low risk	**Comment:** baseline data were collected before randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no baseline differences apparent
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost to follow-up
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering adjusted for in analysis

Neumark-Sztainer 2009

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** 4 urban schools in St. Paul, Minnesota, USA, in which 90% of students qualified for free or reduced price lunch **School exclusion criteria:** — **Student inclusion criteria:** all children in Grades 4 to 6 at intervention and control schools were eligible to participate and were selected on a first come, first served basis **Student exclusion criteria:** — **Setting:** school, community, theatre, urban **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** 3 components • 14 × 2-hour after-school theatre sessions • 8 weekly after-school booster sessions • Family outreach to enhance home support for behavioural changes through positive reinforcement of health behaviours, parent-child participation in PAs, and availability of healthy foods Each theatre session included • A 'check-in' in which children were given an opportunity to share any behavioural changes they had made over the past week (e.g. eating more fruits and vegetables) and to talk about how take-home packages were received by families • Easy-to-prepare healthy snacks • A movement component of fun and easy activities requiring minimal resources (e.g. dancing, walking) • Theatrical ACTivities For the initial sessions, the ACTivities component included exercises to introduce children to theatre techniques and to build trust and cooperation. In later sessions, ACTivities focused on enhancing knowledge and skills related to PA and healthy eating and promoting a positive body image through interactive activities. Children were asked to share their personal experiences related to being active and eating healthfully. The content of the script for the Ready. Set. ACTION! play was developed through these activities. During final sessions, children were introduced to the script and began to rehearse for

Neumark-Sztainer 2009 *(Continued)*

	the final play performance. Booster sessions included activities such as creating advertisements for fruits and vegetables; painting positive affirmations (e.g. I am special) on a mirror to take home; brainstorming ways to be active while watching television (e.g. doing jumping jacks during commercials); teaching dance and strength training exercises to classmates; learning exercises to do at home with families; and rehearsing for school performance of the Ready. Set. ACTION! play. For the family outreach component, Weekly Fun and Fitness packs (i.e. a healthy food with a simple recipe or fitness incentives for the family) and a CD of the Ready. Set. ACTION! songs were sent home (each pack also included a parent postcard with information and interactive activities on a topic addressed in the after-school programme). There were also 2 family events • Students' performance of the play • A 'Ready. Set. ACTION! DVD Release Party' (i.e. family viewing of the DVD recording of the play production, a short performance by children, and a communal family dinner) **Comparator:** theatre-based intervention involving performing a play focused on environmental health issues using a prepared script **Duration of intervention:** 16 weeks **Duration of follow-up:** 16 weeks **Number of schools:** 4 **Theoretical framework**: social cognitive theory
Outcomes	BMI
Study registration	NCT00604513 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** other funding (National Institutes of Health (R21 DK072972 to D.N.S.); National Institute of Diabetes and Digestive and Kidney Diseases; Illusion Theater received additional funding for theatre components from The Medica Foundation, The General Mills Communities of Color Project Grants, and The Best Buy Children's Foundation) **Publication status:** peer-reviewed journal
Stated aim for study	"Our primary aim was to develop and test the feasibility of implementing Ready. Set. ACTION!, developed in partnership between researchers at the University of Minnesota and artists/educators from Illusion Theater, a Minneapolis-based theatre company with experience in educational theatre"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** drawing names [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Comment:** participants were not blinded but did not know of the study hypothesis [author communication]
Blinding of outcome assessment (detection bias)	High risk	**Comment:** outcome assessors were not blinded [author communication]

Neumark-Sztainer 2009 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** authors should have used intention-to-treat analysis. Although they did adjust for baseline differences, they adjusted for only certain characteristics like age and sex, and not for any of the outcome variables
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	Low risk	**Comment:** baseline data were collected before school randomisation [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** no substantive baseline differences were found
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters were lost
Cluster RCT - Incorrect analysis	High risk	**Comment:** clustering was not accounted for in statistical analysis

Peralta 2009

Study characteristics	
Methods	**Study design:** RCT
Participants	**Student inclusion criteria:** participants were recruited from the entire Grade 7 (12 to 13 years; N = 172) student population of a single-sex (boys) secondary school in Sydney, Australia. Following completion of the school's compulsory fitness testing battery, students' cardiorespiratory fitness results (measured by the Multistage Fitness Test) were ranked from highest to lowest (119 to 9 laps). Students with lowest scores (< 49 laps, N = 60; placing them in the bottom 50th percentile among boys this age in New South Wales, Australia) were invited to participate **Student exclusion criteria:** no other inclusion or exclusion criteria **Setting:** school **Age group:** adolescents **Gender distribution:** males **Country/Countries where trial was performed:** Australia
Interventions	**Intervention:** the intervention programme was primarily based on social cognitive theory, with 16 program weeks, each week comprising 1 × 60-minute curriculum session and 2 × 20-minute lunchtime PA sessions. Each 60-minute curriculum session included practical and/or theoretical components focused on promoting PA through increasing physical self-esteem and self-efficacy, reducing time spent in small-screen recreation on weekends, decreasing sweetened beverage consumption, increasing fruit consumption and the acquisition and practice of self-regulatory behaviours such as goal-setting and time management, and identifying and overcoming barriers. Behaviour modification techniques (e.g. group goals converting time spent in PA to kilometres to reach a specified destination) and incentives were used. The practical component included modified games and activities. The researcher primarily facilitated the intervention with staff and parent involvement. A Program Champion (PE teacher) liaised with School Executive and other staff to promote the programme within the school and to assist with logistical requirements. Grade 11 students peer-facilitated lunchtime sessions based on their potential to be positive role models and had 1, 20-minute training session. Parents were emailed 6 newsletters throughout, informing them of programme content, motivating them, and suggesting

Peralta 2009 *(Continued)*

	strategies to engage the family in healthy behaviours, creating a stronger connection between parents and the school **Comparator:** participated in 16 × 60-minute curricular PA sessions at the same time as the intervention group, with a school PE teacher guiding the control group **Duration of intervention:** 16 weeks **Duration of follow-up:** 16 weeks **Number of schools:** 1 **Theoretical framework**: social cognitive theory
Outcomes	PA duration BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** other funding (the broader intervention school community partly funded the study) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of this study was to assess the feasibility, acceptability and potential efficacy of a multifaceted secondary school-based program (the Fitness Improvement Lifestyle Awareness Program) among adolescent boys with low cardiorespiratory fitness"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** participants were randomised, using a computer-based number-producing algorithm, to either intervention or active comparison group
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** not described
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "trained independent assessors, blind to group allocation, conducted the measurements" (Peralta 2009, p538)
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** outcome data complete
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** outcome data complete

Peralta 2009 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published; cannot assess

Walther 2009

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** Grade 6 classes from 3 different schools were recruited **School exclusion criteria:** — **Student inclusion criteria:** study selection was based on willingness of parents to allow their children to participate in the study protocol for at least 1 year **Student exclusion criteria:** none **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Germany
Interventions	**Intervention:** classes were assigned to 1 unit of physical exercise (45 minutes) with at least 15 minutes of endurance training/school day. In addition, lessons on healthy lifestyle were included in the regular schedule once monthly for all pupils **Comparator:** according to German standards, 2 units (each 45 minutes) of PE/week are mandatory in all schools. Non-randomised sport students (reference group) received 12 units (45 minutes/unit) of high-level endurance exercise training/week and frequently participated in competitive sporting events, thus representing maximum of physical fitness attainable under reasonable conditions in school-age children **Duration of intervention:** 1 year **Duration of follow-up:** 1 year **Number of schools:** 3 **Theoretical framework:** —
Outcomes	Fitness BMI
Study registration	NCT00176371
Publication details	**Language of publication:** English **Funding:** other funding (Novartis, Deutsche Forschungsgemeinschaft (KO 3512/1-1), Roland Ernst Stiftung) **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of this study was to investigate the effect of daily school exercise on physical fitness, motor skills, and body composition in school children through a randomised, prospective trial"

Walther 2009 *(Continued)*

Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** randomisation process not reported
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** incomplete outcome data; not adequately addressed
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	Low risk	**Comment:** randomisation completed after students enrolled
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** no information given
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Reed 2008

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** elementary schools from the Vancouver and Richmond School Districts in British Columbia, Canada, not already engaged in PA programmes **School exclusion criteria:** — **Student inclusion criteria:** all children in Grades 4 and 5 attending included schools **Student exclusion criteria:** 3 girls and 2 boys excluded as they had health conditions that could affect normal PA or development **Setting:** school, community, home, urban

Reed 2008 *(Continued)*

	Age group: children **Gender distribution:** females and males **Country/Countries where trial was performed:** Canada
Interventions	**Intervention:** Action Schools! BC model was consistent with the 'active school' framework and emphasised an integrated whole-school approach rather than traditional classroom-based health education, targeting 6 Action Zones • School Environment • Scheduled Physical Education • Extracurricular Activity • School Spirit • Family and Community • Classroom Action. Classroom Action was the only prescriptive component of Action Schools! BC model in which teachers delivered 15 minutes of moderate to intense PA daily to achieve 75 minutes of extra PA/week (in addition to 2 × 40-minute PE classes). Teachers provided opportunities to 'snack on PAs' such as skipping, dancing, and resistance exercises throughout the day School Action Team – comprised school principal, teachers, or both - was convened at each school; an Action Schools! BC facilitator worked with Action Teams to design a programme with activities across the 6 Action Zones. A 1-day training workshop was held for intervention teachers, who were provided a Classroom Action Bin with resources to support their Action Plan, with the goal for each school to provide students with 150 minutes of PA/week (2 × 40-minute PE classes and 15 × 5 minutes/d of Classroom Action) **Comparator:** teachers in usual practice schools continued their regular programmes of PE and school-based PA **Duration of intervention:** 11 months **Duration of follow-up:** 11 months **Number of schools:** 8 **Theoretical framework:** social cognitive theory
Outcomes	BMI Fitness
Study registration	NCT01412203 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** British Columbia Ministry of Health **Publication status:** peer-reviewed journal
Stated aim for study	"Our primary objective was to determine whether Action Schools! BC was an effective model to decrease cardiovascular risk factors in elementary-school children"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Reed 2008 *(Continued)*

Random sequence generation (selection bias)	Low risk	**Quote from publication:** "schools were then remotely randomised to either Usual Practice or Intervention by an epidemiologist not involved in the trial" (Reed 2008, p527) **Comment:** randomisation performed remotely via a random number draw [author communication]
Allocation concealment (selection bias)	High risk	**Comment:** it was reported that it was not possible for schools to be blinded to random assignment; therefore concealment was not attained
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants were not blinded [author communication]
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** outcome assessors were not blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** incomplete outcome data; not adequately addressed
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	High risk	**Comment:** data collection after randomisation
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** not described
Cluster RCT - Loss of clusters	Low risk	**Comment:** very low loss to follow-up, most often due to moving to a different school
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Salmon 2008

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** convenience sample of 3 government primary schools located on 4 campuses in low socioeconomic status areas (based on socioeconomic index for area scores) in metropolitan Melbourne was recruited to the study **School exclusion criteria:** — **Student inclusion criteria:** all Grade 5 (approximately 10 to 11 years old) students at selected schools were eligible to participate and were invited to take part in the study **Student exclusion criteria:** — **Setting:** school, urban **Age group:** children

Salmon 2008 *(Continued)*

	Gender distribution: females and males **Country/Countries where trial was performed:** Australia
Interventions	*Students were assigned to 1 of 4 conditions: a Behavioural Modification group, a Fundamental Motor Skills group, a combined Behavioural Modification and Fundamental Motor Skills group, or a control group. Components of the intervention programme were developed by the study team, with others adapted from previous interventions (SPARK), concepts outlined in Robinson's study, from Planet Health, and from the Victorian Fundamental Motor Skills programme* **Intervention 1:** behavioural modification: included 19 sessions of 40 to 50 minutes over 3 school terms by intervention specialist teacher, with different aims for each set of lessons (e.g. increasing awareness of time use, health benefits of PA, self-monitoring time spent in sedentary behaviours and PA, raising awareness of home and community environments in relation to choices and opportunities, decision-making skills, developing their own PAs and games, 'intelligent viewing', a 'Switch-off Challenge', intermittent reinforcement schedule with a small reward) **Intervention 2:** fundamental motor skills: 19 sessions of 40 to 50 minutes over 3 school terms taught by the same intervention specialist teacher who delivered the behavioural modification intervention. The fundamental motor skills intervention focused on 6 skills, including 3 object control skills and 3 locomotor skills. Skills were taught with emphasis on fun through games and maximum involvement for all children. Most lessons focused on at least 2 skills, and each skill was a focus lesson in at least 6 sessions **Intervention 3:** behavioural modification and fundamental motor skills **Comparator:** usual classroom lessons **Duration of intervention:** 1 school year **Duration of follow-up:** 2 years **Number of schools:** 3 **Theoretical framework:** social marketing theory and behavioural choice theory
Outcomes	PA duration BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (Victorian Health Promotion Foundation) **Publication status:** peer-reviewed journal
Stated aim for study	"The primary aims of this study were to evaluate the effectiveness of an intervention designed to prevent excess weight gain (beyond gains associated with normal growth and maturation), reduce the likelihood of being overweight or obese, reduce time spent in recreational screen behaviours (TV, computer, and electronic games) and promote PA participation among 10-year-old children"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	High risk	**Comment:** participants selected a ticket from a container, which specified group allocation

Salmon 2008 *(Continued)*

Allocation concealment (selection bias)	High risk	**Comment:** allocation was concealed from parents and teachers until after baseline data collection [author communication]
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants and study personnel were not blinded [author communication]
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** 2 trained staff members not blinded to group assignment took measurements
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** incomplete outcome data; not adequately addressed
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** incomplete outcome data; not adequately addressed
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	Low risk	**Comment:** school classes randomised after recruitment
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline differences between groups, but confounders adjusted for in secondary analyses
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Wang 2008

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** elementary schools in Augusta, Georgia **School exclusion criteria:** — **Student inclusion criteria:** all Grade 3 students attending the 9 intervention schools were invited to enrol in the FitKid Project free of charge **Student exclusion criteria:** — **Setting:** school, urban **Age group:** children **Gender distribution:** females and males

Wang 2008 *(Continued)*

	Country/Countries where trial was performed: USA
Interventions	**Intervention:** the 'FitKid' after-school programme was offered 5 days/week (not offered during holidays and vacation periods). Certified school teachers and paraprofessionals implemented the programme, following established guidelines that included reinforcement and teaching techniques, safety measures, evaluation procedures, and monthly activity plans that accommodate local weather conditions (i.e. more outdoor-based activities in spring, winter, and late fall, and more indoor activities in summer and early fall, when it is often too hot and humid to play outside). 2-hour intervention sessions began with a 40-minute period during which youths were provided a healthy snack and academic enrichment activities. Snacks were provided through the US Department of Agriculture's National School Lunch and Child and Adult Care Food Programs in cooperation with the school nutrition service. Academic enrichment activities were incorporated into the programme to ensure that participation in the FitKid intervention during after-school hours would not damage the academic progress of children. The 80 minutes of PA included a variety of activities designed to improve sport skills, aerobic fitness, strength, and flexibility; 40 minutes was devoted to vigorous PA **Comparator:** — **Duration of intervention:** 3 school years **Duration of follow-up:** 3 years **Number of schools:** 18 **Theoretical framework:** —
Outcomes	BMI Fitness
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Institutes of Health) **Publication status:** peer-reviewed journal
Stated aim for study	"The objective of this study was to evaluate the cost-effectiveness of the Medical College of Georgia FitKid Project, a 3-year, after-school program designed to prevent obesity among elementary school students"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Quote from publication:** "schools then were randomised within strata to control or experimental arms of the project using a random number table"
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** students were notified of intervention status
Blinding of outcome assessment (detection bias)	Unclear risk	**Comment:** no information given; likely not done

Wang 2008 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** incomplete outcome data; not adequately addressed
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	High risk	**Comment:** schools randomised before participants enrolled; some students notified of intervention assignment prior to recruitment
Cluster RCT - Baseline imbalance	Low risk	**Comment:** adjusted for baseline differences
Cluster RCT - Loss of clusters	Unclear risk	**Comment:** no information given
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Webber 2008

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** public middle schools at which a majority of students lived in the surrounding community, enrolment of at least 90 grade 8 girls, yearly withdrawal rates < 28%, at least 1 semester of PE required for each grade, willingness to sign a memorandum of understanding and to accept random assignment of the school **School exclusion criteria:** none **Student inclusion criteria:** Grades 6, 7, and 8 female students **Student exclusion criteria:** limited English-speaking skills, inability to participate in PE classes due to a medical condition or disability, contraindication for participating in a submaximal exercise test (2005 measurements only) **Setting:** community, school **Age group:** adolescents **Gender distribution:** females **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** Trial of Activity for Adolescent Girls health education included 6 lessons in each of Grades 7 and 8 designed to enhance behavioural skills known to influence PA participation. Activity challenges associated with lessons reinforced the contents, encouraged self-monitoring, and set goals for behaviour change. To meet varying formats in which health education was taught at the school, Trial of Activity for Adolescent Girls health education was offered in 2 forms: 1 for a traditional classroom setting and 1 for a PE class. Trial of Activity for Adolescent Girls PE class promoted MVPA for at least 50% of class time and encouraged teachers to promote PA outside of class. Activities targeted to create: • environmental and organisational changes supportive of PA; and • cues, messages, and incentives to be more physically active

Webber 2008 *(Continued)*

	Specifically, the intervention was designed to establish more opportunities, improve social support and norms, and increase self-efficacy, outcome expectations, and behavioural skills to foster greater MVPA. 35 to 40 girls were the focus of the intervention; however, health and PE classes were part of the usual school curriculum, and most included boys as well. An innovative feature of the intervention was linking school and community agencies to develop and promote PA programmes for girls. These programmes were delivered both on and off school property, in most cases before or after school **Comparator:** — **Duration of intervention:** 2 years **Duration of follow-up:** 2 years **Number of schools:** 36 **Theoretical framework:** social cognitive theory, diffusion of innovation, operant learning theory
Outcomes	PA duration Sedentary time BMI
Study registration	NCT00006409
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Heart, Lung, and Blood Institute) **Publication status:** peer-reviewed journal
Stated aim for study	"The primary aim of Trial of Activity for Adolescent Girls was to test an intervention to reduce by half the observed decline in MVPA experienced by adolescent girls"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** computer generated [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "Trial of Activity for Adolescent Girls staff was blinded to the study outcomes until the 2006 data collection was complete. Also, separate intervention and measurement staff were employed" (Webber 2008, p174)
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** incomplete outcome data; not addressed adequately **Quote from publication:** "in a study such as Trial of Activity for Adolescent Girls, efforts to obtain a complete set of measurements on the girls assigned to each treatment condition would require considerable resources, as it is expensive to track and measure students who have left a school. Furthermore,

Webber 2008 *(Continued)*

		despite extraordinary efforts, ascertainment of measurements in every girl in the cohort is unlikely" (Stevens 2005, p226)
Incomplete outcome data (attrition bias) Physical activity and sedentary time	High risk	**Comment:** incomplete outcome data; not addressed adequately **Quote from publication:** "in a study such as Trial of Activity for Adolescent Girls, efforts to obtain a complete set of measurements on the girls assigned to each treatment condition would require considerable resources, as it is expensive to track and measure students who have left a school. Furthermore, despite extraordinary efforts, ascertainment of measurements in every girl in the cohort is unlikely" (Stevens 2005, p226)
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	Low risk	**Quote from publication:** "schools at each of the six field centres were randomised in equal numbers to either intervention or control condition after baseline measurements were collected"
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline differences were compared using mixed models, with students nested within schools nested within intervention [author communication]
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost to follow-up
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in the analysis

Weeks 2008

Study characteristics	
Methods	**Study design:** RCT
Participants	**Student inclusion criteria:** students of sound general health, fully ambulatory, with written consent of a parent or guardian **Student exclusion criteria:** metabolic bone disease, endocrine disorder, or chronic renal pathology; taking medications known to affect bone; recovering from lower limb fracture or other immobilised injury; were affected by any condition not compatible with PAs likely to raise heart rate for up to 10 minutes **Setting:** school **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Australia
Interventions	**Intervention:** 10 minutes of directed jumping activity at the beginning of every PE class (twice/week). Activities designed to apply loads to the skeleton at high strain magnitude, frequency, and rate; included jumps, hops, tuck-jumps, jump-squats, stride jumps, star jumps, lunges, side lunges, and skipping. Jumps were occasionally supplemented with upper body strengthening activities, including pushups and exercises with resistive latex bands (AusBand; Ausmedic Australia) **Comparator:** regular PE warm-ups and stretching directed by the usual PE teacher at the beginning of every PE class (twice/week). Activities focused on improving flexibility and general preparedness for PA

Weeks 2008 *(Continued)*

	without specifically loading the skeleton at higher rates than normal, including: brisk walking, light jogging, and stretching **Duration of intervention:** 8 months **Duration of follow-up:** 8 months **Number of schools:** 1 **Theoretical framework:** —
Outcomes	BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** — **Publication status:** peer-reviewed journal
Stated aim for study	"The aim of the Preventing Osteoporosis With Exercise Regimes in Physical Education study was to determine the effect of a practical, evidence-based exercise regimen (10 min of jumping activity twice/week for 8 months) on parameters of bone and muscle strength in healthy adolescent boys and girls in comparison with age- and sex-matched controls"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** block randomisation using a list produced by a random number generator [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** participants not blinded
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** most of the assessment process was blinded, except dual-energy X-ray absorptiometry measures [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** intention-to-treat analysis was not completed on outcomes of interest
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published; cannot assess

Barbeau 2007

Study characteristics

Barbeau 2007 *(Continued)*

Methods	**Study design:** RCT
Participants	**Student inclusion criteria:** black girls 8 to 12 years of age (Grades 3, 4, and 5) from 8 local elementary schools who weighed < 300 lbs; were not taking any medication known to affect body composition or fat distribution; and were able to participate in regular PA **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** 10-month after-school PA programme on body composition and cardiovascular fitness in young black girls, offered every school day during the school year, with transportation (i.e. school bus service) provided to encourage participation. 30 minutes of homework time while students received a free, healthy snack and 80 minutes of PA. Snacks were individually packaged, and every day offered something salty (e.g. crackers and cheese), something sweet (e.g. low-fat cookies), or a fruit or vegetable. Students chose 1 snack with the option of another if they wished. The PA included 25 minutes of skill development, 35 minutes of MVPA, with 20 minutes of toning and stretching. Students wore Polar Accurex Plus HR monitors (Port Washington, NY) every day and were instructed to maintain their heart rate above 150 beats/min during MVPA. MVPA activities included games such as basketball, tag, softball, relay races, etc., modified for activity of all students through the 35-minute period. Students received small weekly prizes for behaviour and attitude, and for having no more than 1 unexcused absence. A student of the month at each school received a slightly larger prize, with prizes intended to reward good behaviour, participation, and effort. Parents were called when students had 2 consecutive unexcused absences, with reasons discussed and parents encouraged to send their daughter back to the programme. Teachers most often worked the intervention at their own school and in some cases were assigned to work at a different school. Teachers received formal training with background information on childhood obesity, PA, and cardiovascular risk factors, study goals, and the study protocol and types of activities appropriate for each segment of the intervention. Role-playing was a large component of training; teachers were asked to prepare a lesson plan for 1 day and did a shortened simulation of it, so feedback could be provided. A Manual of Procedures for each school included all information needed to implement the intervention, including several potential activities. Teachers hired after training received 1-on-1 training on theoretical aspects and observed several sessions before their own implementation **Comparator:** — **Duration of intervention:** 10 months **Duration of follow-up:** 10 months **Number of schools:** 8 **Theoretical framework:** —
Outcomes	BMI Fitness
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Institutes of Health) **Publication status:** peer-reviewed journal

Barbeau 2007 *(Continued)*

Stated aim for study	"This study targeted the prevention of further accretion of undesirable levels of adipose tissue in black girls through regular PA"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** randomisation process not reported
Allocation concealment (selection bias)	Low risk	**Comment:** allocation occurred after testing; therefore concealed. It was not known or determined at time of study entry which group the next participant would go to
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** incomplete outcome data not addressed
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published; cannot assess

Williamson 2007

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** 4 private Catholic schools **School exclusion criteria:** — **Student inclusion criteria:** students in Grades 2 to 6 during Year 1 were enrolled in the programme by written informed consent by students and their parents **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	*The Healthy Eating and Exercise and Alcohol/Tobacco/Drug abuse prevention programmes were developed as environmental approaches for weight gain. The primary components of the programmes were to alter the physical and social environment of schools. Both programmes were rationally linked to a "Wise*

Williamson 2007 *(Continued)*

	Mind" concept, which was a central feature of both programs, thus allowing the use of Wise Mind as the name for the programme (as a whole), as opposed to just 1 intervention arm of the study. The Wise Mind concept represents the idea that with knowledge and environmental changes, students can make wise decisions about nutrition, PA, and substance use or abuse. Environmental changes were designed to alter the ecology of the school environment, including policy, personal, social, cultural, and physical environmental changes **Intervention:** Healthy Eating and Exercise programme, designed with the goal of preventing inappropriate weight gain by modifying the school environment to improve healthy eating habits, increase PA, and decrease sedentary behaviour at school, and to encourage these same behavioural changes outside the school environment. The goal of the PA programme was to increase PA during the school day and at home. Teachers were provided containers filled with indoor play supplies (e.g. balloons, bean bags) and outdoor play supplies (e.g. balls, jump ropes) to promote active play during class time and recess. Posters encouraged the use of these physical activity centres, and brief lesson plans provided academic games that used the supplies provided at physical activity centres **Comparator:** Alcohol/Tobacco/Drug abuse prevention programme, designed with the goal of modifying children's beliefs and attitudes regarding use and abuse of tobacco, alcohol, and illicit drugs, so that they reflected "healthier" values **Duration of intervention:** 2 years **Duration of follow-up:** 2 years **Number of schools:** 4 **Theoretical framework:** —	
Outcomes	BMI	
Study registration	—	
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Institutes of Health Grant R01 DK063453–01) **Publication status:** peer-reviewed journal	
Stated aim for study	"The primary aim of the Wise Mind pilot project was to test whether an environmental approach for weight gain prevention, delivered in schools, was more effective for weight gain prevention in comparison with an active control program that used an environmental approach to prevent substance use. Secondary aims were to test for changes in percentage body fat, dietary habits, PA, and psychosocial variables associated with the weight gain prevention program"	
Notes		
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Comment:** random draw [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Comment:** participants were blinded to group allocation [author communication]

Williamson 2007 *(Continued)*

Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** outcome assessors were not blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** missing values were replaced with calculated estimates
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published; cannot assess
Cluster RCT - Recruitment bias	Low risk	**Comment:** randomisation occurred after baseline data collected [author communication]
Cluster RCT - Baseline imbalance	High risk	**Comment:** not compared [author communication]
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost to follow-up [author communication]
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Haerens 2006

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** random sample of 15 schools out of the 65 schools with technical and vocational education in West Flanders (Belgium) **School exclusion criteria:** — **Student inclusion criteria:** pupils in Grades 7 and 8 **Student exclusion criteria:** — **Setting:** school, urban **Age group:** adolescents **Gender distribution:** females and males **Country/Countries where trial was performed:** Belgium
Interventions	**Intervention 1:** PA and nutrition intervention. PA intervention focused on increasing levels of MVPA to at least 60 minutes/d. Schools received an intervention box with sports materials such as ropes, balls, and beach ball sets and were encouraged to create more non-competitive opportunities for students to be physically active during breaks, at noon, or during after-school hours, and to vary content of PAs offered. Children received a physical fitness test at the beginning of the second intervention year, where all children had to cycle for 10 minutes on a computerised cycle ergometer, then were given information on their fitness level and possible ways to improve it. The computer-tailored portion of the intervention was completed once each school year during 1 class hour. Children completed PA questions on a computer screen, which was immediately followed by tailored feedback on the screen (e.g. normative feedback regarding activity levels, PA recommendations). The nutrition intervention focused on 3 behavioural changes:

Haerens 2006 *(Continued)*

	• increasing fruit consumption 2+ pieces/d; • reducing soft drink consumption and increasing water consumption; and • reducing fat intake Schools were asked to sell fruit at very low prices or for free at least once/week, to offer fruit for dessert at lunch, and to offer free water via drinking fountains **Intervention 2:** PA and nutrition intervention (same as Intervention 1 group) plus parental involvement. Schools invited parents for an interactive meeting on healthy food, PA, and the relationship with overweight and health. 3 times/y, information on healthy food and PA was published in school papers and newsletters for parents, and parents received a free CD with the adult computer-tailored intervention for fat intake and PA (same as the children's computer-tailored intervention) for use at home and were asked to discuss results with their child and to give their child support to create a healthier lifestyle **Comparator:** no PA and nutrition intervention **Duration of intervention:** 2 years **Duration of follow-up:** 2 years **Number of schools:** 15 **Theoretical framework:** trans theoretical model	
Outcomes	PA duration Sedentary time BMI	
Study registration	—	
Publication details	**Language of publication:** English **Funding:** non-commercial funding (Policy Research Centre Sport, Physical Activity and Health, funded by the Flemish Government) **Publication status:** peer-reviewed journal	
Stated aim for study	"The purpose of this study was to evaluate the 2-year effects of an intervention targeting PA and healthy eating in middle schools"	
Notes		
Risk of bias		
Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	**Comment:** randomisation process not reported
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Blinding of outcome assessment (detection bias)	Unclear risk	**Comment:** no information given; likely not done

Haerens 2006 *(Continued)*

All outcomes		
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Comment:** incomplete outcome data; not adequately addressed
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published; cannot assess
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** unclear whether students were enrolled before randomisation
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** baseline characteristics not described
Cluster RCT - Loss of clusters	High risk	**Comment:** 704 participants lost to follow-up; differences between those who dropped out and those who stayed in
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Young 2006

Study characteristics	
Methods	**Study design:** RCT
Participants	**Student inclusion criteria:** Grade 9 girls enrolled in an all-girl public magnet high school and also enrolled in 2 consecutive semesters of required PE **Student exclusion criteria:** excused from meeting Maryland state PE requirements, pregnant or breastfeeding, planning to leave the geographic area, having a sister enrolled in the trial **Setting:** school, urban **Age group:** adolescents **Gender distribution:** females **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** the intervention was taught by a teacher hired by the project. Intervention content included information to make an informed decision about personal benefits of a physically active lifestyle, develop problem-solving skills, and obtain support from others. Specific strategies that were taught and reinforced included goal-setting, problem-solving barriers, communication skills, reinforcement of goal achievement through internal and external rewards, and learning from relevant role models. Skills were taught using class lectures and discussions, small-group discussions, and homework activities. PA self-monitoring was given a strong focus. Students were encouraged to keep weekly exercise logs from which the teacher provided feedback on progress toward goal attainment and reward strategies. All students in class received the intervention, irrespective of whether they were trial participants. The intervention was also designed to maximise PA during PE class. The format was congruent with the school's PE curriculum - 1 semester of individual sports and 1 semester of team sports - taught 5 days/week. Classes were optimised for PA by teaching units that were active in nature (e.g. soccer instead of softball (personal fitness unit), breaking skills training into small-group activities, and playing games in small groups (e.g. 3-on-3 basketball). Skills training was limited to that needed for competency rather than proficiency. Written tests focused on health-related PA and fitness concepts and behavioural skills. The family support component consisted of a family workshop, monthly newsletters, and adult-child homework assignments. A 2-hour family workshop, scheduled shortly after randomisation,

Young 2006 *(Continued)*

	featured tips on how parents could provide support to their daughters. As an in-class activity, students worked on skits illustrating support strategies that were videotaped and viewed at the workshop. Families who did not attend were mailed copies. Families also received a 2-page family support newsletter each month that contained an article on ways families can support PA with their daughter **Comparator:** standard PE class was a curriculum in which students were taught skills in individual and team sports. For example, during the basketball unit, students were taught how to dribble, shoot, and pass, and were tested on concepts such as game rules and defence strategies. Similar to the intervention structure, 1 semester focused on individual sports and the other on team sports. Classes were taught by certified PE teachers employed by the school. Parents of participants in the standard PE class also received monthly newsletters. Topics were of general health interest and an article about PE class content that month was included **Duration of intervention:** 1 school year **Duration of follow-up:** 1 school year **Number of schools:** 1 **Theoretical framework:** social action theory
Outcomes	BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Institutes of Health) **Publication status:** peer-reviewed journal
Stated aim for study	"This trial tests the effectiveness of a life skills–oriented PA intervention, conducted in PE class by a teacher hired by the project, for increasing PA and fitness in ninth-grade girls"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Comment:** coin flip [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** no blinding of personnel or participants [author communication]
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** outcome assessors were blinded for primary outcome assessment [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** less than 10% dropout rate; reasons given

Young 2006 *(Continued)*

Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published or trial registry; cannot assess

Bayne-Smith 2004

Study characteristics	
Methods	**Study design:** RCT
Participants	**Student inclusion criteria:** urban, multi-ethnic teenaged girls, aged 14 to 19 years **Student exclusion criteria:** — **Setting:** school, urban **Age group:** adolescents **Gender distribution:** females **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** the Physical Activity and Teenage Health curriculum was taught as a personal wellness course that integrated vigorous exercise, health and nutrition education, and behaviour modification. Physical Activity and Teenage Health student manuals were developed to provide students with information about anatomy and physiology of the heart, cardiovascular risk factors, the heart disease process, proper exercise and nutrition, stress management, cigarette smoking avoidance and cessation techniques, and strategies for modifying high-risk health behaviours. Physical Activity and Teenage Health teacher manuals were provided to PE teachers containing instructions for teaching the programme curriculum and assessing outcomes. PE teachers using the Physical Activity and Teenage Health curriculum received in-service training from the investigation team before and during the intervention. The Physical Activity and Teenage Health programme consisted of 30-minute classes conducted 5 days/week for 12 weeks. Individual classes began with a 5- to 10-minute lecture and discussion featuring a topic on cardiovascular health and fitness and suggestions for modifying health behaviours. In addition, students frequently were given homework assignments designed to enhance or clarify lecture material through use of Physical Activity and Teenage Health manuals. Lecture and discussion were followed by 20 to 25 minutes of vigorous PA in the form of resistance exercise to improve muscular strength and endurance or aerobic exercise to improve cardiovascular fitness. Students alternated resistance and aerobic training each day. Resistance exercise consisted of a vigorous programme of circuit weight training at a variety of isotonic and isokinetic exercise stations. Students performed 90- to 120-second bouts of weight lifting at 50% to 70% of the 1-repetition maximum (maximum resistance that can be lifted 1 time). Aerobic training included a variety of vigorous exercises, such as stationary bicycling, stair stepping, rope jumping, fast walking, jogging, step aerobics, and aerobic dance. Students were instructed to exercise continuously at 70% to 85% of their age-predicted maximum heart rate. Students were taught how to self-monitor heart rates during or immediately upon cessation of exercise by palpation of the radial or carotid pulse **Comparator:** frequency and duration of traditional PE classes were identical to those of Physical Activity and Teenage Health classes. Because PE classes did not include lecture and discussion, they had approximately 5 minutes more PA/class than Physical Activity and Teenage Health classes **Duration of intervention:** 12 weeks **Duration of follow-up:** 12 weeks **Number of schools:** 3 **Theoretical framework:** —
Outcomes	BMI

Bayne-Smith 2004 *(Continued)*

	Fitness
Study registration	—
Publication details	**Language of publication:** English **Funding:** other funding (Professional Staff Congress - City University of New York, Faculty Research Awards Program, Research Foundation of City University of New York; Department of Health, State of New York; and Operation Fitkids, Inc.) **Publication status:** peer-reviewed journal
Stated aim for study	"We sought to assess the effects of a school based intervention program of vigorous exercise integrated with health and nutrition education promoting behavioral change in cardiovascular disease risk factors, heart health knowledge, and fitness levels among urban, multiethnic teenaged girls"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** randomisation process not reported
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Unclear risk	**Comment:** incomplete outcome data not addressed
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol paper or trial registry

Simon 2004

Study characteristics

Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** 8 schools out of 77 public middle-schools at the Department of Bas-Rhin (Eastern France) were randomly selected **School exclusion criteria:** — **Student inclusion criteria:** all initially first-level students (corresponding to USA Grade 6) at these schools

Simon 2004 *(Continued)*

	Student exclusion criteria: — **Setting:**: community, school, urban **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** France
Interventions	**Intervention:** the Intervention Centred on Adolescents' Physical Activity and Sedentary Behaviour programme was implemented over 4 academic years to promote PA inside and outside. The intervention includes an educational component focusing on PA and sedentary behaviours and new opportunities for PA during school hours (lunch break, recess) and after school hours. Activities implemented are either informal or academic with emphasis on fun and pleasure, well-being, and non-competitiveness. Sporting events and bicycle and on-foot transport are organised, with teachers, parental organisations, and sport associations encouraged to participate in meetings and regular contact. Intervention staff are informed of study objectives and work in collaboration with different partners. The Intervention Centred on Adolescents' Physical Activity and Sedentary Behaviour coordinators regularly visit intervention school members to inquire about difficulties and to help resolve material or personnel needs **Comparator:** — **Duration of intervention:** 40 weeks/y × 4 years **Duration of follow-up:** 4 school years **Number of schools:** 8 **Theoretical framework:** —
Outcomes	BMI
Study registration	NCT00498459 (registered retrospectively)
Publication details	**Language of publication:** English **Funding:** other funding (Caisse Regionale d'Assurance Maladie d'Alsace Moselle, French National Plan for Nutrition and Health, Institut national de la SNE et de la recherche médicale, Conseil General of the Bas-Rhin, Communes of Drusenheim, Illkirch-Graffenstaden, Obernai and Schiltigheim, and Masterfoods) **Publication status:** peer-reviewed journal
Stated aim for study	"We wish to assess whether the intervention as implemented has produced a favourable influence on the activity patterns of the adolescents and on different psychological variables related to PA with a particular interest on the interconnection between these variables"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Comment:** random numbers table [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known

Simon 2004 *(Continued)*

Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** no participants or personnel were blinded other than data analysts [author communication]
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** outcome assessors were not blinded [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** outcome data complete
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	High risk	**Comment:** students were recruited after randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** groups equal at baseline
Cluster RCT - Loss of clusters	Low risk	**Comment:** 2008 paper of complete results; 7/479 and 3/475 were lost for unknown reason; all others due to school transfer
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in analysis

Trevino 2004

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** elementary schools with no previous exposure to Bienestar **School exclusion criteria:** alternative schools **Student inclusion criteria:** all Grade 4 children regardless of race and ethnicity **Student exclusion criteria:** those older than 12 years, students previously diagnosed with type 1 or type 2 diabetes mellitus, and students with extreme dietary values **Setting:** school, urban **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** Bienestar Health Progam, 50 sessions of health programming across 7 months to transmit to children 3 health behaviour messages associated with diabetes mellitus control (decreased dietary saturated fat intake, increased dietary fibre intake, increased PA). Taught and reinforced through classroom, home, school cafeteria, and after school care educational activities. PE teachers, parents, school cafeteria staff, and after school care staff were asked to encourage less dietary saturated fat, greater fibre intake, and more PA, to have less saturated fat and more fibre and PA available. Children were asked to set goals aimed at accomplishing targeted behaviours and to keep records of their ac-

Trevino 2004 *(Continued)*

	complishments. Children were also asked to encourage their peers and adult caretakers to practise 3 health behaviours. Children and parents who practised the 3 health behaviours were rewarded with coupons from a store set up at school. Students could purchase merchandise with the coupons **Comparator:** — **Duration of intervention:** 7 months **Duration of follow-up:** 7 months **Number of schools:** 44 **Theoretical framework:** social cognitive theory and socioecological theory
Outcomes	Fitness
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Institutes of Health - National Institue of Diabetes and Digestive and Kidney Disease) **Publication status:** peer-reviewed journal
Stated aim for study	"This study tested the efficacy of the Bienestar Health Program ('well-being' in Spanish)"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Low risk	**Comment:** randomisation took place via a random numbers table
Allocation concealment (selection bias)	Low risk	**Comment:** methods ensured that no one could foresee intervention assignment
Blinding of participants and personnel (performance bias) All outcomes	Low risk	**Quote from publication:** “principals of schools were informed and asked not to inform students, parents or school staff of the intervention assignment” (Trevino 2004, p912)
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Quote from publication:** "temporary staff, separate from programs and masked to the intervention, were hired and trained to collect the data"
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** outcome data complete
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published or trial registry
Cluster RCT - Recruitment bias	Low risk	**Comment:** data collected before randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** groups balanced at baseline

Trevino 2004 *(Continued)*

Cluster RCT - Loss of clusters	High risk	**Comment:** 1 school withdrew after randomisation
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering accounted for in the analysis

Stone 2003

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** projected enrolment of at least 15 children in Grade 3, at least 90% of third-graders were American Indians, retention rates from Grade 3 to 5 over the past 3 years at least 70%, school meals prepared and administered on-site, existence of facilities for PA programmes and approval of the study by school, community, and tribal authorities **School exclusion criteria:** — **Student inclusion criteria:** Grade 3 students **Student exclusion criteria:** — **Setting:** school **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** the intervention programme was implemented during Grades 3 through 5, with 4 components, including food service, skills-based classroom curricula, family, and PE. The intervention combined social learning theory and principles of American Indian culture and practices, with indigenous learning modes (e.g. story telling) incorporated. Classroom component: 2 × 45-minute lessons delivered by teachers weekly for 12 weeks during Grades 3 and 4, decreased to 8 weeks in Grade 5. Food service component consisted of nutrient guidelines and tools for reducing fat content of school meals while meeting nutrient requirements. Food service staff provided skill building for planning, purchasing, and preparing lower-fat school meals. PE component consisted of a minimum of 3 × 30-minute sessions/week of MVPA based on SPARK. Family component included assistance creating a supportive environment with an interactive forum to discuss Pathways and family action packs and family events at schools **Comparator:** — **Duration of intervention:** 12 weeks/year × 3 years **Duration of follow-up:** 3 years **Number of schools:** 41 **Theoretical framework:** social learning theory, incorporating cultural heritage of American Indians
Outcomes	BMI
Study registration	NCT00000545 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (supported by National Heart, Lung, and Blood Institute grants)

Stone 2003 *(Continued)*

	Publication status: peer-reviewed journal
Stated aim for study	"The Pathways Study was launched in 1993 as a field trial to test the effectiveness of a multi-component school-based program intended to reduce the prevalence of obesity in American-Indian students by focusing on healthy environments as well as diet and PA"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** stratified randomisation by a central coordinating centre
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** no participants or personnel were blinded to study condition [author communication]
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** outcome assessors were not blinded to study condition [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** outcome data complete
Incomplete outcome data (attrition bias) Physical activity and sedentary time	Low risk	**Comment:** outcome data complete
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported
Cluster RCT - Recruitment bias	Low risk	**Comment:** randomisation conducted after individual recruitment
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline comparison found no difference [author communication]
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters were lost to follow-up [author communication]
Cluster RCT - Incorrect analysis	Low risk	**Comment:** describe multi-level model to account for clustering in analysis section (Caballero 2003)

Burke 1998

Study characteristics	
Methods	**Study design:** cluster-RCT

Burke 1998 *(Continued)*

Participants	**School inclusion criteria:** — **School exclusion criteria:** — **Student inclusion criteria:** — **Student exclusion criteria:** — **Setting:** school, home **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** Australia
Interventions	**Intervention 1:** standard PA and nutrition programme (West Australian Schools Physical Activity and Nutrition project) in 6 schools, which consisted of classroom lessons to establish a rationale, plus 20-minute fitness sessions daily by means of small-group activities that allowed for individual fitness levels and provided a range of options by means of progression through graded activities. 4 fitness sessions/week was considered a realistic expectation. The nutrition programme aimed to improve children's diets by prompting families to review their diet; reducing consumption of fat, sugar, and salt; increasing fibre intake; and creating links between home and school for health promotion. The nutrition programme is built around 4 comic books in which 2 space creatures must discover the dietary habits of humans. It includes a Teachers' Handbook, a Home-based Mission Booklet, a Class Activities Booklet, incentives, and a Recipe Booklet that presents recipes written for children by children. Home-based Missions and Class Activities are combined in activities such as planning a week's grocery shopping on the basis of advertised prices and in learning strategies to resist peer pressure. The Incentives Booklet includes a progress chart, stickers, and a completion certificate to encourage participation of children and parents. Duration of nutrition class activities aimed for 1 hour/week **Intervention 2:** standard West Australian Schools Physical Activity and Nutrition programme plus a PA-enrichment programme for higher-risk children in 7 schools, which consisted of incorporating the teacher-parent-student triad and allowed PA needs and preferences to be met outside the setting of the whole class. Children kept regular, but not continuous, 7-day PA diaries, which were used by teachers to identify preferred activities and ways these might be increased in duration or frequency. Teachers and students worked together to establish goals and decide on how these might be attained. Parents were asked to monitor completion of diaries and to encourage increased levels of PA **Comparator:** no programme in 5 schools **Duration of intervention:** 9 months **Duration of follow-up:** 15 months **Number of schools:** 18 **Theoretical framework:** —
Outcomes	BMI Fitness
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (supported by a Program Grant from the National Health and Medical Research Council of Australia and by the Australian Rotary Health Research Fund) **Publication status:** peer-reviewed journal

Burke 1998 *(Continued)*

Stated aim for study	"In the present study, we therefore aim standard West Australian Schools Physical Activity and Nutrition program to involve higher risk children by means of principles of educational reinforcement, combining an 'enrichment' program with the previously reported..."
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** randomisation process not reported
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given, likely not done
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** no information given, likely not done
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** outcome data complete
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol published or trial registry
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** no indication participants were registered before randomisation
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline differences adjusted for in analysis
Cluster RCT - Loss of clusters	Low risk	**Comment:** no clusters lost
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering was accounted for in analysis

Ewart 1998

Study characteristics

Methods	**Study design:** RCT
Participants	**Student inclusion criteria:** after parental consent was obtained, all entering Grade 9 students were invited to participate in health screening. Girls with blood pressure in the top third of normal distribution for systolic or diastolic pressure were invited to participate **Student exclusion criteria:** —

Ewart 1998 *(Continued)*

	Setting: school, home, urban **Age group:** adolescents **Gender distribution:** females **Country/Countries where trial was performed:** USA
Interventions	**Intervention:** 50-minute 'Project Heart' aerobic exercise classes including didactic instruction over 18 weeks **Comparator:** 50-minute standard PE classes **Duration of intervention:** 18 weeks **Duration of follow-up:** 18 weeks **Number of schools:** 1 **Theoretical framework:** —
Outcomes	BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (RO1-HL45139 from the National Heart, Lung, and Blood Institute to the first study author) **Publication status:** peer-reviewed journal
Stated aim for study	"The present study evaluated the effectiveness of a school-based aerobic exercise intervention, Project Heart, in increasing cardiorespiratory fitness and lowering blood pressure in adolescent girls at increased risk for hypertension"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** randomisation process not reported
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** No information given; likely not done
Blinding of outcome assessment (detection bias) All outcomes	Low risk	**Comment:** reported that technicians taking measurements were not aware of girls' experimental status
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** outcome data complete

Ewart 1998 *(Continued)*

Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on

Luepker 1996

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** recruitment of schools was based on their distance from 1 of the 4 study centres, their ethnic diversity, their food service's potential for intervention, and their commitment to offering at least 90 minutes/week of PE and to participating in a 3-year study **School exclusion criteria:** — **Student inclusion criteria:** initially Grade 3 students who agreed to have a blood test **Student exclusion criteria:** — **Setting:** school, home, urban **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	***Intervention (overview):*** *the Child and Adolescent Trial for Cardiovascular Health Intervention included school-based (school food service, PE, classroom curricula) and family-based (home curricula, family fun nights) components. School food service changes and PE enhancement were ongoing throughout the 3 school years, whereas classroom and home curricula were implemented (by classroom teachers) over a fixed time period during each school year and addressed eating habits (Grades 3 through 5), PA (Grades 4 and 5), and cigarette smoking (Grade 5 only). Eat Smart, the food service intervention, provided children with healthy meals that maintained recommended levels of essential nutrients and child participation in school meal programmes. Food service personnel attended a 1-day training session at the beginning of each school year. They were provided more information, assistance in planning, and other support during monthly follow-up visits to schools and booster sessions. PE specialists and teachers attended 1 to 1.5 days of training every school year. Classroom curricula included the Adventures of Hearty Heart and Friends (Grade 3; 15, 30- to 40-minute classes during 5 weeks); Go for Healths (Grade 4; 24, 30- to 40-minute classes during 12 weeks); Go for Health-5 (Grade 5; 16; 30- to 40-minute classes during 8 weeks); and F.A.C.T.S. for Five (Grade 5; 4-session tobacco use prevention curriculum). Classroom teachers attended 1 to 1.5 days of training every year to learn how to implement the curricula. For the home curriculum, 19 activity packets (over the course of 3 school years) that complemented classroom curricula were sent home with students and required adult participation to complete. During Grades 3 and 4, students invited their family members to a "family fun night" (dance performances, food booths, recipe distribution, and games). Intervention schools were further randomised into 2 equal subgroups* **Intervention 1:** 1 group received a school-based programme consisting of school food service modifications, PE interventions, and Child and Adolescent Trial for Cardiovascular Health curricula **Intervention 2:** 1 group received the same school-based programme plus a family-based programme **Comparator:** control group received usual health curricula, PE, and food service programmes, but none of the Child and Adolescent Trial for Cardiovascular Health interventions **Duration of intervention:** 3 years **Duration of follow-up:** 3 years **Number of schools:** 96

Luepker 1996 *(Continued)*

	Theoretical framework: health belief model
Outcomes	BMI
Study registration	NCT00000467 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Heart, Lung, and Blood Institute) **Publication status:** peer-reviewed journal
Stated aim for study	"The Child and Adolescent Trial for Cardiovascular Health 22 was designed to augment the research of the 1980s in cardiovascular disease prevention among young people by using a sophisticated research design involving a large number of schools, a multi-component behavioral health intervention over 3 grades, and children of diverse communities"
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Low risk	**Comment:** computer-generated random numbers table [author communication]
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	High risk	**Comment:** no blinding [author communication]
Blinding of outcome assessment (detection bias) All outcomes	High risk	**Comment:** no blinding [author communication]
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** outcome data complete
Selective reporting (reporting bias)	Low risk	**Comment:** all outcomes identified a priori were reported on
Cluster RCT - Recruitment bias	Low risk	**Comment:** data collected before school randomisation [author communication]
Cluster RCT - Baseline imbalance	Low risk	**Comment:** baseline group balance
Cluster RCT - Loss of clusters	Low risk	**Comment:** no loss of clusters
Cluster RCT - Incorrect analysis	Low risk	**Comment:** clustering adjusted for in the analysis

Bush 1989

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** public elementary schools in Washington, DC **School exclusion criteria:** — **Student inclusion criteria:** students who were attending Grades 4 to 6 at 9 public elementary schools in 1983 **Student exclusion criteria:** — **Setting:** school, home, community, physician office, a mix of urban and rural **Age group:** children **Gender distribution:** females and males **Country/Countries where trial was performed:** USA
Interventions	**Intervention 1:** 'Know Your Body' curriculum. Focus on nutrition, fitness, and prevention of cigarette smoking. Curriculum to motivate students to attain and maintain lifestyles that will reduce students' risk of developing heart disease and cancer. Includes a personalised health screening, with each student receiving results in a 'health passport'. Parents are involved through several mechanisms; they are mailed 2 copies of their children's screening results - 1 copy to keep and 1 for the child's physician - and copies of a quarterly 'Know Your Body' newsletter; the programme is introduced by staff at parent-teacher association meetings **Intervention 2:** received the same intervention as Intervention 1, but only parents received the results of cholesterol tests and students were not provided these results to enter into their 'health passports' with other screening results **Comparator:** did not receive the 'Know Your Body' curriculum and were not provided any screening results. Only parents of control participants received screening results **Duration of intervention:** 4 years **Duration of follow-up:** 4 years **Number of schools:** 9 **Theoretical framework:** PRECEDE and social learning theory
Outcomes	BMI
Study registration	—
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Institutes of Health) **Publication status:** peer-reviewed journal
Stated aim for study	"The goals of the study were to evaluate the effects of the curriculum by measuring changes in the prevalence of risk factors and to evaluate the effectiveness of providing individual cholesterol results to students"
Notes	
Risk of bias	

Bush 1989 *(Continued)*

Bias	Authors' judgement	Support for judgement
Random sequence generation (selection bias)	Unclear risk	**Comment:** no description of the randomisation process given
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Incomplete outcome data (attrition bias) Anthropometrics, Fitness	High risk	**Quote from publication:** "only 431 (41.4%) participants were re-screened 2 years after forming the cohort. Students who had moved from a control to an intervention school or vice versa were dropped from the analysis" (Bush 1989, p472)
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol paper published nor trial registry
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** not described
Cluster RCT - Baseline imbalance	Low risk	**Comment:** differences in baseline values adjusted for in analyses
Cluster RCT - Loss of clusters	High risk	**Comment:** clusters lost to follow-up
Cluster RCT - Incorrect analysis	High risk	**Comment:** no adjustment for clustering in the analysis

Walter 1988

Study characteristics	
Methods	**Study design:** cluster-RCT
Participants	**School inclusion criteria:** elementary schools in School District 11 in the Bronx and elementary schools in 4 school districts in Westchester County **School exclusion criteria:** — **Student inclusion criteria:** schoolchildren in 2 demographically dissimilar areas in and near New York; students in Grade 4 in the Bronx, a lower-income borough, or Westchester County, a middle- and upper-income suburb **Student exclusion criteria:** — **Setting:** school, community, urban **Age group:** children

Walter 1988 *(Continued)*

	Gender distribution: females and males **Country where trial was performed:** USA
Interventions	**Intervention:** a special curriculum targeting voluntary changes in risk behaviour in the area of diet, PA, and smoking. Curriculum content was designed to provide the information and motivation necessary for behavioural changes, as well as training in the skills necessary to make such changes. Intervention foci (perceived susceptibility to, and severity of, health problems; perceived benefits of, and barriers to, adopting and maintaining risk reduction types of behaviour) were derived from the health belief model; skills training strategies were derived from social learning theory. Cognitive development theory provided a framework for appropriate tailoring of these constructs to children's changing maturational stages; the study progressed over a 5-year period. The PA component of the intervention fostered adoption of a regular programme of endurance exercise. The special curriculum was taught in classrooms by specially trained regular teachers for approximately 2 hours/week throughout each school year **Comparator:** — **Duration of intervention:** 6 years **Duration of follow-up:** 6 years **Number of schools:** 37 **Theoretical framework:** PRECEDE, health belief model, social learning theory
Outcomes	BMI
Study registration	NCT00005406 (retrospectively registered)
Publication details	**Language of publication:** English **Funding:** non-commercial funding (National Heart, Lung, and Blood Institute and National Cancer Institute) **Publication status:** peer-reviewed journal
Stated aim for study	"The aims of the study were to shift favourably the population distribution of levels of blood pressure, blood lipids, body mass, and physical fitness through appropriate modifications in diet and PA, and to reduce the number of students starting to smoke cigarettes"
Notes	

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Random sequence generation (selection bias)	Unclear risk	**Comment:** randomisation process not reported
Allocation concealment (selection bias)	Low risk	**Comment:** all participants were allocated at a single point in time following recruitment, so at time of recruitment, allocation was not known
Blinding of participants and personnel (performance bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done
Blinding of outcome assessment (detection bias) All outcomes	Unclear risk	**Comment:** no information given; likely not done

Walter 1988 *(Continued)*

Incomplete outcome data (attrition bias) Anthropometrics, Fitness	Low risk	**Comment:** analyses were done to see if bias would be introduced due to attrition; average risk values were imputed
Selective reporting (reporting bias)	Unclear risk	**Comment:** no protocol paper published; trial registered retrospectively
Cluster RCT - Recruitment bias	Unclear risk	**Comment:** unclear when individual participants were enrolled
Cluster RCT - Baseline imbalance	Unclear risk	**Comment:** no statistical test for baseline differences
Cluster RCT - Loss of clusters	Unclear risk	**Comment:** not described
Cluster RCT - Incorrect analysis	Low risk	**Quote from publication:** "school rather than the student was used as the unit of analysis"

—: denotes not reported.
BMI: body mass index.
MVPA: moderate to vigorous physical activity.
PA: physical activity.
PE: physical education.
RCT: randomised controlled trial.

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Abdukić 2015	Intervention not aimed at promoting physical activity
Aceves-Martins 2017	No objective measure of physical activity or physical fitness
ACTRN12619000091101	No objective measure of physical activity or physical fitness
ACTRN12619000431123	Intervention not aimed at promoting physical activity
ACTRN12619000457145	Data on outcomes from children aged 6 to 18 not reported
ACTRN12619000766112	Intervention < 12 weeks
ACTRN12619000854134	Data on relevant outcomes for children aged 6 to 18 years not reported
ACTRN12619001229167	No objective measure of physical activity or fitness
Adab 2014	Not a randomised controlled trial
Adkins 2017	Not a randomised controlled trial
Adsiz 2012	Data on relevant outcomes not reported
Agurto 2018	Intervention not school-based
Aittasalo 2019	Intervention < 12 weeks

Study	Reason for exclusion
Akdemir 2017	Data on relevant outcomes in children aged 6 to 18 not reported
Aleksić 2013	No objective measure of physical activity or physical fitness
Alexander 2014	Not a randomised controlled trial
Alievi 2019	Data on relevant outcomes not reported
Allara 2018	Not a randomised controlled trial
Almas 2013	Not a randomised controlled trial
Androutsos 2014	Data on relevant outcomes for children aged 6 to 18 years not reported
Annesi 2017	Intervention not school-based
Anselma 2019	Data on relevant outcomes not reported
Araujo-Soares 2009a	No objective measures of physical activity, physical fitness, or body composition
Ardic 2017	Not a randomised controlled trial
Arlinghaus 2017	No objective measure of physical activity or physical fitness reported
Armstrong 2016	Not a randomised controlled trial
Ashanin 2018	Not a randomised controlled trial
Åvitsland 2020	Data on relevant outcomes not reported
Babic 2016	Not aimed at the general population
Bacardi-Gascon 2012	Intervention not aimed at promoting physical activity
Bailey 2015	Intervention < 12 weeks
Baranowski 2019	Not aimed at general population
Barbosa 2015	No objective measure of physical activity or physical fitness
Barbosa Filho 2019	Data on relevant outcomes not reported
Barr-Anderson 2012	Not a randomised controlled trial
Barrett-Williams 2017	Not a randomised controlled trial
Bartholomew 2018	Data on physical activity not reported
Barton 2015	Intervention < 12 weeks
Batistão 2019	Intervention < 12 weeks
Bechter 2019	Intervention < 12 weeks
Bechter 2019a	Intervention < 12 weeks

Study	Reason for exclusion
Beets 2014	Intervention not school-based.
Beets 2015	Intervention not school-based.
Beets 2016	Intervention not school-based.
Belansky 2016	Not a randomised controlled trial
Bell 2019	Intervention not aimed at promoting physical activity
Benden 2011	Data on relevant outcomes not reported
Benden 2014	Data on relevant outcomes not reported
Berger-Jenkins 2014	Not a randomised controlled trial
Beyler 2014	Data on relevant outcomes not reported
Bhave 2016	Not a randomised controlled trial
Biddle 2015	Intervention not school-based.
Bilak-Moconja 2018	No objective measure of physical activity or physical fitness
Blaes 2013	Intervention < 12 weeks
Bleeker 2015	Data on relevant outcomes not reported
Bogart 2016	Intervention < 12 weeks
Bonnema 2020	Data on relevant outcomes not reported
Bonsergent 2013	Intervention not aimed at promoting physical activity
Brandstetter 2012	Intervention not aimed at promoting physical activity
Braun 2017	Not a randomised controlled trial
Bremer 2018	Not a randomised controlled trial
Brill 2012	Intervention < 12 weeks
Bronikowski 2011	Not a randomised controlled trial
Brusseau 2016	Not a randomised controlled trial
Buchan 2012	Intervention < 12 weeks
Bugge 2012	Not a randomised controlled trial
Bundy 2017	Data on relevant outcomes not reported
Bungum 2014	Not a randomised controlled trial
Bunketorp 2015	Not a randomised controlled trial

Study	Reason for exclusion
Burguera 2011	Intervention not school-based
Burns 2015	Not a randomised controlled trial
Bustos 2016	Primary focus not to increase physical activity
Børrestad 2012	Not aimed at general population
Calvert 2018	Not a randomised controlled trial
Cao 2015	Intervention not aimed at promoting physical activity
Cao 2019	Intervention not aimed at promoting physical activity
Castelli 2014	Not a randomised controlled trial
Centis 2012	Clinical intervention; not relevant to public health
Chase 2018	Intervention < 12 weeks
Chen 2016	Data on relevant outcomes for children aged 6 to 18 years not reported
Chillon 2011	Not a randomised controlled trial
Christiansen 2014	Intervention not aimed at promoting physical activity
Cichy 2012	Data on relevant outcomes not reported
Clapham 2015	Not a randomised controlled trial
Clemes 2020	Primary purpose not to increase physical activity
Coknaz 2019	Intervention not school-based
Colin-Ramirez 2010	No objective measures of physical activity, physical fitness, or body composition
Collins 2014	Not aimed at general population
Costa-Urrutia 2019	Not a randomised controlled trial
Costigan 2018	Intervention < 12 weeks
CTRI/2019/03/018133	Not aimed at the general population
CTRI/2019/04/018834	No objective measure of physical activity or physical fitness
CTRI/2019/09/021452	No objective measure of physical activity or fitness
Čuljak 2011	Data on relevant outcomes not reported
Cunha 2017	Data on relevant outcomes not reported
Cvejić 2017	Intervention < 12 weeks
D'Haese 2013	Intervention < 12 weeks

Study	Reason for exclusion
Dai 2014	Intervention not school-based
Dallolio 2016	Not a randomised controlled trial
Danielson 2018	Not a randomised controlled trial
Dannenberg 2018	Data on relevant outcomes not reported
Darabi 2017	Data on relevant outcomes for children aged 6 to 18 years not reported
da Silva 2013	Not a randomised controlled trial
da Silva Bandeira 2019	No objective measure of physical activity or fitness
de Araujo 2012	Not a randomised controlled trial
de Barros 2009	Outcomes not reported for children aged 6 to 18
de Greeff 2014	Not a randomised controlled trial
Del Duca 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Delgado-Floody 2018	Not aimed at general population
de Meij 2011	Not a randomised controlled trial
de Meij 2013	Not a randomised controlled trial
Demetriou 2019a	Data on relevant outcomes not reported
de Souza Santos 2015	Intervention not aimed at promoting physical activity
Detter 2014	Not a randomised controlled trial
Detter 2014a	Not a randomised controlled trial
Deutsch 2019	Not a randomised controlled trial
Dewar 2013	Not aimed at general population
Dewar 2014	Not aimed at general population
Dills 2011	Not a randomised controlled trial
Dishman 2004	No objective measures of physical activity, physical fitness, or body composition
Duberg 2020	Intervention not aimed at general population
Ducheyne 2014	Intervention < 12 weeks
Duncan 2011	Intervention < 12 weeks
Duncan 2019	Intervention < 12 weeks
Dzewaltowski 2011	Intervention not school-based.

Study	Reason for exclusion
Dzielska 2020	No objective measure of physical activity or fitness
Efstathiou 2016	Not relevant to public health or health promotion
Egger 2019	Data on relevant outcomes not reported
Eichner 2016	Not a randomised controlled trial
Elder 2011	Objective measure of physical activity or physical fitness not reported
Elinder 2012	Not a randomised controlled trial
Elinder 2018	Not aimed at increasing physical activity
Elizondo-Montemayor 2013	Not aimed at general population
Engelen 2013	Data on relevant outcomes in children aged 6 to 18 years not reported
Erfle 2015	Not a randomised controlled trial
Ericsson 2011	Data on relevant outcomes for children aged 6 to 18 years not reported
Ericsson 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Erwin 2011	Not a randomised controlled trial
Esquivel 2019	Not a randomised controlled trial
Esquivel 2019a	Not a randomised controlled trial
Evans 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Ezendam 2012	Intervention < 12 weeks
Farias 2015	Data on relevant outcomes in children aged 6 to 18 years not reported
Fedewa 2018	Data on relevant outcomes in children aged 6 to 18 years not reported
Fernandes 2014	Not a randomised controlled trial
Fernandez-Jimenez 2019	Data on relevant outcomes not reported
Filho 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Filho 2019	Data on relevant outcomes not reported
Finn 2018	Not a randomised controlled trial
Fitzgibbon 2011	Data on relevant outcomes for children aged 6 to 18 years not reported
Foo 2014	Not aimed at general population
Ford 2012	Not a randomised controlled trial
Franceschi Neto 2017	Intervention not aimed at promoting physical activity

Study	Reason for exclusion
Francois 2014	Not a randomised controlled trial
Friedrich 2012	Not a randomised controlled trial
Fritz 2016	Not a randomised controlled trial
Fritz 2016a	Not a randomised controlled trial
Frost 2018	Not a randomised controlled trial
Fu 2016	Not a randomised controlled trial
Galle 2016	Not a randomised controlled trial
Gallotta 2015	Not aimed at general population
Gallotta 2017	Intervention not aimed at promoting physical activity
Gammon 2019	Intervention < 12 weeks
Garcia-Hermoso 2020	Outcomes nor reported for children aged 6 to 18 years
Gatz 2018	Not a randomised controlled trial
Geanina 2011	Data on relevant outcomes in children aged 6 to 18 years not reported
Gevat 2012	Not a randomised controlled trial
Gill 2019	Data on relevant outcomes not reported
Giralt 2011	Data on relevant outcomes for children aged 6 to 18 years not reported
Glapa 2018	Data on relevant outcomes in children aged 6 to 18 years not reported
Goh 2014	Not a randomised controlled trial
Goh 2017	Not a randomised controlled trial
Gortmaker 2012	Intervention not school-based.
Grasten 2017	Data on relevant outcomes in children aged 6 to 18 years not reported
Gray 2015	Intervention < 12 weeks
Greve 2015	Primary purpose not to increase physical activity
Griffiths 2019	Data on relevant outcomes not reported
Grillich 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Gunawardena 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Ha 2014	Intervention < 12 weeks
Ha 2015	Intervention < 12 weeks

Study	Reason for exclusion
Ha 2020	intervention < 12 weeks
Haapala 2017	Not a randomised controlled trial
Habib-Mourad 2014	Primary purpose not to increase physical activity
Haerens 2009	No objective measures of physical activity, physical fitness, or body composition
Hager 2018	Intervention not aimed at promoting physical activity
Haible 2019	Intervention < 12 weeks
Haible 2019a	Intervention < 12 weeks
Hamilton 2020	Intervention < 12 weeks
Hankonen 2016	Intervention < 12 weeks
Hankonen 2017	Intervention < 12 weeks
Hannah 2018	Data on relevant outcomes not reported
Hardman 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Hayes 2014	Intervention not school-based
Hebden 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Hejazi 2017	Not a randomised controlled trial
Heo 2018	Not a randomised controlled trial
Herbert 2013	Not a randomised controlled trial
Hernández López 2018	Not a randomised controlled trial
Hill 2015	Intervention not aimed at promoting physical activity
Hillman 2014	Intervention not school-based
Hind 2014	Not a randomised controlled trial
Hogg 2012	Not a randomised controlled trial
Hortz 2015	Intervention < 12 weeks
Huberty 2011	Not a randomised controlled trial
Huberty 2014	Data on relevant outcomes not reported
Hyde 2020	Not a randomised controlled trial
Idris 2015	Not a randomised controlled trial
Ilyasova 2014	Intervention not aimed at promoting physical activity

Study	Reason for exclusion
Ilyasova 2015	Intervention not aimed at promoting physical activity
Ingrida 2012	Not a randomised controlled trial
ISRCTN75118772	Intervention < 12 weeks
Jago 2012	Intervention < 12 weeks
Jamerson 2017	Not a randomised controlled trial
James 2017	Data on relevant outcomes not reported
James-Burdumy 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Janssen 2015	Data on relevant outcomes in children aged 6 to 18 years not reported
Jemmott 2019a	Intervention < 12 weeks
Jenkinson 2012	Data on relevant outcomes in children aged 6 to 18 years not reported
Jian 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Johnston 2013	Not aimed at general population
Jones 2008	No objective measures of physical activity, physical fitness, or body composition
Jones 2015	Not aimed at general population
Jones 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Jones 2020	Intervention not school-based
Jurak 2013	Not a randomised controlled trial
Jussila 2015	Intervention < 12 weeks
Kahan 2018	Not a randomised controlled trial
Kahan 2019	Intervention < 12 weeks
Kahlin 2014	Not aimed at general population
Karachle 2017	Data on relevant outcomes in children aged 6 to 18 years not reported
Kawabata 2018	Intervention < 12 weeks
Keihner 2017	Intervention < 12 weeks
Kelly 2014	Intervention < 12 weeks
Kennedy 2018	Intervention < 12 weeks
Kennedy 2019	Intervention < 12 weeks
Ketelhut 2017	Intervention not aimed at promoting physical activity

Study	Reason for exclusion
Kidokoro 2019	Not a randomised controlled trial
Kipping 2008	No measure of physical activity or physical fitness
Klakk 2013	Not a randomised controlled trial
Knox 2012	Not a randomised controlled trial
Kobel 2017	Not aimed at general population
Koch 2019	Intervention not aimed at general population
Kokkonen 2019	No objective measure of physical activity or physical fitness
Kokkonen 2019a	No objective measures of physical activity or fitness
Kong 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Konijnenberg 2018	Not a randomised controlled trial
Kopaev 2015	Data on relevant outcomes in children aged 6 to 18 years not reported
Krawiec 2013	Not a randomised controlled trial
Kremer 2011	Not a randomised controlled trial
Kriellaars 2019	Not a randomised controlled trial
Ladapo 2016	Intervention < 12 weeks
Lane 2018	Intervention aim is not primarily to increase physical activity
Lang 2017	Intervention not aimed at promoting physical activity
Larsen 2017	Intervention not aimed at promoting physical activity
La Torre 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Lazorick 2015	Not a randomised controlled trial
Lee 2012	Data on relevant outcomes in children aged 6 to 18 years not reported
Leme 2016	Not aimed at general population
Lennox 2013	Not a randomised controlled trial
Leung 2018	Data on relevant outcomes in children aged 6 to 18 years not reported
Li 2010	No measure of physical activity or physical fitness
Li 2017	Intervention not aimed at promoting physical activity
Liao 2019	Intervention not school-based
Liu 2019	Intervention not aimed at promoting physical activity

Study	Reason for exclusion
Llargues 2011	Intervention not aimed at promoting physical activity
Llaurado 2014	Intervention not aimed at promoting physical activity
Llaurado 2018	Data on relevant outcomes in children aged 6 to 18 years not reported
Lloyd 2017	Intervention not aimed at promoting physical activity
Lofgren 2013	Not a randomised controlled trial
Lonsdale 2013	Intervention < 12 weeks
Lonsdale 2019	Data on relevant outcomes not reported
Lopes 2017	Intervention not aimed at promoting physical activity
López Sánchez 2017	Data on relevant outcomes in children aged 6 to 18 years not reported
López Sánchez 2018	Not a randomised controlled trial
Lubans 2009	Data on relevant outcomes for children aged 6 to 18 years not reported
Lubans 2011	Intervention not aimed at general population (only low active boys were included in the study)
Lubans 2012b	Not aimed at general population
Lubans 2012c	Not aimed at general population
Lubans 2013	Not aimed at general population
Lubans 2014	Not aimed at general population
Lubans 2015	Not aimed at general population
Lubans 2016	Not aimed at general population
Lucertini 2013	Intervention not aimed at promoting physical activity
Ludyga 2019	Intervention < 12 weeks
Lynch 2016	Intervention not aimed at promoting physical activity
Madsen 2013	Intervention not school-based.
Madsen 2020	Intervention < 12 weeks
Mandarić 2011	Intervention < 12 weeks
Mandigo 2019	Intervention < 12 weeks
Manley 2014	Not a randomised controlled trial
Marandi 2014	Not a randomised controlled trial
Marin 2013	Data on relevant outcomes in children aged 6 to 18 years not reported

Study	Reason for exclusion
Martin 2017	Intervention < 12 weeks
Martinez 2008	No measure of physical activity or physical fitness
Martinez-Vizcaino 2019a	Data on relevant outcomes not reported
Martinez-Vizcaino 2020	Outcomes not reported for children aged 6 to 18 years
Masse 2012	Not a randomised controlled trial
Massey 2017	Not a randomised controlled trial
Maszczak 2013	Data on relevant outcomes in children aged 6 to 18 years not reported
Mavilidi 2019	Intervention < 12 weeks
Mayorga-Vega 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Mayorga-Vega 2020	Intervention < 12 weeks
Mazzoli 2019	Intervention < 12 weeks
McCluskey 2020	No objective measure of physical activity or fitness
McCreary 2012	Not a randomised controlled trial
McDonald 2015	Intervention < 12 weeks
McFarlin 2013	Not aimed at general population
McKay 2015	Not a randomised controlled trial
McLoughlin 2017	Intervention < 12 weeks
McManus 2008	Intervention < 12 weeks
McMinn 2012	Not a randomised controlled trial
Meinhardt 2013	Data on relevant outcomes in children aged 6 to 18 years not reported
Mejia 2017	Intervention not aimed at promoting physical activity
Mekic 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Mendoza 2011	Intervention < 12 weeks
Mendoza 2017	Intervention < 12 weeks
Menrath 2015	Intervention not aimed at promoting physical activity
Merrotsy 2019	Not a randomised controlled trial
Messiah 2015	Intervention not school-based.
Michailidis 2019	Intervention not school-based

Study	Reason for exclusion
Miller 2015	Intervention < 12 weeks
Möhrle 2015	Not a randomised controlled trial
Mok 2020	Data on relevant outcomes not reported
Monti 2012	Intervention not school-based
Monyeki 2012	Not a randomised controlled trial
Moodie 2011	Intervention not school-based.
Moreira 2012	Intervention not school-based
Morris 2013	Not a randomised controlled trial
Morris 2019	Not a randomised controlled trial
Moya 2011	Intervention not school-based
Moynihan 2014	Not a randomised controlled trial
Muller 2019	Intervention not aimed at promoting physical activity
Muntaner-Mas 2017	Intervention < 12 weeks
Murillo 2016	Not a randomised controlled trial
Murtagh 2013	Intervention < 12 weeks
Muzaffar 2019	Intervention not school-based
Nabors 2015	Not a randomised controlled trial
Naidoo 2012	Not a randomised controlled trial
Nathan 2019a	Data on relevant outcomes not reported
Nawi 2015	Not aimed at general population
Nazieffa 2020	Intervention not primarily aimed at increasing physical activity
NCT03081013	Intervention not school-based
NCT03308500	Intervention not aimed at promoting physical activity
NCT03885115	Intervention not school-based
NCT03893149	Intervention < 12 weeks
NCT03937336	Intervention < 12 weeks
NCT03952754	Intervention < 12 weeks
NCT03975335	Intervention not aimed at promoting physical activity

Study	Reason for exclusion
NCT04113707	Intervention not aimed at promoting physical activity
NCT04118543	Intervention < 12 weeks
NCT04213014	Not aimed at the general population
Nelson 2011	Not a randomised controlled trial
Neto 2014	Intervention not aimed at promoting physical activity
Nichols 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Nigg 2019	Not a randomised controlled trial
Norris 2016	Intervention < 12 weeks
NTR6173	Intervention < 12 weeks
O'Neill 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Oli 2019	Intervention not school-based
Ostergaard 2012	Not aimed at general population
PACTR201903750173871	Not school-based
Pardo 2013	Not a randomised controlled trial
Pardo 2014	Not a randomised controlled trial
Parrish 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Parrish 2018	Intervention not aimed at promoting physical activity
Penalvo 2015	Data on relevant outcomes in children aged 6 to 18 years not reported
Perez 2012	Intervention not aimed at promoting physical activity
Pesce 2013	Not a randomised controlled trial
Petchers 1988	No objective measures of physical activity, physical fitness, or body composition
Pienaar 2012	Data on relevant outcomes in children aged 6 to 18 years not reported
Pinto-Escalona 2019	Intervention < 12 weeks
Plavsic 2020	Intervention not aimed at the general population
Polet 2019	Intervention < 12 weeks
Polevoy 2020	Not a randomised controlled trial
Polo-Oteyza 2017	Not a randomised controlled trial
Post 2019	Not a randomised controlled trial

Study	Reason for exclusion
Post 2019a	Not a randomised controlled trial
Postler 2017	Not a randomised controlled trial
Powell 2013	Intervention < 12 weeks
Prins 2012	Intervention < 12 weeks
Puma 2013	Not a randomised controlled trial
Quizan-Plata 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Radnor 2017	Intervention < 12 weeks
RBR-5fm97x	Data on relevant outcomes not reported
RBR-86xv46	No objective measure of physical activity or fitness
Reed 2013	Not a randomised controlled trial
Rees-Punia 2017	Not a randomised controlled trial
Resal 2018	Not a randomised controlled trial
Resaland 2011	Not a randomised controlled trial
Resaland 2018	Not a randomised controlled trial
Rexen 2015	Not a randomised controlled trial
Reznik 2015	Intervention < 12 weeks
Riiser 2020	Intervention not school-based
Riley 2014	Intervention < 12 weeks
Robbins 2014	Intervention < 12 weeks
Robbins 2020	No objective measure of physical activity or fitness
Robinson 1999	Stated aim not to increase physical activity or physical fitness
Romanelli 2015	Not a randomised controlled trial
Ronsley 2013	Not a randomised controlled trial
Rosenkranz 2012	Intervention < 12 weeks
Rostami-Moez 2017	Intervention < 12 weeks
Routen 2017	Not a randomised controlled trial
Ruiz-Ariza 2019	Data on relevant outcomes not reported
Ruiz-Ariza 2019a	Data on relevant outcomes not reported

Study	Reason for exclusion
Sahota 2019	No objective measure of physical activity or fitness
Salmoirago-Blotcher 2015	Intervention < 12 weeks
Salmon 2011	Data on relevant outcomes in children aged 6 to 18 years not reported
Sanchez-Lopez 2019	Outcomes not reported for children aged 6 to 18 years
Sanchez-Lopez 2019a	Outcomes not reported for children aged 6 to 18 years
Saraf 2015	Data on relevant outcomes in children aged 6 to 18 years not reported
Sauder 2018	Not aimed at general population
Savin 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Schneider 2017	Not aimed at general population
Schoerner 2014	Data on relevant outcomes not reported
Schwager 2019	Intervention not aimed at promoting physical activity
Sebire 2018	Intervention < 12 weeks
Sebire 2019	Intervention < 12 weeks
Seo 2013	Not a randomised controlled trial
Shang 2020	Intervention not aimed at promoting physical activity
Shang-yi 2013	Not a randomised controlled trial
Sharma 2017	Intervention not aimed at promoting physical activity
Sigmund 2012	Not a randomised controlled trial
Silva 2014	Outcomes not reported for children aged 6 to 18 years
Silva 2018	Not a randomised controlled trial
Simon 2011	Not a randomised controlled trial
Singh 2009	No measure of physical activity or physical fitness
Singhal 2010	No measure of physical activity or physical fitness
Sinyavsky 2015	Data on relevant outcomes in children aged 6 to 18 years not reported
Skoradal 2018	Intervention < 12 weeks
Smedegaard 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Smith 2011	Intervention not school-based
Smith 2014a	Not aimed at general population

Study	Reason for exclusion
Smith 2016	Not aimed at general population
Smith 2017	Not aimed at general population
Spencer 2013	Not a randomised controlled trial
Springer 2013	Data on relevant outcomes in children aged 6 to 18 years not reported
Springer 2019	No objective measure of physical activity or physical fitness
Stephens 1998	Data on relevant outcomes for children aged 6 to 18 years not reported
Stoepker 2018	Not a randomised controlled trial
Story 2012	Data on relevant outcomes in children aged 6 to 18 years not reported
Sujová 2016	Not a randomised controlled trial
Sun 2011	Intervention < 12 weeks
Sutherland 2019a	Data on relevant outcomes not reported
Swartz 2019	Intervention < 12 weeks
Takehara 2019a	Data on relevant outcomes not reported
Tarro 2014	Data on relevant outcomes not reported
Tarro 2017	Data on relevant outcomes in children aged 6 to 18 years not reported
Taylor 2018	Intervention < 12 weeks
Telford 2019a	Data on relevant outcomes not reported
Telles 2013	Intervention not aimed at promoting physical activity
Tercedor 2017	Intervention < 12 weeks
Thakur 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
Theodore 2018	Not a randomised controlled trial
Tian 2017	Not a randomised controlled trial
Tolano 2015	Data on relevant outcomes in children aged 6 to 18 years not reported
Tomlin 2012	Not a randomised controlled trial
Trajkovic 2020	No objective measure of physical activity or fitness
Treu 2017	Not a randomised controlled trial
Tumynaitė 2014	Data on relevant outcomes in children aged 6 to 18 years not reported
Tymms 2016	Intervention < 12 weeks

Study	Reason for exclusion
Uys 2016	Data on relevant outcomes in children aged 6 to 18 years not reported
van den Berg 2019	Intervention < 12 weeks
van den Berg 2019a	Intervention < 12 weeks
van der Niet 2016	Not a randomised controlled trial
Vander Ploeg 2014	Not a randomised controlled trial
van Dongen 2019	Data on relevant outcomes not reported
Van Kann 2015	Not a randomised controlled trial
van Stralen 2012	Not a randomised controlled trial
Verloigne 2012	Intervention < 12 weeks
Verloigne 2018	Outcome data on outcomes relevant to this review not reported
Verstraete 2006	Outcome data on outcomes relevant to this review not reported
Vetter 2015	Intervention < 12 weeks
Vetter 2018	Intervention < 12 weeks
Vetter 2020	Intervention < 12 weeks
Vidoni 2012	Not a randomised controlled trial
Vieira 2019	Not a randomised controlled trial
Villa-Gonzalez 2017	Not a randomised controlled trial
Wade 2019	Intervention not school-based
Wadolowska 2019	No objective measure of physical activity or physical fitness
Wadsworth 2015	Not a randomised controlled trial
Wallinga 2014	Intervention < 12 weeks
Wang 2012	Intervention < 12 weeks
Wang 2017	Not a randomised controlled trial
Wassenaar 2019a	Data on relevant outcomes not reported
Watanabe 2016	Intervention not aimed at promoting physical activity
Watson 2017	Intervention < 12 weeks
Watson 2019	Intervention < 12 weeks
Weaver 2018	Not a randomised controlled trial

Study	Reason for exclusion
Weaver 2018a	Not a randomised controlled trial
Weber 2017	Not a randomised controlled trial
Webster 2015	Not a randomised controlled trial
Weiss 2015	Not a randomised controlled trial
Weiss 2019	Not a randomised controlled trial
Welk 2016	Not a randomised controlled trial
Wells 2014	Not aimed at general population
White 2018	Not a randomised controlled trial
White 2018a	Not a randomised controlled trial
Whitt-Glover 2011	Intervention < 12 weeks
Whooten 2018	Not a randomised controlled trial
Widhalm 2018	No objective measure of physical activity or physical fitness
Wilkinson 2013	Not a randomised controlled trial
Williams 2014	Not a randomised controlled trial
Williamson 2012	Intervention not aimed at promoting physical activity
Willis 2019a	Outcomes not reported for children aged 6 to 18 years
Wilson 2009	Data on relevant outcomes not reported
Winkler 2016	Intervention not aimed at promoting physical activity
Woods-Townsend 2015	Intervention not aimed at promoting physical activity
Wyatt 2011	Not a randomised controlled trial
Xu 2015	Intervention not aimed at promoting physical activity
Yañez 2015	Not a randomised controlled trial
Yang 2017	Not a randomised controlled trial
You 2013	Intervention < 12 weeks
Yu 2020	Not aimed at general population
Семенов 2017	Not a randomised controlled trial
项立敏 2016	Not a randomised controlled trial

Characteristics of studies awaiting classification [author-defined order]

Martinez-Vizcaino 2019

Methods	**Type of trial:** effectiveness **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** open
Participants	**Estimated number of schools:** - **Number of students:** 570 **Inclusion criteria (schools):** at least 1 full classroom for both fourth and fifth grades, approval of board of governors **Exclusion criteria (schools):** - **Inclusion criteria (students):** 8 to 11 years old **Exclusion criteria (students):** severe Spanish language learning difficulties, serious physical or mental disorders identified by parents or teachers that would impede participation in the programme's activities or diagnoses of chronic disorders, such as heart disease, diabetes, or asthma, which in the opinion of their paediatricians would prevent their participation in the programme's activities
Interventions	**Intervention:** high-intensity interval training intervention that consists of (1) 4 hours/week of a standardised recreational, non-competitive physical activity extracurricular programme; and (2) informative sessions for parents and teachers about how schoolchildren can became more active **Comparator:** no intervention
Outcomes	**Primary outcome:** fitness **Secondary outcomes:** brain-derived neurotrophic factor, health-related quality of life, sleep, motor skills, physical activity, % body fat, academic achievement, arterial stiffness, pulse wave velocity, subclinical atherosclerosis, executive function, glucose profile, lipid profile, insulin profile, ultra-sensitive protein profile **Other outcomes:** -
Reason for awaiting classification	Marked as complete in ClinicalTrials.gov, but no results published
Stated aim of study	"The objective of this study was to assess the effectiveness of the MOVI-daFIT! intervention in children from 9 to 11 years old on improving physical fitness, and reducing fat mass and cardiovascular risk; and improving executive function and academic achievement"
Notes	

Nathan 2019

Methods	**Type of trial:** efficacy **Allocation:** cluster-randomised **Intervention model:** parallel assignment

Nathan 2019 *(Continued)*

	Masking: single-blind (data collectors)
Participants	**Estimated number of schools:** 62 **Estimated number of students:** – **Inclusion criteria (schools):** all government and Catholic schools in the study region **Exclusion criteria (schools):** schools participating in another physical activity intervention, schools with both primary and secondary students (i.e. central schools), and schools catering exclusively to children with special needs **Inclusion criteria (students):** subset of school students (i.e. those in Grades 2 and 3) **Exclusion criteria (students):** –
Interventions	**Intervention:** to support schools, scheduled physical activity across the school week a 12-month (4-school term) multi-component implementation support strategy will be offered to schools. The intervention will consist of the following: • 1 × 5 hours face-to-face training delivered by trained PE teachers for primary school stage coordinators to help with scheduling of PE, sport, and other physical activity will occur at the start of the intervention (i.e. Term 4) to align with schools' planning phase for the following year; • 1 × 2 hours face-to-face professional development for all teachers to increase the quality and activity of PE and sport will occur at the beginning of the school year (i.e. Term 1); • Resources including example schedules, policy, manuals that support the teaching of PE that are existing resources at the Department of Education or are developed specifically for the trial, and pedometers for teachers to use with students to increase activity in PE and sport; and • Ongoing support via telephone and email and an on-line portal to support implementation of the policy **Comparator:** usual practice towards physical activity in the school community
Outcomes	**Primary outcomes:** mean minutes of physical activity scheduled by primary school teachers across the school week; mean minutes of class physical activity across the school week where > 50% of students within classes are engaged in moderate or vigorous physical activity **Secondary outcomes:** students' physical activity, teachers' physical activity, teachers' well-being, students' on-task behaviour, cost-effectiveness **Other outcomes:** –
Reason for awaiting classification	Noted completed in clinical trials registry, but no results published
Stated aim of study	**Quote:** "the primary aim of this trial is to assess the effectiveness and cost-effectiveness of a multi-component implementation strategy in increasing the minutes of planned weekly physical activity scheduled by classroom teachers consistent with the New South Wales (NSW) Government School Sport and Physical Activity Policy"
Notes	

NCT03817047

Methods	**Type of trial:** efficacy **Allocation:** cluster-randomised **Intervention model:** parallel assignment

NCT03817047 *(Continued)*

	Masking: none (open-label)
Participants	**Estimated number of schools:** – **Estimated number of students:** 2045 **Inclusion criteria (schools):** – **Exclusion criteria (schools):** – **Inclusion criteria (students):** enrolled in Grade 9 **Exclusion criteria (students):** –
Interventions	**Intervention 1:** physical activity learning including 60 minutes of physical education in addition to ordinary PE lessons, 30 minutes of physical activity learning, and 30 minutes of physical activity a week to stimulate mastery, joy, and well-being **Intervention 2:** don't worry - be happy, including physical education (60 minutes) and physical activity (60 minutes) as self-organised activity groups of at least 3 students developed according to activity preferences **Comparators:** current practice
Outcomes	**Primary outcome:** physical activity **Secondary outcomes:** time spent in MVPA, time spent sedentary, sedentary behaviour, upper limb strength, explosive strength in the lower body, abdominal muscle endurance, cardiorespiratory fitness, academic performance in reading, academic performance in numeracy, overall psychosocial problems and strengths, subjective health and well-being, self-evaluation of competence or adequacy, anxiety and depression, learning environment, school environment **Other outcomes:** BMI, waist circumference, satisfaction with psychological needs, emotional responses to physical education, eagerness to join physical education
Reason for awaiting classification	Recorded as completed in clinical trials registry, but no results published
Stated aim of study	**Quote:** "this study evaluates the effect of 120 minutes extra of physical education (PE) or physical activity (PA) on adolescents' physical health, mental health, academic performance and learning environment. This is a cluster-randomised controlled trial with three arms, where the participants in two of the groups will have different models of increased PE/PA during the school week, whereas the participants in the third arm is the control group including current practice"
Notes	

NCT03983447

Methods	**Type of trial:** efficacy **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** single (investigator)
Participants	**Estimated number of schools:** 2 **Estimated number of students:** 352

NCT03983447 *(Continued)*

	Inclusion criteria (schools): - **Exclusion criteria (schools):** - **Inclusion criteria (students):** 5 to 13 years **Exclusion criteria (students):** physical diseases that prevent PA
Interventions	**Intervention:** physical (environmental) adaptation of playground, time adaptation of lunch breaks, curriculum-based programme, workshops and newsletters for parents, meetings for teachers **Comparator:** no change to school
Outcomes	**Primary outcome:** physical activity, sedentary time **Secondary outcomes:** anthropometry, parental information, standing broad jump, plate tapping test, shuttle run, cardiorespiratory fitness, academic achievement, attention **Other outcomes:** -
Reason for awaiting classification	Listed as 'complete' in ClinicalTrials.gov, but no results published
Stated aim of study	"This study has many goals: 1) to propose an intervention to promote PA (Physical Activity) and reduce ST (Sedentary Time) of children aged 6 to 13 years from a primary school located in a disadvantaged neighbourhood and measures the effectiveness of this intervention (1rst grade-5th grade). This intervention was based on the factors of socioecological model related to health behaviours. The levels of PA and ST of the experimental school will be compared to a control school with the realization of pre and post intervention measures. 2) To study the relationships between PA, ST, motors skills, attention abilities and academic achievement. 3)To real ise a descriptive analysis of PA and ST of children in 2nd and 5th grade from France and Spain (observational study). For this goal, an other school in Spain was included in the study (city of Huesca, 60 children)"
Notes	

Takehara 2019

Methods	**Type of trial:** efficacy **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** open
Participants	**Estimated number of schools:** 10 **Estimated number of students:** 2337 **Inclusion criteria (schools):** - **Exclusion criteria (schools):** - **Inclusion criteria (students):** 10 to 12 years old, attending fourth grade at 1 of 10 public schools in Sukhbaatar District with written consent and can speak, read, or understand Mongolian **Exclusion criteria (students):** comorbidities or contraindications prohibiting participation in exercise or attending classes with special curriculum

Takehara 2019 *(Continued)*

Interventions	**Intervention:** school-based 2-minute high-intensity interval training at least 3 times per week **Comparator:** no intervention
Outcomes	**Primary outcome:** examination marks **Secondary outcomes:** proportion obese and overweight, physical fitness, exercise, sleep, psychosocial health, cognitive function **Other outcomes:** -
Reason for awaiting classification	Marked as complete in clinical trials registry, but no data published
Stated aim of study	"The primary objective of our study is to investigate the effectiveness of exercise intervention on academic achievement among children using a large cluster RCT. The secondary objective is to investigate the effectiveness of exercise intervention on reducing the prevalence of obesity and overweight and on improving physical fitness performance, lifestyle, mental health, and cognitive function"
Notes	

Telford 2019

Methods	**Type of trial:** efficacy **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking: -**
Participants	**Estimated number of schools:** 14 **Estimated number of students: -** **Inclusion criteria (schools):** - **Exclusion criteria (schools):** - **Inclusion criteria (students):** - **Exclusion criteria (students):** -
Interventions	**Intervention:** physical education and physical literacy coach assigned to schools for 1 year to improve delivery and frequency of PE, improve professional development of classroom teachers, increase opportunities for PA, and create links with community sport **Comparator:** usual practice
Outcomes	**Primary outcome: -** **Secondary outcomes:** physical activity, fundamental movement skills, student attitudes towards PE, self-perceptions of physical abilities, classroom PA **Other outcomes:** acceptability from principals, teachers, and students
Reason for awaiting classification	Conference abstract only

Telford 2019 *(Continued)*

Stated aim of study	"The aim of this study was to evaluate the feasibility and effectiveness of a jurisdiction Education Department funded multi component approach to improve the development of childhood physical literacy"
Notes	

Wassenaar 2019

Methods	**Type of trial:** efficacy **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** single-blind (outcome assessor)
Participants	**Estimated number of schools:** 104 **Estimated number of students:** 18,261 **Inclusion criteria (schools):** secondary state or academy schools, but not grammar schools; mixed or single-gender; with proportion of pupils eligible for free school meals, preferably more than 15%, which is the average for England (at the time of recruitment); located within a pre-defined set of local authorities, encompassing the following geographical locations: Greater London; Thames Valley; Southampton and Portsmouth; Bristol and Bath; Birmingham and Coventry; Cheltenham/Gloucester; and Luton, Bedford Milton Keynes; Year 7 pupils who will move on to Year 8 at the start of the intervention; delivery of PE as part of the curriculum; signing an agreement to send opt-out consent forms to parents/carers of Year 7 pupils; informing the research team of pupils who have opted out of data storage **Exclusion criteria (schools):** – **Inclusion criteria (students):** all pupils in Year 8 at the start of the intervention **Exclusion criteria (students):** –
Interventions	**Intervention:** the intervention requires teachers to deliver specific elements of additional vigorous physical activity, over and above normal vigorous activity, during all Year 8 PE lessons, for the whole school year. Four minutes of vigorous physical activity is incorporated into the PE lesson as part of a warm-up, and three 2-minute infusions per hour of PE are incorporated into the main PE class **Comparator:** PE as usual
Outcomes	**Primary outcome:** academic attainment **Secondary outcomes:** cardiorespiratory fitness, cognitive measures, mental health, global self-esteem, physical self-esteem, global health, physical activity, daytime sleepiness, PE enjoyment, psychological variables linked to PA, PA during PE **Other outcomes:** brain imaging (sub-sample)
Reason for awaiting classification	Noted as complete in clinical trials registry, but no data published
Stated aim of study	
Notes	

NCT03579810

Methods	**Type of trial:** efficacy **Allocation:** randomised **Intervention model:** parallel assignment **Masking:** none (open-label)
Participants	**Estimated number of schools:** 9 **Estimated number of students:** 870 **Inclusion criteria (schools):** private schools located in the urban area of Bogotá with an appropriate physical activity space and infrastructure, that allowed study conduction **Exclusion criteria (schools):** schools that have received interventions longer than 1 month in healthy habits (nutrition and/or physical activity) during the year prior to the start of the study or during study follow-up, schools with a history of annual dropout greater than 10% **Inclusion criteria (students):** aged 4 to 8 years **Exclusion criteria (students):** –
Interventions	**Intervention:** a 2.5-year pedagogical intervention to increase knowledge, attitudes, and healthy lifestyle habits about physical activity, healthy eating, and knowledge of the body and heart, targeting children, parents, and teachers. Among children, the intervention included class activities (1/week) and the use of educational materials (posters and educative guide). For parents, the intervention included 3 workshops/year (2 hours each), sending healthy notes (1/month), and celebrating healthy family day (1/year). For teachers, the intervention included 3 workshops/y (2 hours each); planning and implementing pedagogical activities with students (1/week); and conducting follow-up visits to school (1/month) **Comparators:** children received the standard curriculum in health and physical activity of the national Ministry of Education. For parents and teachers, this included 3 workshops/y (2 hours each) about first aid and accident prevention
Outcomes	**Primary outcomes:** physical activity energy expenditure, healthy food consumption **Secondary outcomes:** BMI, waist circumference, total cholesterol, triglycerides, fasting glucose, blood pressure, health food consumption (teachers), healthy food consumption (parents) **Other outcomes:** –
Reason for awaiting classification	Noted as complete in clinical trials registry, but no results published
Stated aim of study	**Quote:** "the objectives of this project are to evaluate changes in healthy foods consumption and energy expenditure in children from kindergarten to second grade of elementary school that receives pedagogical intervention (PI) adapted to its context, compared to another EC that develops its habitual curriculum. In addition, this study evaluates changes on cardiovascular risk factors in children. Also, it evaluates changes in healthy foods consumption in their parents and teachers"
Notes	

Brown 2017

Methods	**Type of trial:** effectiveness and cost-effectiveness

Brown 2017 *(Continued)*

	Allocation: cluster-randomised **Intervention model:** parallel assignment **Masking:** single-blind (measurement staff)
Participants	**Estimated number of schools:** 16 **Estimated number of participants:** 2400 **Inclusion criteria (schools):** government-funded, non-fee-paying (state), all-ability, co-educational secondary schools including Year 9 students in Cambridgeshire and Essex, UK **Exclusion criteria (schools):** – **Inclusion criteria (students):** all Year 9 students (13 to 14 years) in participating schools **Exclusion criteria (students):** none
Interventions	**Intervention:** GoActive is implemented using a tiered-leadership system whereby mentors (older adolescents within the school) and peer-leaders (within each class) encourage students to try these activities each week. Mentors remain paired with each class for the duration of the programme, whereas peer-leaders (2 per class each week) change every week. Teachers are encouraged to use 1 tutor time weekly to do one of the chosen activities as a class; however, students gain points for trying these new activities in or out of school. Points are gained every time they try an activity; there is no expectation of time spent in the activity, as points are rewarded for the taking part itself. Individual students keep track of their own points privately on the study website, and their points are entered into the between-class competition, so that each class competes against each other. Class rankings are circulated each week to encourage teacher support, and students receive small rewards (e.g. Frisbee, water bottle) for reaching points thresholds **Comparator:** no treatment or 'usual care'
Outcomes	**Primary outcome:** accelerometer-assessed change in average daily MVPA **Secondary outcomes:** accelerometer-assessed sedentary, light, overall physical activity during school time, weekday evenings, weekends; self-reported physical activity, self-efficacy, self-esteem, peer support, friendship quality, mood, school-reported absence and academic performance, body fat %, BMI, waist circumference; within-trial, long-term cost-effectiveness and cost-utility analyses; mixed methods process evaluation assessing programme acceptability, uptake, maintenance, and dose; putative moderators/mediators **Relevant proposed outcome measures for SoF table:** physical activity duration, sedentary time, BMI
Reason for awaiting classification	Marked as 'completed' in trials registry, but no publication available
Stated aim of study	**Quote:** "the primary aim of this study is to assess the 10-month effectiveness of the GoActive intervention to increase average daily objectively measured MVPA among 13–14-year-old adolescents"
Notes	

Kovalskys 2017

Methods	**Type of trial:** effectiveness **Allocation:** cluster-randomised **Intervention model:** parallel assignment

Kovalskys 2017 *(Continued)*

	Masking: no blinding
Participants	**Estimated number of schools:** 12 **Estimated number of participants:** 405 **Inclusion criteria (schools):** public schools located in middle- to low-income areas of Buenos Aires **Exclusion criteria (schools):** – **Inclusion criteria (students):** first grade children **Exclusion criteria (students):** families without Internet access
Interventions	**Intervention** • Virtual: specially designed web-based contents, targeting families and children, aimed at (a) encouraging improvement in eating habits for the whole family, both at home and at school, and (b) increasing mothers' knowledge of the benefits of PA and the consequences of sedentary behaviour, and proposing pleasurable movement entailing activities for the children. Thematic goals are breakfast, PA, water intake, fruit and vegetable consumption, energy balance, parents as models, and snacking • Active breaks: activities comprising movement during school breaks are promoted with motivation as a backbone and devoid of a competitive strive; active play in which fun, pleasure, and sharing were emphasised. PA instructor-guided activities take place 3 times a week during 2 school breaks, with the goal of promoting active play for a minimum of 20 to 30 minutes/d, depending on each school **Comparator:** college students of nutrition will deliver 2 educational workshops for parents once intervention and assessment are completed
Outcomes	**Primary outcomes** • Weight measured to the nearest 0.1 kg using a portable digital scale • Height measured to the nearest 0.1 cm with a portable stadiometer • Waist circumference measured to the nearest 0.1 cm with an anthropometric tape • BMI z-score calculated using the 2007 WHO reference growth charts • Child's and parent's dietary intake and habits assessed with two 24-hour recalls using the Multiple Pass Method completed by participating parent or guardian • Child's physical activity and sedentary behaviour assessed with accelerometers (ActiGraph wGT3X-BT) used during 7 days • Parent's physical activity and sedentary behaviour assessed with the Global Physical Activity Questionnaire • Blood pressure assessed with a digital automatic sphygmomanometer **Secondary outcomes** • Environmental characteristics assessed with a modified and adapted version of the International Study of Childhood Obesity, Lifestyle and the Environment (ISCOLE) Questionnaire, administered to the parent • Social and economic levels assessed with an adapted version of the survey elaborated by the Social Observatory of SAIMO (Argentine Society for Research of Marketing and Opinion) **Relevant proposed outcome measures for SoF table:** physical activity duration, BMI
Reason for awaiting classification	Marked as 'completed' in trials registry, but no publication available
Stated aim of study	**Quote:** "the main aim of MINI SALTEN is to assess the effects of a technology family-based and PA school-based intervention on (1) physical activity, and (2) quality of diet and eating behaviour in first grade children of the city of Buenos Aires"

Kovalskys 2017 *(Continued)*

Notes	

Lonsdale 2016

Methods	**Type of trial:** effectiveness-implementation **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** open
Participants	**Estimated number of schools:** 20 **Estimated number of students:** 1219 **Inclusion criteria (schools):** – **Exclusion criteria (schools):** schools designated as 'Schools for Specific Purposes' and those that participated in the original SCORES efficacy study **Inclusion criteria (students):** students in Years 3 and 4 **Exclusion criteria (students):** –
Interventions	**Intervention:** "Internet-based Professional Learning to help teachers support Activity in Youth (iPLAY)" intervention. The aim of this project is to modify, scale-up, and evaluate the effectiveness of an intervention previously shown to be efficacious in improving children's physical activity, fundamental movement skills, and cardiorespiratory fitness. iPLAY will include 6 components to promote physical activity participation and fundamental movement skill competency. These components are (1) quality physical education and school sport; (2) classroom movement breaks; (3) physically active homework; (4) active playgrounds; (5) community physical activity links; (6) parent and caregiver engagement. Teachers will be trained in the components using a mixture of face-to-face workshops, online learning, and individualised observation and feedback **Comparator:** teacher professional learning designed to improve delivery of the NSW Kindergarten-Year 6 Science and Technology curriculum. This programme, known as My Science, has been shown to increase teacher confidence and student engagement in science; however, it is not expected to influence outcomes of the trial. Schools allocated to the attention control will be eligible to receive iPLAY after the study has been completed (i.e. 24 months post baseline)
Outcomes	**Primary outcome:** cardiorespiratory fitness **Secondary outcomes:** student physical activity, anthropometry, teacher's interpersonal style during PE and school sport, student behaviour, affect and cognition during PE and school sport, subjective well-being, academic achievement, fundamental movement skill competency, cognitive control **Other outcomes:** teacher-, principal-, and school-level outcomes
Reason for awaiting classification	Marked as 'complete' in clinical trials registry, but data not published
Stated aim of study	"The aim of this project is to modify, scale-up and evaluate the effectiveness of an intervention previously shown to be efficacious in improving children's physical activity, fundamental movement skills and cardiorespiratory fitness"
Notes	

Wright 2016

Methods	**Type of trial:** efficacy trial **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** –
Participants	**Estimated number of schools:** 24 **Estimated number of participants:** 1182 **Inclusion criteria (schools):** school districts with greater than 40% of students qualifying for free or reduced price lunch and/or with greater than 40% non-Caucasian students and at least 4 elementary schools serving third through fifth graders **Exclusion criteria (schools):** none **Inclusion criteria (students):** all third and fourth grade students **Exclusion criteria (students):** none
Interventions	**Intervention 1:** 100 Mile Club, a school-based programme that encourages children to walk, run, or wheel 100 miles over the course of the school year (approximately 3 miles per week). The programme can be implemented before, during, and/or after school, depending on the school schedule, and is led by 1 or 2 champions (e.g. PE teachers), identified by school administration, who log student miles **Intervention 2:** Just Move, a programme of structured, classroom-based, PA breaks that integrates high- and low-intensity movements (e.g. jumping jacks, squats, stretches, yoga) with academic material to provide children with opportunities for engaging in PA while learning. Breaks are designed to be short (5 to 15 minutes), and teachers are encouraged to incorporate at least 1 break per day **Comparator:** delayed intervention of either programme after study completion
Outcomes	**Primary outcomes:** schooltime and total daily MVPA **Secondary outcomes:** cognitive performance, academic achievement **Other outcomes:** physical activity, social support, self-efficacy, dietary intake, fitness
Reason for awaiting classification	Marked as 'completed' in ClinicalTrials.gov, but no publication available
Stated aim of study	**Quote:** "the primary aim of the FLEX Study is to evaluate the impact of two school-based PA programs, 100 Mile Club® and Just Move™, on children's schooltime MVPA and total daily MVPA, compared to a control group"
Notes	

Chen 2015

Methods	**Type of trial:** effectiveness **Allocation:** cluster-randomised **Intervention model:** parallel assignment

Chen 2015 *(Continued)*

	Masking: –
Participants	**Estimated number of schools:** 12 to 16 schools per centre **Estimated number of students:** 70,000 **Inclusion criteria (schools):** schools in Liaoning, Tianjin, Ningxia, Shanghai, Chongqing, Hunan, and Guangdong **Exclusion criteria (schools):** – **Inclusion criteria (students):** students aged 7 to 18 years **Exclusion criteria (students):** students in the last year of primary and secondary school (Grades 6, 9, and 12) were not contacted due to their study load
Interventions	**Intervention:** Health Lifestyles Intervention is a multi-component school-based and family-involved scheme that takes place over 9 months and aims to deliver a generally healthy lifestyle message encouraging health energy balance. Four components include: • Creating a supportive school and family environment, including learning about what is known about obstacles and success factors that influence the development and implementation of these programmes for the target group, setting the foundation for successful delivery of subsequent components; • Educational strategies involving health education lessons and related compulsory activities towards children and parents; • School physical education; and • Based on monitoring and instruction of obesity-related behaviours **Comparator:** usual health practice
Outcomes	**Primary outcome:** change in prevalence of overweight and obesity **Secondary outcomes** • Anthropometric outcomes: waist circumference, hip circumference, blood pressure, skin fold thickness • Behavioural outcomes: dietary, sedentary, or PA behaviours and their determinants (e.g. child or parental knowledge, beliefs, and attitudes; parental BMI, PA, and eating behaviours; school environment) • Blood chemical outcomes: fasting plasma glucose, fasting triglycerides, total cholesterol, high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) • Physical fitness outcomes: standing-board jump, 50-metre speed run, 50 meters × 8 shuttle run (primary students), and run of 800/1000 metres (secondary school students) **Other outcomes:** process evaluation **Relevant proposed outcome measures for SoF table:** physical activity duration, sedentary time, BMI, fitness
Reason for awaiting classification	Marked as 'completed' in ClinicalTrials.gov, but no publication available
Stated aim of study	**Quote:** "the aim of this multi-centred cluster randomised controlled trial (RCT) is to determine the effectiveness and cost-effectiveness of the Health Lifestyles Interventions in preventing overweight and obesity in Chinese school children and adolescents"
Notes	

Friedrich 2015

Methods	**Type of trial:** efficacy trial **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** single-blind (participants)
Participants	**Estimated number of schools:** 12 **Estimated number of participants:** 1041 **Inclusion criteria (schools):** primary municipal schools in the city of Porto Alegre/RS **Exclusion criteria (schools):** schools that did not offer afternoon classes for all grades, night schools, schools catering exclusively to special needs students **Inclusion criteria (students):** children of both genders enrolled in first through fourth grades who attended afternoon classes **Exclusion criteria (students):** students who were unable to undergo anthropometric assessment, who had special needs, or who were absent from school on the 2 occasions on which anthropometric measurements were taken
Interventions	**Intervention:** TriAtiva Program: Education, Nutrition and Physical Activity, was a year-long initiative that aimed to implement educational activities about healthy eating and physical activity, so as to develop a favourable environment for student health. Nutrition education and physical activity interventions involved in the programme were developed and implemented by a research team of nutritionists, physical education teachers, and professors of nutrition and physical education. All interventions were adapted to each school year based on a participative and playful approach. TriAtiva Program activities were performed every 15 days during school hours, and physical activity interventions were alternated with nutrition education initiatives, for a total of 6 months of activities. At the end of each TriAtiva event at school, extracurricular activities related to the topic of discussion were planned **Comparator:** followed regular curriculum of twice-weekly physical education classes of 50 minutes each
Outcomes	**Primary outcome:** body mass **Secondary outcomes:** waist circumference; percent body fat; blood pressure; behavioural variables such as eating habits and physical activity levels; prevalence, incidence, and remission rates of obesity **Relevant proposed outcome measures for SoF table:** physical activity duration, BMI
Reason for awaiting classification	Protocol paper published, but no results
Stated aim of study	**Quote:** "the aim of the present study was to assess the effects of an intervention program involving nutrition education and physical activity - namely, the TriAtiva Program: education, nutrition and physical activity - on the prevention and control of obesity in public primary school children in the city of Porto Alegre/Brazil using a randomised controlled trial"
Notes	

O'Malley 2011

Methods	**Type of trial:** – **Allocation:** cluster-randomised **Intervention model:** – **Masking:** –
Participants	**Estimated number of schools:** 4 **Estimated number of participants:** – **Inclusion criteria (schools):** – **Exclusion criteria (schools):** – **Inclusion criteria (students):** – **Exclusion criteria (students):** –
Interventions	**Intervention:** health promotion **Comparator:** –
Outcomes	**Primary outcome:** – **Secondary outcome:** – **Other outcome:** – **Relevant proposed outcome measures for SoF table:** BMI, physical activity duration
Reason for awaiting classification	Conference abstract only
Stated aim of study	**Quote:** "the TeesCAKE project is an exploratory cluster randomised con-trolled trial which aims to determine whether an evidence-based health promotion intervention can improve eating behaviours and activity levels amongst socially-deprived children in the UK"
Notes	

Salmon 2011a

Methods	**Type of trial:** effectiveness **Allocation:** cluster-randomised **Intervention model:** factorial **Masking:** –
Participants	**Estimated number of schools:** 20 **Estimated number of participants:** 600 **Inclusion criteria:** primary schools within a 50-km radius of Melbourne with enrolment of over 300 students **Exclusion criteria:** – **Inclusion criteria:** Year 3 children

Salmon 2011a *(Continued)*

	Exclusion criteria: –
Interventions	**Intervention 1:** SB-I, reducing uninterrupted time spent sitting during school hours will be aimed for in the school setting; and reducing overall sitting time and discretionary screen-based behaviours (i.e. television viewing, computer use, and electronic games) will be aimed for in the family setting **Intervention 2:** PA-I, physical activity intervention arm - increasing or maintaining moderate- to vigorous-intensity physical activity (e.g. active play, organised and non-organised games) during recess and lunch breaks will be targeted in the school setting, and time spent outdoors will be targeted in the family setting **Intervention 3:** SB + PA-I, combined sedentary behaviour and physical activity intervention arm - a blended version of the 2 interventions, but with the same intervention 'dose'. For example, when children in this arm complete a behavioural contract to switch off the television, they will be encouraged to participate in physical activity (SB-I children will not be directly encouraged to participate in activity when they switch off their television). The combined intervention arm will include 18 class lessons (9 per year), standing lessons and interruptions to children's classroom sitting time (short breaks), promotion of physical activity during recess and lunch breaks, and 18 newsletters to parents **Comparator:** asked to continue usual lesson delivery; will receive all intervention materials at completion of the 12-month follow-up period
Outcomes	**Primary outcomes:** physical activity, sedentary behaviour **Secondary outcomes:** anthropometry (height, weight, waist circumference), blood pressure, biomarkers, nutritional intake **Other outcome:** economic evaluation **Relevant proposed outcome measures for SoF table:** physical activity duration, sedentary time, BMI
Reason for awaiting classification	Only baseline data and mid-intervention results published
Stated aim of study	**Quote:** "the primary aim of the Transform-Us! study is to determine whether an 18-month, behavioral and environmental intervention in the school and family settings results in higher levels of physical activity and lower rates of sedentary behavior among 8-9 year old children compared with usual practice (post-intervention and 12-months follow-up)"
Notes	

Characteristics of ongoing studies [author-defined order]

Ferreira da Silva dos Santos 2020

Study name	SCHOOL IN ACTION
Methods	**Type of trial:** implementation **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** open
Participants	**Number of schools:** 5

Ferreira da Silva dos Santos 2020 *(Continued)*

	Number of students: 370 **Inclusion criteria (schools):** full-time, public primary schools with integral education programmes in the state of São Paulo, Brazil **Exclusion criteria (schools):** - **Inclusion criteria (students):** all students in selected schools **Exclusion criteria (students):** none
Interventions	**Intervention:** based on socioecological theory, at the individual level, the intervention involved development and monitoring of physical exercise in PE classes, physical activity during lunch breaks, vegetable gardening, and a healthy life project. At the school level, the intervention involved teacher training in PE, active breaks during non-PE classes, parent counselling, menu labelling, and changes to the physical environment **Comparator:** outcome assessment only
Outcomes	**Primary outcome:** physical activity **Secondary outcomes:** body composition, physical fitness, eating habits, sleep **Other outcomes:** potential mediating factors
Starting date	**Trial start date:** March through April 2017 **Trial completion date:** -
Contact information	**Responsible party/principal investigator:** S. Ferreira da Silva dos Santos; sueylaf.silva@ufam.edu.br
Notes	

O'Kane 2020

Study name	Walking in ScHools (WISH)
Methods	**Type of trial:** effectiveness **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** open
Participants	**Estimated number of schools:** 18 **Estimated number of students:** 384 **Inclusion criteria (schools):** post-primary schools in Northern Ireland and Ireland. Schools in Northern Ireland must have at least 80 girls in years 9 and 10 and must be located in Co. Derry/Londonderry. Schools in Ireland; must have enrolment of > 240 girls and must be located in Co. Donegal **Exclusion criteria (schools):** - **Inclusion criteria (students):** female students in year 9/10 (North Ireland) and in first/second year (Ireland)

O'Kane 2020 *(Continued)*

	Exclusion criteria (students): students who are unable to walk, or for whom walking is contraindicated
Interventions	**Intervention:** peer-led walking intervention, based on previous feasibility trial **Comparator:** -
Outcomes	**Primary outcome:** total physical activity **Secondary outcomes:** total physical activity and mid-point and follow-up; time spent in sedentary, light, moderate, and vigorous activity; proportion of students meeting physical activity guidelines; height, weight, BMI, waist and hip circumference; coping, resilience, and cognitive reappraisal; sleep quality, duration, and efficiency; social media use; social integration; emotional connection to social media; body weight and appearance satisfaction **Other outcomes:** process evaluation
Starting date	**Trial start date:** 01/09/2019 **Trial completion date:** -
Contact information	**Responsible party/principal investigator:** Dr Maria O'Kane; m.okane@ulster.ac.uk
Notes	

Szabo-Reed 2020

Study name	PAAC3
Methods	**Type of trial:** comparative effectiveness **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** open
Participants	**Estimated number of schools:** 16 **Estimated number of students:** ~ 1200 **Inclusion criteria (schools):** urban and rural schools within a 50-mile radius of Lawrence or Kansas City, KS **Exclusion criteria (schools):** - **Inclusion criteria (students):** second and third grade students **Exclusion criteria (students):** students who are confined to a wheelchair, are blind, or are intellectually disadvantaged, who may not be able to perform tests
Interventions	**Intervention:** classroom activity breaks delivered remotely via a television in the classroom **Comparator:** classroom activity breaks delivered by the classroom teacher
Outcomes	**Primary outcome:** MVPA during activity breaks **Secondary outcomes:** MVPA during the school day, total MVPA, BMI, energy expenditure **Other outcomes:** cardiovascular fitness, process evaluation, implementation, school environment

Szabo-Reed 2020 *(Continued)*

Starting date	**Trial start date:** 01/03/2018 **Trial completion date:** 01/08/2023
Contact information	**Responsible party/principal investigator:** Joseph Donnelly, PhD; jdonnelly2@kumc.edu
Notes	

van Delden 2020

Study name	A Good Beginning
Methods	**Type of trial:** efficacy **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** open-label
Participants	**Estimated number of schools:** 1 **Estimated number of students:** 56 **Inclusion criteria (schools):** - **Exclusion criteria (schools):** - **Inclusion criteria (students):** third grade, consent to participate (child and parent), physically able to stand, no serious health issues or injuries **Exclusion criteria (students):** -
Interventions	**Intervention:** each student received a sit-stand desk **Comparator:** -
Outcomes	**Primary outcome:** academic performance, proportion of sitting time at school **Secondary outcomes:** physical fitness, height, weight, body composition, cognitive function, happiness, quality of life, sleep, stool habits, satisfaction with school environment **Other outcomes:** -
Starting date	**Trial start date:** 01/05/2017 **Trial completion date:** 29/02/2020
Contact information	**Responsible party/principal investigator:** Lex van Delden; delden@leydenacademy.nl
Notes	

Demetriou 2019

Study name	CReActivity
Methods	**Type of trial:** effectiveness

Demetriou 2019 *(Continued)*

	Allocation: cluster-randomised **Intervention model:** parallel assignment **Masking:** open
Participants	**Estimated number of schools:** - **Estimated number of students:** 600 **Inclusion criteria (schools):** - **Exclusion criteria (schools):** - **Inclusion criteria (students):** female, ages 10 to 14 years, secondary school in the region of München **Exclusion criteria (students):** none
Interventions	**Intervention:** theory-based intervention implemented within PE classes, focused on behaviour change techniques **Comparator:** regular PE
Outcomes	**Primary outcomes:** total PA and PA during PE **Secondary outcomes:** autonomy, competence, relatedness, self-efficacy, social support, behavioural regulation, BMI **Other outcomes:** environmental factors, teacher characteristics, process evaluation
Starting date	**Trial start date:** 18/10/01 **Trial completion date:** -
Contact information	**Responsible party/principal investigator:** Ms. Prof. Dr. Yolanda Demetriou; yolanda.demetriou at tum.de
Notes	

Santos-Beneit 2019

Study name	The Program SI! for Cardiovascular Health Promotion at Elementary School (PSIE)
Methods	**Type of trial:** efficacy **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** none (open-label)
Participants	**Estimated number of schools:** **Estimated number of participants:** 1770 **Inclusion criteria (schools):** **Exclusion criteria (schools):** **Inclusion criteria (students):**

Santos-Beneit 2019 *(Continued)*

	Exclusion criteria (students):
Interventions	*Program SI! The core intervention comprises classroom activities grouped into healthy challenges (about diet, physical activity, human body and heart, and emotions management) distributed across different levels and implemented by corresponding teachers. All materials, formal training, and a teaching guide are provided to the school staff by the SHE Foundation. Families receive family challenges and key messages about their children's health. The school environment is intervened mainly through an annual Healthy Fair* **Intervention 1:** intervention is implemented during all elementary levels **Intervention 2:** intervention is implemented during first 3 levels of elementary school **Intervention 3:** intervention is implemented during last 3 levels of elementary schools **Comparator:** schools in control group keep their normal curriculum and do not join any school programme about health until the end of the study
Outcomes	**Primary outcomes:** knowledge, attitudes, and habits related to diet, physical activity, body and heart and emotion management, cardiovascular health markers (blood pressure, height, weight, waist circumference, and triceps and subscapular skin-fold thickness) **Secondary outcome:** family habits, teacher habits, aspects of the school environment **Other outcomes:** –
Starting date	**Trial start date:** October 2014 **Trial end date:** June 2020 (anticipated)
Contact information	Valentín Fuster, MD, PhD
Notes	

Sutherland 2019

Study name	PA4E1 Implementation
Methods	**Type of trial:** implementation **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** blinded (participants, outcome assessors, data analysts)
Participants	**Estimated number of schools:** 49 **Estimated number of students:** – **Inclusion criteria (schools):** co-educational secondary Department of Education (DOE) and Catholic schools that enrol students in Grades 7 through 10, are located in socioeconomically disadvantaged communities (ranked in the bottom 50% of NSW suburbs based on the SEIFA Index of Relative Socioeconomic Disadvantage), are not fully selective/sports/performing arts/agriculture/boarding schools, are not participating in other major whole-school physical activity intervention studies/initiatives, have the capacity to release a teacher to implement the intervention (school champion) student-level measures **Exclusion criteria (schools):** -

Sutherland 2019 *(Continued)*

	Inclusion criteria (students): 11 to 14 years **Exclusion criteria (students):** severe intellectual or physical disabilities
Interventions	**Intervention:** PA4E1 will be implemented using an in-school champion, obtaining executive and leadership support, with teacher professional learning, tools and resources, prompts and reminders, implementation support, and implementation performance monitoring and feedback **Comparator:** low-dose intervention at completion of the trial
Outcomes	**Primary outcome:** implementation of 4 of 7 PA practices **Secondary outcomes:** physical activity, adiposity, cost and cost-effectiveness **Other outcomes:** –
Starting date	**Trial start date:** 18/05/2017 **Trial completion date:** 30/06/2020 (anticipated)
Contact information	**Responsible party/Principal investigator:** Rachel Sutherland (Responsible Party), Prof. John Wiggers (Principal Investigator)
Notes	

Willis 2019

Study name	PLAN-A
Methods	**Type of trial:** effectiveness **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** open
Participants	**Estimated number of schools:** 20 **Estimated number of students:** 1583 (actual) **Inclusion criteria (schools):** – **Exclusion criteria (schools):** – **Inclusion criteria (students):** Year 9 girls at participating schools **Exclusion criteria (students):** none
Interventions	**Intervention:** peer nomination, peer-supporter training, peer diffusion of health messages **Comparator:** –
Outcomes	**Primary outcome:** accelerometer-determined weekday physical activity **Secondary outcomes:** accelerometer-determined weekend physical activity, weekend sedentary time, cost-effectiveness **Other outcomes:** –

Willis 2019 *(Continued)*

Starting date	**Trial start date:** 01/05/2018 **Trial completion date:** 21/12/2020 (anticipated)
Contact information	**Responsible Party/Principal Investigator:** Prof. Russ Jago
Notes	

ISRCTN74109264

Study name	Engaging adolescents in changing behaviour (EACH-B): a programme of research to improve the diets and physical activity levels of adolescents
Methods	**Type of trial:** efficacy **Allocation:** cluster-randomised **Intervention model:** parallel assignment **Masking:** open
Participants	**Estimated number of schools:** 50 **Estimated number of students:** 2300 **Inclusion criteria (schools):** state schools in Hampshire and surrounding areas **Exclusion criteria (schools):** single-sex schools **Inclusion criteria (students):** aged 12 and 13 (Year 8) **Exclusion criteria (students):** -
Interventions	**Intervention** • Participation in LifeLab at the University of Southampton: a 3-week science module linked to the National Curriculum, which helps teenagers think about science and their health • Encouragement from teachers trained to support students to improve their diets and exercise • A specially designed, interactive smartphone app that involves friends and has game features **Comparator:** no intervention
Outcomes	**Primary outcomes:** dietary quality, physical activity **Secondary outcomes:** well-being, self-regulation, body composition, compliance/adherence, self-efficacy, use of digital intervention, teachers' competence, educational outcomes, cost **Other outcomes:** –
Starting date	**Trial start date:** January 2016 **Trial completion date:** March 2022
Contact information	**Responsible Party/Principal Investigator:** Dr. Sofia Strommer
Notes	

NCT03504059

Study name	School-based Behavioural Intervention to Face Obesity and Promote Cardiovascular Health Among Spanish Adolescents
Methods	**Type of trial:** efficacy **Allocation:** cluster randomised **Intervention model:** parallel assignment **Masking:** none (open-label)
Participants	**Estimated number of schools:** – **Estimated number of students:** 1366 **Inclusion criteria (schools):** – **Exclusion criteria (schools):** – **Inclusion criteria (students):** any student in the first academic year of secondary school **Exclusion criteria (-students):** none
Interventions	**Intervention:** comprehensive educational school-based intervention for adolescents on cardiovascular health, including obesity/adiposity and metabolic profiles, through classroom intervention and complementary intervention in the family setting, at school, and by teachers **Comparator:** usual educational programme
Outcomes	**Primary outcomes:** changes in composite ICH score of adolescents from baseline to Years 2 and 4. ICH score measures cardiovascular health and includes 7 components: • No smoking • Being physically active • Good nutritional habits • Normal weight - health factors • Normal blood pressure • Normal cholesterol level • Normal glucose levels: to meet the complete definition of ideal cardiovascular health, an individual would need to meet the ideal levels of all 7 components **Secondary outcomes:** body mass index, waist circumference, percentage of body fat, distribution of body fat, dietary habits, attitudes about eating, polyphenol consumption, carotenoid consumption, energy and nutrition, metabolomics, physical activity, sedentary habits, attitudes towards abuse substances, smoking habits, self-image, self-esteem, emotional eating, mood, educational effectiveness, cardiovascular score **Other outcomes:** –
Starting date	**Trial start date:** 1 June 2017 **Trial completion date:** 30 June 2021 (anticipated)
Contact information	**Responsible Party/Principal Investigator:** Rosa M Lamuela-Raventós, PhD, Gloria Santos-Beneit, PhD, Juan M Fernández Alvira, PhD, Valentín Fuster, PhD, MD
Notes	

NCT03440580

Study name	BOOSTH: Promoting Physical Activity in Primary Schools in Combination With Serious Gaming
Methods	**Type of trial:** efficacy **Allocation:** randomised **Intervent:ion model:** parallel assignment **Masking:** none (open-label)
Participants	**Estimated number of schools:** – **Estimated number of students:** 1240 **Inclusion criteria (school):** located in the Limburg-region of the Netherlands; at least 25 students enrolled in Grades 5, 6, 7; school works with a technological device with Bluetooth option to synchronise activity points **Exclusion criteria (school):** schools with plans to merge with another school or to relocate in the upcoming year **Inclusion criteria (students):** boys and girls in fifth to seventh grades **Exclusion criteria (students):** children who are wheelchair-dependent
Interventions	**Intervention:** the intervention school will receive the BOOSTH intervention: Boosth activity tracker, Boosth sync app, Boosht game app. BOOSTH as a serious game is used as a tool to motivate children to perform more PA. BOOSTH uses the combination of a smartphone game and a pedometer that assesses daily PA by measuring steps/d. The BOOSTH activity monitor is a wrist-worn activity monitor that is able to provide online feedback on the child's PA levels. Moreover, BOOSTH is a reward-based game, as a child is given incentive to increase PA level, to acquire activity points, which can be used later to unlock levels and to progress in the BOOSTH game **Comparator:** standard curriculum
Outcomes	**Primary outcome:** moderate to vigorous physical activity (minutes/d) with accelerometer **Secondary outcomes:** change in step count, change in physical activity behaviour, BMI z-score, motivation toward physical activity, screen time, quality of life, cardiovascular alterations (pulse wave velocity and retinal image), blood pressure, aerobic fitness **Other outcomes:** comprehensive general parenting questionnaire, parenting practices questionnaire, process evaluation
Starting date	**Trial start date:** 17 August 2018 **Trial completion date:** 31 December 2020 (anticipated)
Contact information	**Responsible Party/Principal Investigator:** Dr. Anita Vreugdenhil, Dr. Gabrielle ten velde
Notes	

Oluwasanu 2017

Study name	Ibadan Active Kids Project (IBAKP)
Methods	**Type of trial:** efficacy

Oluwasanu 2017 *(Continued)*

	Allocation: cluster-randomised **Intervention model:** parallel assignment **Masking:** –
Participants	**Estimated number of schools:** 22 **Estimated number of students:** 1000 **Inclusion criteria (schools):** – **Exclusion criteria (schools):** – **Inclusion criteria (students):** in-school adolescents in public and private schools **Exclusion criteria (students):** out-of-school youths, adolescents in schools for the disabled
Interventions	**Intervention:** activities that are under consideration include educational materials for students, special dance events in schools, debates and other co-curricular activities, experience sharing by role models/athletes, Mhealth, and peer education. Preferred interventions will be jointly developed by adolescents, school authorities, and researchers. At the school level, activities under consideration include meetings and policy dialogue forums, production of evidence-based dissemination materials on the importance of physical activity for the health and mental well-being of students, and advocacy visits to engage policymakers to prioritise resources aimed at promoting physical activity in schools. The policy goal for this intervention is to ensure that all in-school adolescents participate in 30 minutes of daily structured moderate to vigorous physical activity **Comparator:** –
Outcomes	**Primary outcomes:** self-reported physical activity, step counts **Secondary outcomes:** anthropometric measures, fitness, knowledge, attitudes, self-efficacy, perceived behavioural control, intention, social norms, social support, policy or programme changes **Other outcomes:** –
Starting date	**Trial start:** 01 March 2016 (anticipated) **Trial completion:** –
Contact information	**Principal Investigator:** Mrs. Mojisola Oluwasanu
Notes	

DATA AND ANALYSES

Comparison 1. PA programme vs no PA programme

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1 Physical activity participation: all data	5		Other data	No numeric data
1.1.1 Children: before and after school programme	1		Other data	No numeric data

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.1.2 Children: schooltime PA	1		Other data	No numeric data
1.1.3 Children: multi-component interventions	1		Other data	No numeric data
1.1.4 Adolescents: multi-component interventions	2		Other data	No numeric data
1.2 Physical activity duration (minutes/d): meta-analysis	33	20614	Mean Difference (IV, Random, 95% CI)	0.73 [0.16, 1.30]
1.2.1 Children	22	10715	Mean Difference (IV, Random, 95% CI)	1.01 [0.08, 1.93]
1.2.2 Adolescents	11	9899	Mean Difference (IV, Random, 95% CI)	1.84 [0.34, 3.35]
1.3 Physical activity duration by intervention type (minutes/d): meta-analysis	33	20614	Mean Difference (IV, Random, 95% CI)	0.73 [0.16, 1.30]
1.3.1 Before and after school programmes	6	2571	Mean Difference (IV, Random, 95% CI)	0.77 [-1.40, 2.94]
1.3.2 Enhanced PE	3	2050	Mean Difference (IV, Random, 95% CI)	-0.23 [-1.58, 1.11]
1.3.3 Multi-component interventions	16	12135	Mean Difference (IV, Random, 95% CI)	2.42 [0.62, 4.22]
1.3.4 Schooltime PA	8	3858	Mean Difference (IV, Random, 95% CI)	5.30 [0.89, 9.72]
1.4 Physical activity duration: additional data	6		Other data	No numeric data
1.4.1 Before and after school programmes	1		Other data	No numeric data
1.4.2 Enhanced PE	2		Other data	No numeric data
1.4.3 Multi-component intervention	2		Other data	No numeric data
1.4.4 Schooltime PA	2		Other data	No numeric data
1.5 Sedentary time (minutes/d): meta-analysis	16	11914	Mean Difference (IV, Random, 95% CI)	-3.78 [-7.80, 0.24]
1.5.1 Children	11	5766	Mean Difference (IV, Random, 95% CI)	-3.35 [-9.30, 2.60]
1.5.2 Adolescents	5	6148	Mean Difference (IV, Random, 95% CI)	-5.67 [-11.48, 0.14]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.6 Sedentary time (minutes/d) by intervention type: meta-analysis	16	11914	Mean Difference (IV, Random, 95% CI)	-3.78 [-7.80, 0.24]
1.6.1 Before and after school programmes	2	773	Mean Difference (IV, Random, 95% CI)	2.01 [-15.28, 19.31]
1.6.2 Enhanced PE	1	540	Mean Difference (IV, Random, 95% CI)	-11.18 [-21.96, -0.40]
1.6.3 Multi-component interventions	11	9164	Mean Difference (IV, Random, 95% CI)	-4.60 [-9.08, -0.12]
1.6.4 Schooltime PA	2	1437	Mean Difference (IV, Random, 95% CI)	-3.26 [-19.05, 12.52]
1.7 Sedentary time: additional data	4		Other data	No numeric data
1.7.1 Before and after school programmes	1		Other data	No numeric data
1.7.2 Enhanced PE	3		Other data	No numeric data
1.7.5 Multi-component intervention	1		Other data	No numeric data
1.8 Physical fitness (mL/kg/min): meta-analysis	13	3980	Mean Difference (IV, Random, 95% CI)	1.19 [0.57, 1.82]
1.8.1 Children	9	2215	Mean Difference (IV, Random, 95% CI)	1.47 [0.84, 2.09]
1.8.2 Adolescents	4	1765	Mean Difference (IV, Random, 95% CI)	0.58 [-0.18, 1.35]
1.9 Physical fitness (mL/kg/min) by intervention type: meta-analysis	13	3980	Mean Difference (IV, Random, 95% CI)	1.19 [0.57, 1.82]
1.9.1 Before and after school programmes	5	724	Mean Difference (IV, Random, 95% CI)	1.38 [0.34, 2.41]
1.9.2 Enhanced PE	4	1387	Mean Difference (IV, Random, 95% CI)	1.99 [0.76, 3.21]
1.9.3 Multi-component interventions	3	1697	Mean Difference (IV, Random, 95% CI)	-0.33 [-0.73, 0.08]
1.9.4 Schooltime PA	1	172	Mean Difference (IV, Random, 95% CI)	2.70 [1.04, 4.36]
1.10 Physical fitness: additional data	29		Other data	No numeric data
1.10.1 Before or after school programme	4		Other data	No numeric data
1.10.2 Enhanced PE	5		Other data	No numeric data

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.10.3 Multi-component intervention	11		Other data	No numeric data
1.10.4 Schooltime PA	10		Other data	No numeric data
1.11 BMI: meta-analysis [z-scores]	21	22948	Mean Difference (IV, Random, 95% CI)	-0.06 [-0.09, -0.02]
1.11.1 Children	16	15732	Mean Difference (IV, Random, 95% CI)	-0.06 [-0.11, -0.01]
1.11.2 Adolescents	5	7216	Mean Difference (IV, Random, 95% CI)	-0.03 [-0.05, -0.00]
1.12 BMI by intervention type: meta-analysis [z-scores]	21	22948	Mean Difference (IV, Random, 95% CI)	-0.06 [-0.09, -0.02]
1.12.1 Before and after school programmes	2	1615	Mean Difference (IV, Random, 95% CI)	-0.02 [-0.05, 0.01]
1.12.2 Enhanced PE	1	174	Mean Difference (IV, Random, 95% CI)	-0.08 [-0.29, 0.13]
1.12.3 Multi-component interventions	17	19489	Mean Difference (IV, Random, 95% CI)	-0.06 [-0.11, -0.01]
1.12.4 Schooltime PA	1	1670	Mean Difference (IV, Random, 95% CI)	-0.03 [-0.08, 0.02]
1.13 BMI: meta-analysis [kg/m2]	50	34337	Mean Difference (IV, Random, 95% CI)	-0.07 [-0.15, 0.01]
1.13.1 Children	38	25447	Mean Difference (IV, Random, 95% CI)	-0.11 [-0.19, -0.02]
1.13.2 Adolescents	12	8890	Mean Difference (IV, Random, 95% CI)	0.05 [-0.16, 0.25]
1.14 BMI by intervention type: meta-analysis [kg/m2]	50	34337	Mean Difference (IV, Random, 95% CI)	-0.07 [-0.15, 0.01]
1.14.1 Before and after school programmes	9	2314	Mean Difference (IV, Random, 95% CI)	-0.12 [-0.25, 0.01]
1.14.2 Enhanced PE	10	3357	Mean Difference (IV, Random, 95% CI)	-0.04 [-0.32, 0.24]
1.14.3 Multi-component interventions	20	24417	Mean Difference (IV, Random, 95% CI)	-0.10 [-0.24, 0.03]
1.14.4 Schooltime PA	11	4249	Mean Difference (IV, Random, 95% CI)	-0.05 [-0.14, 0.04]
1.15 BMI: additional data	9		Other data	No numeric data

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1.15.1 Before or after school programme	1		Other data	No numeric data
1.15.2 Enhanced PE	1		Other data	No numeric data
1.15.3 Multi-component intervention	4		Other data	No numeric data
1.15.4 Schooltime PA	3		Other data	No numeric data
1.16 Health-related quality of life: all data	7		Other data	No numeric data
1.16.1 Children	5		Other data	No numeric data
1.16.2 Adolescents	2		Other data	No numeric data
1.17 Adverse events: all data	16		Other data	No numeric data

Analysis 1.1. Comparison 1: PA programme vs no PA programme, Outcome 1: Physical activity participation: all data

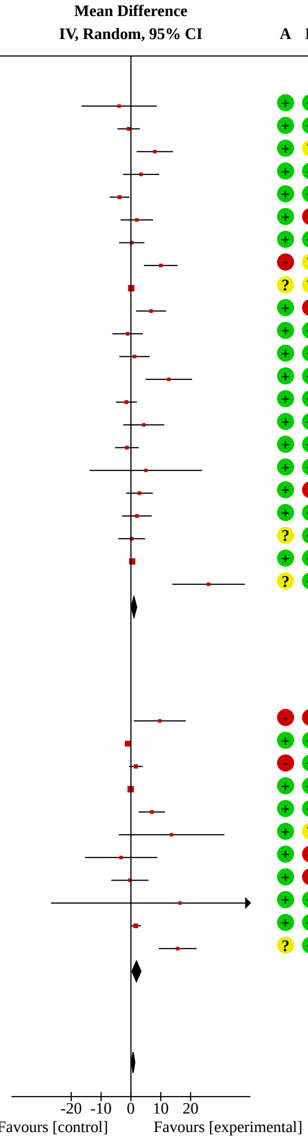
Physical activity participation: all data

Study	Study population	Intervention group	Control Group	Measurement period	Overall effect	Comment
Children: before and after school programme						
Jago 2015	Year 7 female students	After-school dance classes	Provided data only	20 weeks	Between group difference in % meeting 60 min/day of MVPA: −1.11% (95% CI −1.68, −0.73)	
				1 year	Between group difference in % meeting 60 min/day of MVPA: −1.18% ((95% CI −1.82, 0.76)	
Children: schooltime PA						
Kobel 2014	Pupils at primary school, grades 1 and 2	Teacher training, PA education, and active breaks	No intervention	1 year	Between-group difference in % meeting 60 min/day of MVPA: 10.4% (not statistically significant) Intervention group: 54.7% Control group: 44.3%	
Children: multi-component interventions						
Adab 2018	Year 1 students (aged 5 to 6 years)	30 min of additional MVPA on each school day, cooking workshops, a 6-week healthy eating program, and information sheets for families	Ongoing year 2 health related activities and education resources, excluding topics related to healthy eating and PA	15 months	Between-group difference in % meeting 60 min/day of MVPA: 0.005% (95% CI −0.101, 0.140)	
				18 months	Between-group difference in % meet-	

					ing 60 min/day of MVPA: −0.067% (95% CI −0.165, 0.096)
Adolescents: multi-component interventions					
Andrade 2014	Grades 8 and 9 students	ACTIVITAL individual- and environmental-based intervention	Standard curriculum	28 months	Between-group difference in % meeting guidelines: 12.22% (P < 0.01) Intervention group: -5.87% Control: -18.09%
Harrington 2018	Female students in years 7 to 9, 11 to 14 years old	Support for PA, PE, and school sport culture and practices with the support of the Youth Sport Trust and a hub school	Continued with normal PA habits	7 months (midpoint)	Meeting guidelines: OR: 0.78 (0.23, 2.65)
				14 months	Meeting guidelines: OR: 0.65 (0.23, 1.85)

Analysis 1.2. Comparison 1: PA programme vs no PA programme, Outcome 2: Physical activity duration (minutes/d): meta-analysis

Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI	A	B	C	D	E	F	G	H	I
1.2.1 Children															
Adab 2018	-3.939	6.4399	334	386	0.2%	-3.94 [-16.56 , 8.68]	+	+	-	+	+	+	+	+	+
Jago 2019	-0.75	1.910714286	113	139	2.0%	-0.75 [-4.49 , 2.99]	+	+	-	-	+	+	+	-	+
Seljebotn 2019	8	3.1105	189	188	0.8%	8.00 [1.90 , 14.10]	+	?	-	-	-	-	?	+	-
Have 2018	3.4	3.1	187	127	0.8%	3.40 [-2.68 , 9.48]	+	+	-	+	+	+	+	+	+
Farmer 2017	-3.8	1.683673469	295	278	2.5%	-3.80 [-7.10 , -0.50]	+	+	-	+	-	-	+	+	+
Sutherland 2017	1.96	2.780612245	497	492	1.0%	1.96 [-3.49 , 7.41]	+	-	+	+	+	+	?	-	+
Daly 2016	0.2645	2.1642	273	267	1.6%	0.26 [-3.98 , 4.51]	+	+	-	-	-	+	+	+	+
Drummy 2016	10	2.8886	54	53	1.0%	10.00 [4.34 , 15.66]	-	?	-	-	?	-	+	+	-
Kocken 2016	0.1	0.102	41	37	16.5%	0.10 [-0.10 , 0.30]	?	?	-	?	?	+	+	-	+
Lau 2016	6.73	2.566326531	40	40	1.2%	6.73 [1.70 , 11.76]	+	-	-	+	?				
Resaland 2016	-1.1	2.6021	564	496	1.2%	-1.10 [-6.20 , 4.00]	+	+	-	-	+	+	+	-	+
Tarp 2016	1.2	2.602040816	96	148	1.2%	1.20 [-3.90 , 6.30]	+	+	-	?	+	-	+	-	+
Cohen 2015	12.7	3.9797	62	76	0.5%	12.70 [4.90 , 20.50]	+	+	-	-	+	+	+	+	+
Jago 2015	-1.523	1.79	255	265	2.3%	-1.52 [-5.03 , 1.99]	+	+	-	+	+	+	+	+	+
Jago 2014	4.3	3.5205	153	157	0.7%	4.30 [-2.60 , 11.20]	+	+	-	-	+	+	+	+	+
Kipping 2014	-1.35	2.010204082	603	649	1.9%	-1.35 [-5.29 , 2.59]	+	+	-	+	+	+	+	+	+
Kobel 2014	5	9.61	106	61	0.1%	5.00 [-13.84 , 23.84]	+	+	-	+	-	-	+	-	-
Fairclough 2013	2.85	2.2909	107	123	1.5%	2.85 [-1.64 , 7.34]	+	-	-	-	+	-	+	-	+
Grydeland 2013	2	2.55102041	215	458	1.2%	2.00 [-3.00 , 7.00]	+	+	-	-	+	-	+	+	+
Wilson 2011	0.25	2.29	729	693	1.5%	0.25 [-4.24 , 4.74]	?	+	?	+	+	+	+	+	+
Kriemler 2010	0.44	0.19642857	297	205	15.6%	0.44 [0.06 , 0.82]	+	+	+	+	+	+	+	-	+
Donnelly 2009	26	6.2034	77	90	0.2%	26.00 [13.84 , 38.16]	?	+	-	+	+	?	+	-	+
Subtotal (95% CI)			**5287**	**5428**	**55.4%**	**1.01 [0.08 , 1.93]**									
Heterogeneity: Tau² = 1.00; Chi² = 67.02, df = 21 (P < 0.00001); I² = 69%															
Test for overall effect: Z = 2.13 (P = 0.03)															
1.2.2 Adolescents															
Belton 2019	9.657	4.4424	158	170	0.4%	9.66 [0.95 , 18.36]	-	-	-	-	-	-	+	-	+
Lonsdale 2019a	-1.09	0.398	520	488	12.8%	-1.09 [-1.87 , -0.31]	+	+	+	+	+	-	+	+	+
Harrington 2018	1.65	1.168367347	867	885	4.5%	1.65 [-0.64 , 3.94]	-	+	-	+	+	+	+	-	+
Robbins 2018	-0.08	0.0663	706	680	16.7%	-0.08 [-0.21 , 0.05]	+	+	+	+	+	-	+	+	+
Sutherland 2016	7	2.2449	245	191	1.5%	7.00 [2.60 , 11.40]	+	+	-	+	+	+	?	+	+
Andrade 2014	13.6	9.0308	64	60	0.1%	13.60 [-4.10 , 31.30]	+	?	+	?	+	-	+	+	+
Toftager 2014	-3.3	6.1736	376	421	0.2%	-3.30 [-15.40 , 8.80]	+	-	-	-	+	-	+	+	+
Okely 2011	-0.35	3.1786	306	298	0.8%	-0.35 [-6.58 , 5.88]	+	-	+	+	+	-	?	-	+
Peralta 2009	16.4	22.04081633	12	11	0.0%	16.40 [-26.80 , 59.60]	+	+	?	+	?				
Webber 2008	1.6	0.8674	1689	1689	6.7%	1.60 [-0.10 , 3.30]	+	+	?	+	+	+	+	+	+
Haerens 2006	15.6638	3.2385	51	12	0.8%	15.66 [9.32 , 22.01]	?	+	?	?	?	?	?	-	+
Subtotal (95% CI)			**4994**	**4905**	**44.6%**	**1.84 [0.34 , 3.35]**									
Heterogeneity: Tau² = 2.55; Chi² = 53.90, df = 10 (P < 0.00001); I² = 81%															
Test for overall effect: Z = 2.40 (P = 0.02)															
Total (95% CI)			**10281**	**10333**	**100.0%**	**0.73 [0.16 , 1.30]**									
Heterogeneity: Tau² = 0.50; Chi² = 127.23, df = 32 (P < 0.00001); I² = 75%															
Test for overall effect: Z = 2.51 (P = 0.01)															
Test for subgroup differences: Chi² = 0.86, df = 1 (P = 0.35), I² = 0%															



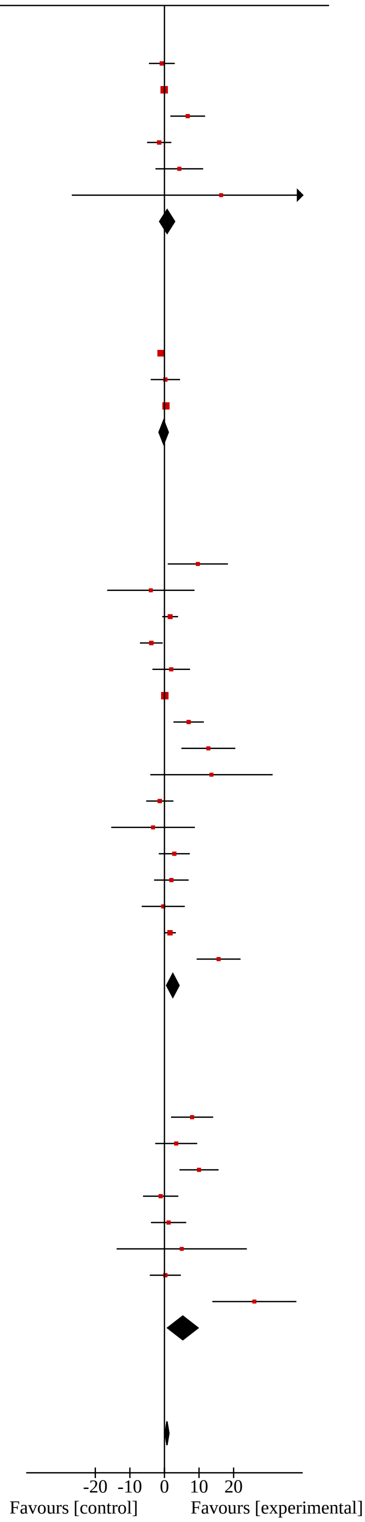
Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Selective reporting (reporting bias)
(F) Cluster RCT - Recruitment bias
(G) Cluster RCT - Baseline imbalance
(H) Cluster RCT - Loss of clusters
(I) Cluster RCT - Incorrect analysis

Analysis 1.3. Comparison 1: PA programme vs no PA programme, Outcome 3: Physical activity duration by intervention type (minutes/d): meta-analysis

Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.3.1 Before and after school programmes						
Jago 2019	-0.75	1.910714286	113	139	2.0%	-0.75 [-4.49 , 2.99]
Robbins 2018	-0.08	0.0663	706	680	16.7%	-0.08 [-0.21 , 0.05]
Lau 2016	6.73	2.566326531	40	40	1.2%	6.73 [1.70 , 11.76]
Jago 2015	-1.523	1.79	255	265	2.3%	-1.52 [-5.03 , 1.99]
Jago 2014	4.3	3.5205	153	157	0.7%	4.30 [-2.60 , 11.20]
Peralta 2009	16.4	22.04081633	12	11	0.0%	16.40 [-26.80 , 59.60]
Subtotal (95% CI)			**1279**	**1292**	**22.9%**	**0.77 [-1.40 , 2.94]**
Heterogeneity: Tau² = 3.00; Chi² = 9.92, df = 5 (P = 0.08); I² = 50%						
Test for overall effect: Z = 0.70 (P = 0.49)						
1.3.2 Enhanced PE						
Lonsdale 2019a	-1.09	0.398	520	488	12.8%	-1.09 [-1.87 , -0.31]
Daly 2016	0.2645	2.1642	273	267	1.6%	0.26 [-3.98 , 4.51]
Kriemler 2010	0.44	0.19642857	297	205	15.6%	0.44 [0.06 , 0.82]
Subtotal (95% CI)			**1090**	**960**	**30.1%**	**-0.23 [-1.58 , 1.11]**
Heterogeneity: Tau² = 0.94; Chi² = 11.89, df = 2 (P = 0.003); I² = 83%						
Test for overall effect: Z = 0.34 (P = 0.73)						
1.3.3 Multi-component interventions						
Belton 2019	9.657	4.4424	158	170	0.4%	9.66 [0.95 , 18.36]
Adab 2018	-3.939	6.4399	334	386	0.2%	-3.94 [-16.56 , 8.68]
Harrington 2018	1.65	1.168367347	867	885	4.5%	1.65 [-0.64 , 3.94]
Farmer 2017	-3.8	1.683673469	295	278	2.5%	-3.80 [-7.10 , -0.50]
Sutherland 2017	1.96	2.780612245	497	492	1.0%	1.96 [-3.49 , 7.41]
Kocken 2016	0.1	0.102	41	37	16.5%	0.10 [-0.10 , 0.30]
Sutherland 2016	7	2.2449	245	191	1.5%	7.00 [2.60 , 11.40]
Cohen 2015	12.7	3.9797	62	76	0.5%	12.70 [4.90 , 20.50]
Andrade 2014	13.6	9.0308	64	60	0.1%	13.60 [-4.10 , 31.30]
Kipping 2014	-1.35	2.010204082	603	649	1.9%	-1.35 [-5.29 , 2.59]
Toftager 2014	-3.3	6.1736	376	421	0.2%	-3.30 [-15.40 , 8.80]
Fairclough 2013	2.85	2.2909	107	123	1.5%	2.85 [-1.64 , 7.34]
Grydeland 2013	2	2.55102041	215	458	1.2%	2.00 [-3.00 , 7.00]
Okely 2011	-0.35	3.1786	306	298	0.8%	-0.35 [-6.58 , 5.88]
Webber 2008	1.6	0.8674	1689	1689	6.7%	1.60 [-0.10 , 3.30]
Haerens 2006	15.6638	3.2385	51	12	0.8%	15.66 [9.32 , 22.01]
Subtotal (95% CI)			**5910**	**6225**	**40.4%**	**2.42 [0.62 , 4.22]**
Heterogeneity: Tau² = 6.60; Chi² = 62.80, df = 15 (P < 0.00001); I² = 76%						
Test for overall effect: Z = 2.64 (P = 0.008)						
1.3.4 Schooltime PA						
Seljebotn 2019	8	3.1105	189	188	0.8%	8.00 [1.90 , 14.10]
Have 2018	3.4	3.1	187	127	0.8%	3.40 [-2.68 , 9.48]
Drummy 2016	10	2.8886	54	53	1.0%	10.00 [4.34 , 15.66]
Resaland 2016	-1.1	2.6021	564	496	1.2%	-1.10 [-6.20 , 4.00]
Tarp 2016	1.2	2.602040816	96	148	1.2%	1.20 [-3.90 , 6.30]
Kobel 2014	5	9.61	106	61	0.1%	5.00 [-13.84 , 23.84]
Wilson 2011	0.25	2.29	729	693	1.5%	0.25 [-4.24 , 4.74]
Donnelly 2009	26	6.2034	77	90	0.2%	26.00 [13.84 , 38.16]
Subtotal (95% CI)			**2002**	**1856**	**6.7%**	**5.30 [0.89 , 9.72]**
Heterogeneity: Tau² = 26.95; Chi² = 26.21, df = 7 (P = 0.0005); I² = 73%						
Test for overall effect: Z = 2.35 (P = 0.02)						
Total (95% CI)			**10281**	**10333**	**100.0%**	**0.73 [0.16 , 1.30]**
Heterogeneity: Tau² = 0.50; Chi² = 127.23, df = 32 (P < 0.00001); I² = 75%						
Test for overall effect: Z = 2.51 (P = 0.01)						
Test for subgroup differences: Chi² = 9.28, df = 3 (P = 0.03), I² = 67.7%						

Mean Difference
IV, Random, 95% CI



Analysis 1.4. Comparison 1: PA programme vs no PA programme, Outcome 4: Physical activity duration: additional data

Physical activity duration: additional data

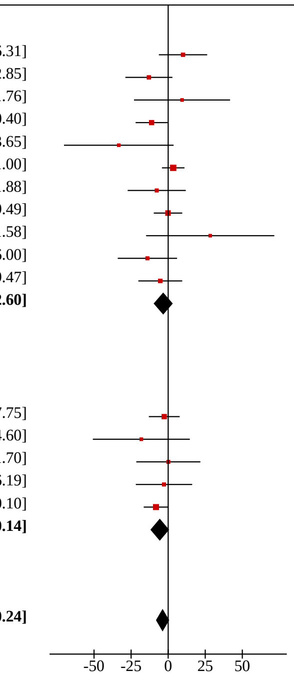
Study	Study population	Intervention group	Control Group	Measurement period	Overall effect	Comment
Before and after school programmes						
Zhou 2019	Junior high school students, grade 7	I1: Biweekly after school program	Regular PE (2 days per week)	32 weeks	% of time spent in MVPA: MD 1.99 (95% CI: 1.68, 2.30) I1: m 4.22 (sd 1.39) Control: m 2.23 (sd 1.52)	% time reported, not min/day
		I2: Enhanced PE (3 days per week) plus after school program	Regular PE (2 days per week)	32 weeks	% of time spent in MVPA: MD 4.98 (95% CI: 4.62, 5.34) I2: m 7.21 (sd 1.84) Control: m 2.23 (sd 1.52)	Authors note that statistically significant changes were found from baseline to follow-up in both intervention groups but not the control group however analyses were not described.
Enhanced PE						
Ten Hoor 2018	Secondary school students, 11 to 15 years old	Strength training and motivational interviewing	Usual curriculum	1 year	Between group difference in % of time spent in MPVA tested, P = 0.046	No values reported
Zhou 2019	Junior high school students, grade 7	I1: Enhanced PE (3 days per week)	Regular PE (2 days per week)	32 weeks	% of time spent in MVPA: MD 3.12 (95% CI: 2.76, 3.48) I1: m 5.35 (sd 1.79) Control: m 2.23 (sd 1.52)	% time reported, not min/day
		I2: Enhanced PE (3 days per week) plus after school program			% of time spent in MVPA: MD 4.98 (95% CI: 4.62, 5.34) I2: m 7.21 (sd 1.84) Control: m 2.23 (sd 1.52)	Authors note that statistically significant changes were found from baseline to follow-up in both intervention groups but not the control group however analyses were not described.
Multi-component intervention						
Corepal 2019	Students age 12-14	Pedometer challenge	Usual school	Baseline	Intervention: m 33.3 min/day, IQR: 23.6, 49.0) Control: m 43.6 min/day, IQR: 31.0, 69.3	Feasibility trial, therefore statistical testing not conducted
				22 weeks	MD: -14.4 min/day Intervention: m 33.0 min/day, IQR: 20.0, 46.2 Control: m 47.4 min/day, IQR: 32.7, 65.1	No estimates of variance given, only mean and interquartile range
Salmon 2008	Grade 5 students (10 to 11 years old)	I1: Behavioral modification group, I2: fundamental motor skills group, I3: combined behavioral modification and fundamental motor skills group	Usual classroom lessons	1 school year	Adjusted between group difference (vs. control group) I1: MD 2.8 (95% CI 0.3, 5.4) min/day I2: MD 7.8 (95% CI 3.4, 12.3) min/day I3: MD 3.1 (95% CI -0.58, 6.7) min/day	Vigorous PA only
				1 year post-intervention	Adjusted between group difference (vs. control group)	Vigorous PA only

					I1: MD 2.8 (95% CI 0.2, 5.4) min/day I2: MD 7.7 (95% CI 3.2, 12.2) min/day I3: MD 3.0 (95% CI -0.59, 6.6) min/day	
Schooltime PA						
Ford 2013	Primary school students aged 5 to 11 years	Accumulated brisk walking program	Normal school lessons	15 weeks	Change from baseline MD -27.4 (95% CI: -91.0, 36.2) counts per min Intervention group: -29.2 (-72.0, 13.6) counts per min, P = 0.415 Control group: -1.8 (-50.3, 46.7) counts per min, P = 0.772	Weekday counts per min only
Magnusson 2011	Children attending grade 2 (born in 1999)	Students engaged in PA during PE lessons, recess, and during classes; schools had access to PA equipment to use in school lessons; teaching materials promoting PA were provided	Followed the general PA curriculum	1 year (midpoint)	Group x time interaction in multivariable model P < 0.0001	
				2 years	Group x time interaction in multivariable model P = 0.10	

Analysis 1.5. Comparison 1: PA programme vs no PA programme, Outcome 5: Sedentary time (minutes/d): meta-analysis

Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI	A	B	C	D	E	F	G	H	I
1.5.1 Children															
Jago 2019	10.01	8.3165	113	139	5.2%	10.01 [-6.29 , 26.31]	+	+	-	-	+	+	+	-	+
Seljebotn 2019	-13	8.0873	189	188	5.5%	-13.00 [-28.85 , 2.85]	+	?	-	-	-	-	?	+	-
Adab 2018	9.36	16.5309	334	386	1.5%	9.36 [-23.04 , 41.76]	+	+	-	+	+	+	+	+	+
Daly 2016	-11.1816	5.4992	273	267	10.2%	-11.18 [-21.96 , -0.40]	+	+	-	-	-	+	+	+	+
Kocken 2016	-33.31	18.8575	41	37	1.1%	-33.31 [-70.27 , 3.65]	?	?	-	?	?	+	+	-	+
Resaland 2016	3.4	3.8776	564	496	16.1%	3.40 [-4.20 , 11.00]	+	+	-	-	+	+	+	-	+
Jago 2015	-7.72	10.0002	256	265	3.8%	-7.72 [-27.32 , 11.88]	+	+	-	+	+	+	+	+	+
Kipping 2014	-0.11	4.897959184	603	649	12.0%	-0.11 [-9.71 , 9.49]	+	+	-	+	+	+	+	+	+
Fairclough 2013	28.35	22.05612245	107	123	0.8%	28.35 [-14.88 , 71.58]	+	-	-	-	+	-	+	-	+
Grydeland 2013	-14	10.2043	215	458	3.7%	-14.00 [-34.00 , 6.00]	+	+	-	-	+	-	+	+	+
Haerens 2006	-5.3307	7.5524	51	12	6.2%	-5.33 [-20.13 , 9.47]	?	+	?	?	?	?	?	-	+
Subtotal (95% CI)			**2746**	**3020**	**66.1%**	**-3.35 [-9.30 , 2.60]**									
Heterogeneity: Tau² = 32.52; Chi² = 15.81, df = 10 (P = 0.11); I² = 37%															
Test for overall effect: Z = 1.10 (P = 0.27)															
1.5.2 Adolescents															
Harrington 2018	-2.64	5.301020408	680	565	10.7%	-2.64 [-13.03 , 7.75]	-	+	-	+	+	+	+	-	+
Andrade 2014	-18.1	16.684	64	60	1.5%	-18.10 [-50.80 , 14.60]	+	?	+	?	+	-	+	+	+
Toftager 2014	0.1	11.0206	376	421	3.2%	0.10 [-21.50 , 21.70]	+	-	-	-	+	-	+	+	+
Okely 2011	-2.81	9.6941	306	298	4.0%	-2.81 [-21.81 , 16.19]	+	-	+	+	+	-	?	-	+
Webber 2008	-8.2	4.2348	1689	1689	14.5%	-8.20 [-16.50 , 0.10]	+	+	?	+	+	+	+	+	+
Subtotal (95% CI)			**3115**	**3033**	**33.9%**	**-5.67 [-11.48 , 0.14]**									
Heterogeneity: Tau² = 0.00; Chi² = 1.60, df = 4 (P = 0.81); I² = 0%															
Test for overall effect: Z = 1.91 (P = 0.06)															
Total (95% CI)			**5861**	**6053**	**100.0%**	**-3.78 [-7.80 , 0.24]**									
Heterogeneity: Tau² = 11.09; Chi² = 18.24, df = 15 (P = 0.25); I² = 18%															
Test for overall effect: Z = 1.84 (P = 0.07)															
Test for subgroup differences: Chi² = 0.30, df = 1 (P = 0.58), I² = 0%															

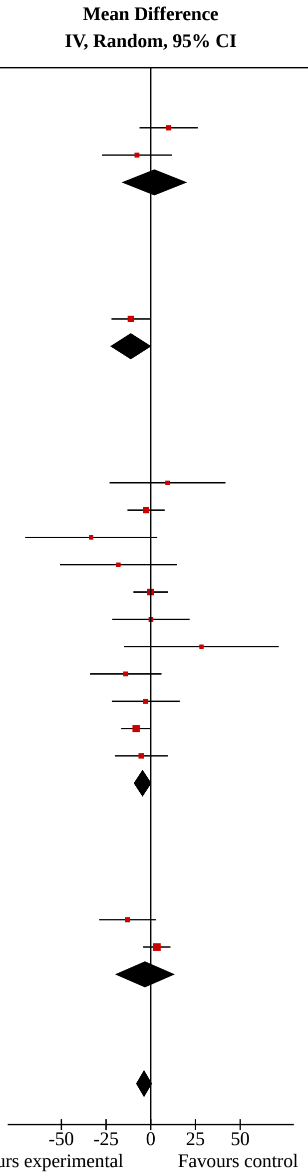
Mean Difference IV, Random, 95% CI



Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Blinding of participants and personnel (performance bias)
(D) Blinding of outcome assessment (detection bias)
(E) Selective reporting (reporting bias)
(F) Cluster RCT - Recruitment bias
(G) Cluster RCT - Baseline imbalance
(H) Cluster RCT - Loss of clusters
(I) Cluster RCT - Incorrect analysis

Analysis 1.6. Comparison 1: PA programme vs no PA programme, Outcome 6: Sedentary time (minutes/d) by intervention type: meta-analysis

Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.6.1 Before and after school programmes						
Jago 2019	10.01	8.3165	113	139	5.2%	10.01 [-6.29 , 26.31]
Jago 2015	-7.72	10.0002	256	265	3.8%	-7.72 [-27.32 , 11.88]
Subtotal (95% CI)			**369**	**404**	**9.0%**	**2.01 [-15.28 , 19.31]**
Heterogeneity: Tau² = 72.59; Chi² = 1.86, df = 1 (P = 0.17); I² = 46%						
Test for overall effect: Z = 0.23 (P = 0.82)						
1.6.2 Enhanced PE						
Daly 2016	-11.1816	5.4992	273	267	10.2%	-11.18 [-21.96 , -0.40]
Subtotal (95% CI)			**273**	**267**	**10.2%**	**-11.18 [-21.96 , -0.40]**
Heterogeneity: Not applicable						
Test for overall effect: Z = 2.03 (P = 0.04)						
1.6.3 Multi-component interventions						
Adab 2018	9.36	16.5309	334	386	1.5%	9.36 [-23.04 , 41.76]
Harrington 2018	-2.64	5.301020408	680	565	10.7%	-2.64 [-13.03 , 7.75]
Kocken 2016	-33.31	18.8575	41	37	1.1%	-33.31 [-70.27 , 3.65]
Andrade 2014	-18.1	16.684	64	60	1.5%	-18.10 [-50.80 , 14.60]
Kipping 2014	-0.11	4.897959184	603	649	12.0%	-0.11 [-9.71 , 9.49]
Toftager 2014	0.1	11.0206	376	421	3.2%	0.10 [-21.50 , 21.70]
Fairclough 2013	28.35	22.05612245	107	123	0.8%	28.35 [-14.88 , 71.58]
Grydeland 2013	-14	10.2043	215	458	3.7%	-14.00 [-34.00 , 6.00]
Okely 2011	-2.81	9.6941	306	298	4.0%	-2.81 [-21.81 , 16.19]
Webber 2008	-8.2	4.2348	1689	1689	14.5%	-8.20 [-16.50 , 0.10]
Haerens 2006	-5.3307	7.5524	51	12	6.2%	-5.33 [-20.13 , 9.47]
Subtotal (95% CI)			**4466**	**4698**	**59.2%**	**-4.60 [-9.08 , -0.12]**
Heterogeneity: Tau² = 0.00; Chi² = 8.69, df = 10 (P = 0.56); I² = 0%						
Test for overall effect: Z = 2.01 (P = 0.04)						
1.6.4 Schooltime PA						
Seljebotn 2019	-13	8.0873	189	188	5.5%	-13.00 [-28.85 , 2.85]
Resaland 2016	3.4	3.8776	564	496	16.1%	3.40 [-4.20 , 11.00]
Subtotal (95% CI)			**753**	**684**	**21.6%**	**-3.26 [-19.05 , 12.52]**
Heterogeneity: Tau² = 94.26; Chi² = 3.34, df = 1 (P = 0.07); I² = 70%						
Test for overall effect: Z = 0.41 (P = 0.69)						
Total (95% CI)			**5861**	**6053**	**100.0%**	**-3.78 [-7.80 , 0.24]**
Heterogeneity: Tau² = 11.09; Chi² = 18.24, df = 15 (P = 0.25); I² = 18%						
Test for overall effect: Z = 1.84 (P = 0.07)						
Test for subgroup differences: Chi² = 1.97, df = 3 (P = 0.58), I² = 0%						



Analysis 1.7. Comparison 1: PA programme vs no PA programme, Outcome 7: Sedentary time: additional data

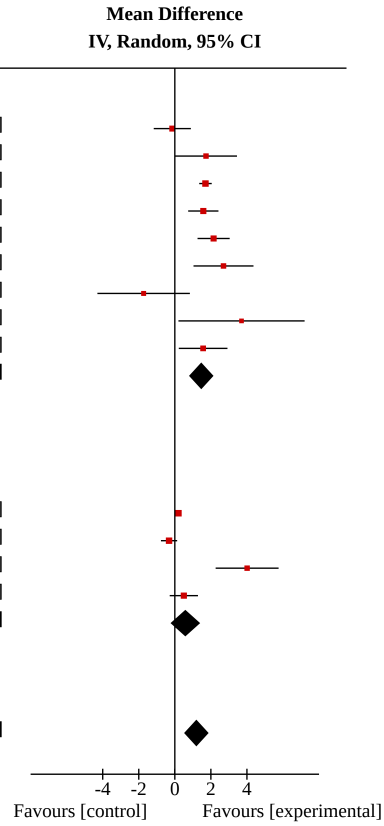
Sedentary time: additional data

Study	Study population	Intervention group	Control Group	Measurement period	Overall effect	Comment
Before and after school programmes						
Zhou 2019	Junior high school students, grade 7	I1: Biweekly after school program	Regular PE (2 days per week)	32 weeks	% of time spent sedentary: MD 1.34 (95% CI: -0.73, 3.41) I1: m 75.74 (sd 8.81) Control: m 74.40 (sd 10.80)	% time reported, not min/day
		I2: Enhanced PE (3 days per week) plus after school program	Regular PE (2 days per week)	32 weeks	% of time spent sedentary: MD 0.11 (95% CI: -2.31, 2.54) I2: m 74.51 (sd 11.95)	Authors note that statistically significant changes were found from baseline to follow-up in

					Control: m 74.40 (sd 10.80)	the after school program only, however analyses were not described or presented
Enhanced PE						
Lonsdale 2019a	Grade 8 students	Teacher PE training	Standard teaching	7-8 months	% time spent sedentary: MD 0.92 (95% CI −0.28, 2.13)	% time reported, not min/day
				14-15 months	% time spent sedentary: MD 0.02 (95% CI −0.99, 0.95)	
Ten Hoor 2018	Secondary school students, 11 to 15 years old	Strength training and motivational interviewing	Usual curriculum	1 year	Between group difference in % of time spent sedentary, P = 0.715	% time reported, not min/day
Zhou 2019	Junior high school students, grade 7	I1: Enhanced PE (3 days per week)	Regular PE (2 days per week)	32 weeks	% of time spent sedentary: MD 1.11 (95%CI: -1.09, 3.31) I1: m 75.51 (sd 9.64) Control: m 74.40 (sd 10.80)	% time reported, not min/day
		I2: Enhanced PE (3 days per week) plus after school program	Regular PE (2 days per week)	32 weeks	% of time spent sedentary: MD 0.11 (95% CI: -2.31, 2.54) I2: m 74.51 (sd 11.95) Control: m 74.40 (sd 10.80)	Authors note that statistically significant changes were found from baseline to follow-up in the after school program only group, however analyses were not described.
Multi-component intervention						
Corepal 2019	Students 12-14 years old	Pedometer challenge	Usual school	Baseline	Intervention: m 449.6 min/day, IQR: 416.5, 524.3 Control: m 466.3 min/day, IQR: 410.0, 534.9	Feasibility trial therefore no statistical analyses performed
				22 weeks	MD 1.2 min/day Intervention: m 454.7 min/day, IQR: 405.7, 517.8 Control: m 453.5 min/day IQR: 399.8, 529.6	Variance cannot be calculated as only mean and interquartile range reported

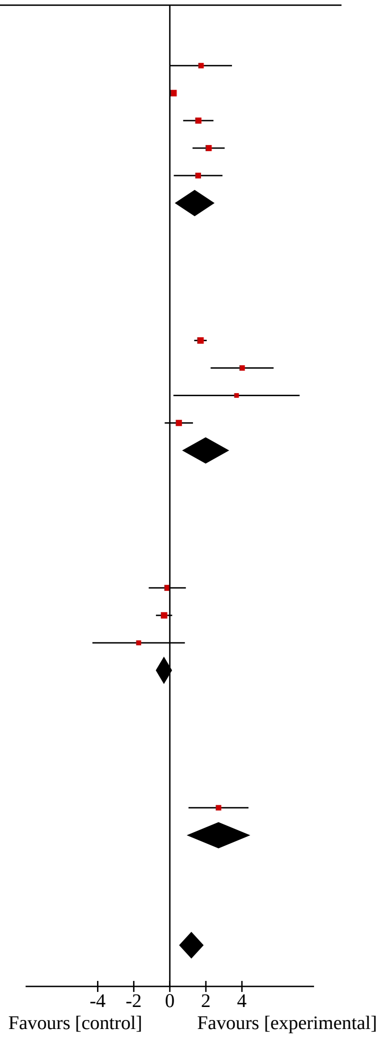
Analysis 1.8. Comparison 1: PA programme vs no PA programme, Outcome 8: Physical fitness (mL/kg/min): meta-analysis

Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.8.1 Children						
Müller 2019	-0.14	0.5255	234	255	8.5%	-0.14 [-1.17 , 0.89]
Pablos 2018	1.73	0.8766	82	76	6.0%	1.73 [0.01 , 3.45]
Jarani 2016	1.7	0.177	512	248	10.7%	1.70 [1.35 , 2.05]
Lau 2016	1.58	0.4286	40	40	9.2%	1.58 [0.74 , 2.42]
Muros 2015	2.1514	0.4548	73	62	9.0%	2.15 [1.26 , 3.04]
Nogueira 2014	2.7	0.8488	104	68	6.2%	2.70 [1.04 , 4.36]
Fairclough 2013	-1.73	1.3086	22	24	3.9%	-1.73 [-4.29 , 0.83]
Walther 2009	3.7	1.7857	106	68	2.5%	3.70 [0.20 , 7.20]
Barbeau 2007	1.57	0.6888	118	83	7.3%	1.57 [0.22 , 2.92]
Subtotal (95% CI)			**1291**	**924**	**63.3%**	**1.47 [0.84 , 2.09]**
Heterogeneity: Tau² = 0.47; Chi² = 22.32, df = 8 (P = 0.004); I² = 64%						
Test for overall effect: Z = 4.58 (P < 0.00001)						
1.8.2 Adolescents						
Robbins 2018	0.2	0.0867	72	78	10.9%	0.20 [0.03 , 0.37]
Suchert 2015	-0.32	0.2296	702	460	10.4%	-0.32 [-0.77 , 0.13]
Ardoy 2011	4.0104	0.8911	48	18	6.0%	4.01 [2.26 , 5.76]
Bayne-Smith 2004	0.5	0.4	285	102	9.4%	0.50 [-0.28 , 1.28]
Subtotal (95% CI)			**1107**	**658**	**36.7%**	**0.58 [-0.18 , 1.35]**
Heterogeneity: Tau² = 0.45; Chi² = 23.91, df = 3 (P < 0.0001); I² = 87%						
Test for overall effect: Z = 1.49 (P = 0.14)						
Total (95% CI)			**2398**	**1582**	**100.0%**	**1.19 [0.57 , 1.82]**
Heterogeneity: Tau² = 0.94; Chi² = 124.30, df = 12 (P < 0.00001); I² = 90%						
Test for overall effect: Z = 3.72 (P = 0.0002)						
Test for subgroup differences: Chi² = 3.06, df = 1 (P = 0.08), I² = 67.4%						



Analysis 1.9. Comparison 1: PA programme vs no PA programme, Outcome 9: Physical fitness (mL/kg/min) by intervention type: meta-analysis

Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.9.1 Before and after school programmes						
Pablos 2018	1.73	0.8766	82	76	6.0%	1.73 [0.01 , 3.45]
Robbins 2018	0.2	0.0867	72	78	10.9%	0.20 [0.03 , 0.37]
Lau 2016	1.58	0.4286	40	40	9.2%	1.58 [0.74 , 2.42]
Muros 2015	2.1514	0.4548	73	62	9.0%	2.15 [1.26 , 3.04]
Barbeau 2007	1.57	0.6888	118	83	7.3%	1.57 [0.22 , 2.92]
Subtotal (95% CI)			**385**	**339**	**42.5%**	**1.38 [0.34 , 2.41]**
Heterogeneity: Tau² = 1.11; Chi² = 32.53, df = 4 (P < 0.00001); I² = 88%						
Test for overall effect: Z = 2.61 (P = 0.009)						
1.9.2 Enhanced PE						
Jarani 2016	1.7	0.177	512	248	10.7%	1.70 [1.35 , 2.05]
Ardoy 2011	4.0104	0.8911	48	18	6.0%	4.01 [2.26 , 5.76]
Walther 2009	3.7	1.7857	106	68	2.5%	3.70 [0.20 , 7.20]
Bayne-Smith 2004	0.5	0.4	285	102	9.4%	0.50 [-0.28 , 1.28]
Subtotal (95% CI)			**951**	**436**	**28.5%**	**1.99 [0.76 , 3.21]**
Heterogeneity: Tau² = 1.04; Chi² = 16.58, df = 3 (P = 0.0009); I² = 82%						
Test for overall effect: Z = 3.17 (P = 0.002)						
1.9.3 Multi-component interventions						
Müller 2019	-0.14	0.5255	234	255	8.5%	-0.14 [-1.17 , 0.89]
Suchert 2015	-0.32	0.2296	702	460	10.4%	-0.32 [-0.77 , 0.13]
Fairclough 2013	-1.73	1.3086	22	24	3.9%	-1.73 [-4.29 , 0.83]
Subtotal (95% CI)			**958**	**739**	**22.8%**	**-0.33 [-0.73 , 0.08]**
Heterogeneity: Tau² = 0.00; Chi² = 1.28, df = 2 (P = 0.53); I² = 0%						
Test for overall effect: Z = 1.58 (P = 0.11)						
1.9.4 Schooltime PA						
Nogueira 2014	2.7	0.8488	104	68	6.2%	2.70 [1.04 , 4.36]
Subtotal (95% CI)			**104**	**68**	**6.2%**	**2.70 [1.04 , 4.36]**
Heterogeneity: Not applicable						
Test for overall effect: Z = 3.18 (P = 0.001)						
Total (95% CI)			**2398**	**1582**	**100.0%**	**1.19 [0.57 , 1.82]**
Heterogeneity: Tau² = 0.94; Chi² = 124.30, df = 12 (P < 0.00001); I² = 90%						
Test for overall effect: Z = 3.72 (P = 0.0002)						
Test for subgroup differences: Chi² = 28.25, df = 3 (P < 0.00001), I² = 89.4%						



Analysis 1.10. Comparison 1: PA programme vs no PA programme, Outcome 10: Physical fitness: additional data

Physical fitness: additional data

Study	Study population	Intervention group	Control Group	Measurement period	Overall effect	Comment
Before or after school programme						
Carlin 2018	Female students, aged 11 to 13 years old	Brisk walking intervention	Continued with normal PA habits	12 weeks	No significant changes were observed between group	Data not shown
				6 months	No significant changes were observed between group	
de Heer 2011	Children in grades 3 to 5 with no condition that would endanger their own or others' safety	Bienstar intervention of health education and 45 min to 60 min of after school PA	Grade 4 health workbooks and incentives	12 weeks	Shuttle run performance: MD 3.87 (SE 1.51) laps, P = 0.012	

Wang 2008	Grade 3 students	'FitKid' after-school intervention sessions	—	3 years	Heart rate response to step test, group*time interaction P < 0.01	
Zhou 2019	Junior high school students, grade 7	I1: Biweekly after school program	Regular PE (2 days per week)	32 weeks	20-m shuttle run performance (change from baseline): MD 8.86, 95% CI: 5.68, 12.04) I1: m 12.38 (95% CI 10.2, 14.56) Control: m 3.52 (95% CI 1.18, 5.85)	Authors note that statistically significant changes were found between both intervention and control groups but analyses were not described
		I2: Enhanced PE (3 days per week) plus after school program	Regular PE (2 days per week)	32 weeks	20-m shuttle run performance (change from baseline): MD 22.26 laps (95% CI: 19.15, 25.37) I2: m 25.78 (95% CI: 23,7, 27.86) Control: m 3.52 (95% CI: 1.18, 5.85)	
Enhanced PE						
Ketelhut 2020	Grade 3 students	High intensity interval training	Regular PE	12 weeks	Between-group difference in aerobic fitness z-score: 7.7 (95% CI 2.3, 13.2)	
Kriemler 2010	Grades 1 and 5 students	2 additional 45-minute PE lessons/ week, activity breaks, and PA homework	Usual, mandatory PE lessons	9 months	Adjusted shuttle run performance: MD −0.12 (95% CI −0.21, −0.03) stages, P = 0.009	
Ordóñez Dios 2019	Children age 11-12 years	Daily run added to regular PE	Regular PE	12 weeks	1km time Between-group difference in change from baseline: -0.55 minutes, 95% CI: -0.75, -0.35	
Thivel 2011	Children in grades 1 or 2	120 min of additional supervised PE	Habitual 2 H of PE/ week	6 months	Shuttle run performance Between-group difference in change from baseline: m 0.36, 95% CI: 0.23, 0.49 stages	
Zhou 2019	Junior high school students, grade 7	I1: Enhanced PE (3 days per week)	Regular PE (2 days per week)	32 weeks	20-m shuttle run performance (change from baseline): MD 14.33 laps (95%CI: 11.16, 17.50) I1: m 17.85 (95% CI 15.68, 20.02) Control: m 3.52 (95% CI 1.18, 5.85)	Authors note that statistically significant changes were found between both intervention and control groups but analyses were not described
		I2: Enhanced PE (3 days per week) plus after school program			20-m shuttle run performance (change from baseline): MD 22.26 laps (95% CI: 19.15, 25.37) I2: m 25.78 (95% CI: 23,7, 27.86) Control: m 3.52 (95% CI: 1.18, 5.85)	
Multi-component intervention						
Aburto 2011	Students in grades 4 and 5	I1: basic intervention of environmen-	No change to the standard practices	18 months	From baseline to follow-up, there	

		tal and policy-level change I2: plus intervention adding additional resources and daily morning exercise			were no significant changes in either group in distance run during the 9 minute run test (P > 0.05)	
Andrade 2014	Grades 8 and 9 students	ACTIVITAL individual- and environmental-based intervention	Standard curriculum	28 months	Shuttle run performance: MD −0.19 (95% CI −0.54, 0.16) min	
Burke 1998	—	I1: standard PA and nutrition program including classroom lessons, fitness sessions daily, and nutrition program, I2: I1 plus a PA enrichment program for higher-risk children	No program	9 months	Shuttle run performance Girls: Number of laps increased in both intervention groups vs. control group (P = 0.0001) Boys: Number of laps increased in both intervention groups vs. control group (P = 0.0008)	
Cohen 2015	Grades 3 and 4 students	Teacher learning, PA policies, school-community linkages	Usual PE and school sport programs	12 months	Shuttle run performance: MD 5.4 (95% CI 2.3, 8.6) laps, P = 0.003	20 m shuttle run test
Jago 2011	Students enrolled in grade 6	Education, social marketing, food environment, PE curriculum, and equipment provision	Recruitment and data collection only	2.5 years	Between-group difference in change in shuttle run performance: MD 0.2 laps, 95% CI: -0.5, 0.9)	
Jansen 2011	Grades 3 to 5	3 PE sessions/week, additional after school sport and play, classroom education, and parent health promotion	Continued with usual curriculum	1 school year	Shuttle run performance: MD 0.57 (95% CI 0.13, 1.01) laps	
	Grades 6 to 8				Shuttle run performance: MD 0.04 (95% CI -0.45, 0.53) laps	
Madsen 2015	Grades 3, 4, and 5 students	Nutrition education curriculum, Playworks structured recess before or after school activities, PA and games implemented by teachers	—	2 years	Mile run time: MD 0.2 (95% CI -0.8, 0.4) minutes	
Reed 2008	Grades 4 and 5 children	Action Schools!BC whole-school PA approach	Regular program of PE and school-based PA	11 months	Shuttle run performance, adjusted for baseline values: MD 6 laps, 95% CI: 1.6, 10.4	
Seibert 2019	Grade 5, 9 to 10 years old	Physically active lessons (45 min) 2-3d/week on days without PE, physically active homework and physically active recess	Normal routine, 135 min/week of PA	10 months	Progressive Aerobic Cardiovascular Endurance Run score (change from baseline): MD -1.1, 95% CI: -2.2, 0.01) Fitness z-scores (change from baseline: MD -0.10, 95% CI: -0.15, -0.04	Change favours the control group

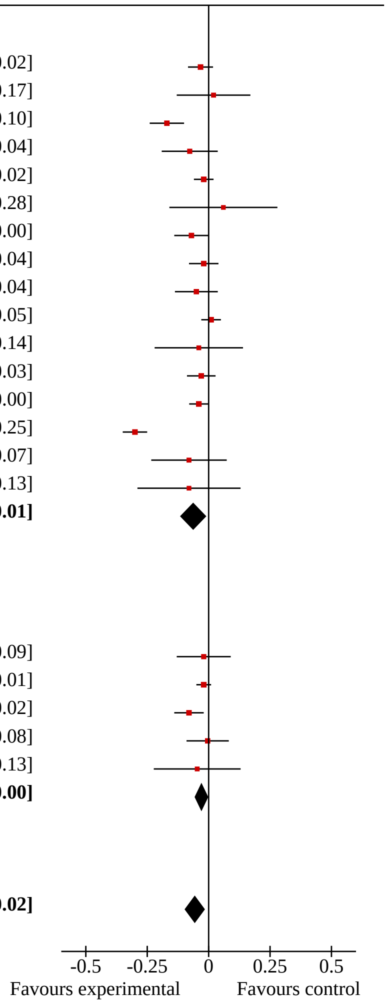
Toftager 2014	—	Physical and organizational environmental changes	—	2 years	Shuttle run distance: MD 6 (95% CI -20, 31) metres, P = 0.43	
Trevino 2004	All grade 4 children	Health programming regarding 3 health behavior messages associated with diabetes mellitus control and goal setting	—	7 months	Fitness score: MD 1.87 (95% CI -1.44, 5.17) points, P = 0.04	Harvard Step Test used
Schooltime PA						
Breheny 2020	Years 3 (aged 7–8 years) and 5 (aged 9–10 years)	Daily mile, 15-minutes of PA incorporated into the school day	Usual school day	12 months	Linear track test: MD -37.4 (95% CI -74.7, -0.19) metres	Difference favours control group
de Greeff 2016	Grades 2 and 3 students	Physically active mathematics and language lessons	Usual curriculum	2 years	Shuttle run performance: MD adjusted for baseline values 0.05 stages, SE: 0.14	
Donnelly 2017	Grades 2 and 3 students	Academic Achievement and Physical Activity Across the Curriculum lessons, 160 min/week of MVPA	Traditional classroom instruction and typical PE schedule	3 years	Progressve Aerobic Cardiorespiratory Endurance Run test performance: MD 1.3 laps, 95% CI: -0.5, 3.1	
Have 2018	Grade 1 students	Active math lessons	Regular classroom instruction	10 months	Between group difference in intermittent shuttle run test performance: MD 10.0 (SE 13.9) metres, P > 0.05	
Leahy 2019	Grade 11 students	Burn2Learn, multi component high intensity interval training	Usual school activities	14 weeks	Shuttle run performance: MD 8.9 (95% CI 1.7, 16.2) laps, P = 0.01	
Magnusson 2011	Children attending grade 2	Students engaged in PA during PE lessons, recess, and during classes; schools had access to PA equipment to use in school lessons; teaching materials promoting PA were provided	Followed the general PA curriculum	2 years	Load achieved on a cycling test: MD 0.37 (95% CI -0.27, 1.01) w/kg, P = 0.18	
Resaland 2016	Grade 5 and 6	Physically active Norwegian, mathematics, and English lessons on the playground; PA breaks and PA homework	Curriculum-prescribed PE and PA	7 months	Intermittent shuttle run test performance: MD 6.9 (95% CI −8.9, 22.6) metres, P = 0.387	
Seljebotn 2019	Grade 5 students	Physically active lessons, active homework, and physically active recess	Continued normal routine, approximately 135 min/week of PA	10 months	No significant differences found (no data reported)	
Tarp 2016	Grades 6 and 7 students	60 min of PA during school time, PA homework	Normal practice	20 weeks	Shuttle run test performance: MD 9.4 (95% CI -3.7, 22.4) metres, P = 0.16	

Torbeyns 2017	Grades 3 and 4 students	Cycling desks	No lifestyle change	22 weeks	Shuttle run test performance (change from baseline): MD 0.5 stages, 95% CI: -0.5, 1.5

Analysis 1.11. Comparison 1: PA programme vs no PA programme, Outcome 11: BMI: meta-analysis [z-scores]

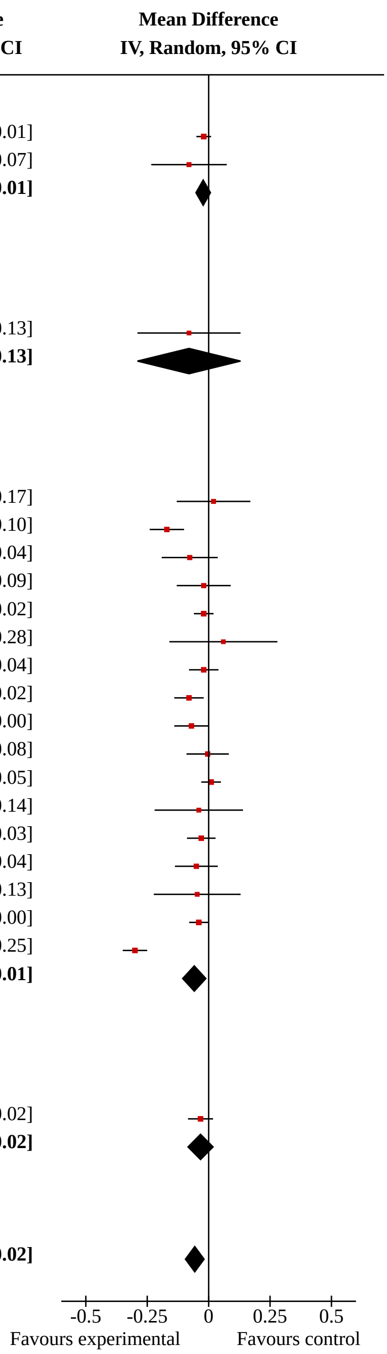
Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.11.1 Children						
Breheny 2020	-0.033	0.026	850	820	6.0%	-0.03 [-0.08 , 0.02]
Jago 2019	0.02	0.0765	113	139	3.3%	0.02 [-0.13 , 0.17]
Müller 2019	-0.17	0.0357	264	255	5.5%	-0.17 [-0.24 , -0.10]
Adab 2018	-0.077	0.0582	393	444	4.2%	-0.08 [-0.19 , 0.04]
Farmer 2017	-0.02	0.0204	318	306	6.3%	-0.02 [-0.06 , 0.02]
Kocken 2016	0.06	0.1122	499	391	2.1%	0.06 [-0.16 , 0.28]
Madsen 2015	-0.07	0.0357	446	230	5.5%	-0.07 [-0.14 , -0.00]
Kipping 2014	-0.02	0.0306	880	945	5.8%	-0.02 [-0.08 , 0.04]
Siegrist 2013	-0.05	0.0445	422	297	5.0%	-0.05 [-0.14 , 0.04]
Santos 2014	0.01	0.0204	340	307	6.3%	0.01 [-0.03 , 0.05]
Fairclough 2013	-0.04	0.0918	107	123	2.7%	-0.04 [-0.22 , 0.14]
Grydeland 2013	-0.03	0.0297	465	859	5.8%	-0.03 [-0.09 , 0.03]
Jago 2011	-0.04	0.02	2307	2296	6.3%	-0.04 [-0.08 , -0.00]
Angelopoulos 2009	-0.3	0.0254	321	325	6.0%	-0.30 [-0.35 , -0.25]
Neumark-Sztainer 2009	-0.08	0.0784	51	45	3.2%	-0.08 [-0.23 , 0.07]
Walther 2009	-0.08	0.1071	106	68	2.2%	-0.08 [-0.29 , 0.13]
Subtotal (95% CI)			**7882**	**7850**	**75.8%**	**-0.06 [-0.11 , -0.01]**
Heterogeneity: Tau² = 0.01; Chi² = 121.79, df = 15 (P < 0.00001); I² = 88%						
Test for overall effect: Z = 2.49 (P = 0.01)						
1.11.2 Adolescents						
Harrington 2018	-0.02	0.0561	735	626	4.3%	-0.02 [-0.13 , 0.09]
Robbins 2018	-0.02	0.0153	753	766	6.4%	-0.02 [-0.05 , 0.01]
Sutherland 2016	-0.08	0.0306	560	425	5.8%	-0.08 [-0.14 , -0.02]
Andrade 2014	-0.004	0.0439	539	521	5.0%	-0.00 [-0.09 , 0.08]
Haerens 2006	-0.0466	0.0902	1700	591	2.7%	-0.05 [-0.22 , 0.13]
Subtotal (95% CI)			**4287**	**2929**	**24.2%**	**-0.03 [-0.05 , -0.00]**
Heterogeneity: Tau² = 0.00; Chi² = 3.51, df = 4 (P = 0.48); I² = 0%						
Test for overall effect: Z = 2.33 (P = 0.02)						
Total (95% CI)			**12169**	**10779**	**100.0%**	**-0.06 [-0.09 , -0.02]**
Heterogeneity: Tau² = 0.01; Chi² = 129.76, df = 20 (P < 0.00001); I² = 85%						
Test for overall effect: Z = 2.93 (P = 0.003)						
Test for subgroup differences: Chi² = 1.41, df = 1 (P = 0.23), I² = 29.3%						

Mean Difference IV, Random, 95% CI



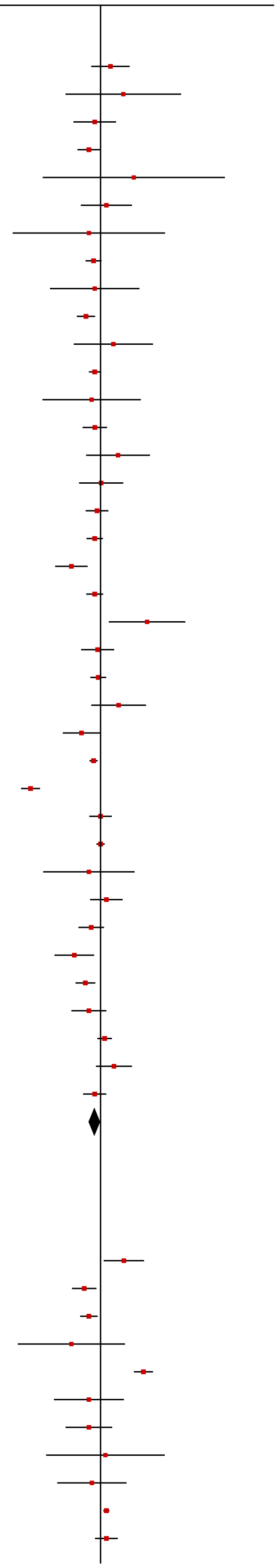
Analysis 1.12. Comparison 1: PA programme vs no PA programme, Outcome 12: BMI by intervention type: meta-analysis [z-scores]

Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.12.1 Before and after school programmes						
Robbins 2018	-0.02	0.0153	753	766	6.4%	-0.02 [-0.05 , 0.01]
Neumark-Sztainer 2009	-0.08	0.0784	51	45	3.2%	-0.08 [-0.23 , 0.07]
Subtotal (95% CI)			**804**	**811**	**9.6%**	**-0.02 [-0.05 , 0.01]**
Heterogeneity: Tau² = 0.00; Chi² = 0.56, df = 1 (P = 0.45); I² = 0%						
Test for overall effect: Z = 1.48 (P = 0.14)						
1.12.2 Enhanced PE						
Walther 2009	-0.08	0.1071	106	68	2.2%	-0.08 [-0.29 , 0.13]
Subtotal (95% CI)			**106**	**68**	**2.2%**	**-0.08 [-0.29 , 0.13]**
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.75 (P = 0.46)						
1.12.3 Multi-component interventions						
Jago 2019	0.02	0.0765	113	139	3.3%	0.02 [-0.13 , 0.17]
Müller 2019	-0.17	0.0357	264	255	5.5%	-0.17 [-0.24 , -0.10]
Adab 2018	-0.077	0.0582	393	444	4.2%	-0.08 [-0.19 , 0.04]
Harrington 2018	-0.02	0.0561	735	626	4.3%	-0.02 [-0.13 , 0.09]
Farmer 2017	-0.02	0.0204	318	306	6.3%	-0.02 [-0.06 , 0.02]
Kocken 2016	0.06	0.1122	499	391	2.1%	0.06 [-0.16 , 0.28]
Kipping 2014	-0.02	0.0306	880	945	5.8%	-0.02 [-0.08 , 0.04]
Sutherland 2016	-0.08	0.0306	560	425	5.8%	-0.08 [-0.14 , -0.02]
Madsen 2015	-0.07	0.0357	446	230	5.5%	-0.07 [-0.14 , -0.00]
Andrade 2014	-0.004	0.0439	539	521	5.0%	-0.00 [-0.09 , 0.08]
Santos 2014	0.01	0.0204	340	307	6.3%	0.01 [-0.03 , 0.05]
Fairclough 2013	-0.04	0.0918	107	123	2.7%	-0.04 [-0.22 , 0.14]
Grydeland 2013	-0.03	0.0297	465	859	5.8%	-0.03 [-0.09 , 0.03]
Siegrist 2013	-0.05	0.0445	422	297	5.0%	-0.05 [-0.14 , 0.04]
Haerens 2006	-0.0466	0.0902	1700	591	2.7%	-0.05 [-0.22 , 0.13]
Jago 2011	-0.04	0.02	2307	2296	6.3%	-0.04 [-0.08 , -0.00]
Angelopoulos 2009	-0.3	0.0254	321	325	6.0%	-0.30 [-0.35 , -0.25]
Subtotal (95% CI)			**10409**	**9080**	**82.2%**	**-0.06 [-0.11 , -0.01]**
Heterogeneity: Tau² = 0.01; Chi² = 123.16, df = 16 (P < 0.00001); I² = 87%						
Test for overall effect: Z = 2.43 (P = 0.02)						
1.12.4 Schooltime PA						
Breheny 2020	-0.033	0.026	850	820	6.0%	-0.03 [-0.08 , 0.02]
Subtotal (95% CI)			**850**	**820**	**6.0%**	**-0.03 [-0.08 , 0.02]**
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.27 (P = 0.20)						
Total (95% CI)			**12169**	**10779**	**100.0%**	**-0.06 [-0.09 , -0.02]**
Heterogeneity: Tau² = 0.01; Chi² = 129.76, df = 20 (P < 0.00001); I² = 85%						
Test for overall effect: Z = 2.93 (P = 0.003)						
Test for subgroup differences: Chi² = 1.83, df = 3 (P = 0.61), I² = 0%						



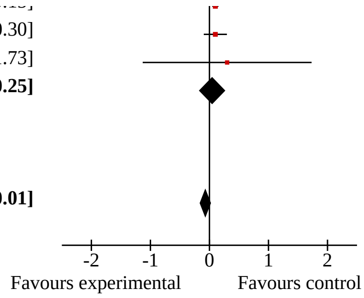
Analysis 1.13. Comparison 1: PA programme vs no PA programme, Outcome 13: BMI: meta-analysis [kg/m2]

Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.13.1 Children						
Jago 2019	0.17	0.1684	113	139	2.1%	0.17 [-0.16 , 0.50]
Ordóñez Dios 2019	0.39	0.5058	89	44	0.6%	0.39 [-0.60 , 1.38]
Seljebotn 2019	-0.1	0.1867	189	188	1.9%	-0.10 [-0.47 , 0.27]
Have 2018	-0.2	0.1	275	186	2.6%	-0.20 [-0.40 , -0.00]
Pablos 2018	0.57	0.7969	82	76	0.3%	0.57 [-0.99 , 2.13]
Siegrist 2018	0.1	0.2241	243	191	1.7%	0.10 [-0.34 , 0.54]
Torbeyns 2017	-0.2	0.6668	21	23	0.4%	-0.20 [-1.51 , 1.11]
de Greeff 2016	-0.12	0.07	249	250	2.8%	-0.12 [-0.26 , 0.02]
Drummy 2016	-0.1	0.3916	54	53	0.9%	-0.10 [-0.87 , 0.67]
Jarani 2016	-0.25	0.0799	512	248	2.8%	-0.25 [-0.41 , -0.09]
Lau 2016	0.22	0.3469	40	40	1.0%	0.22 [-0.46 , 0.90]
Tarp 2016	-0.1	0.051	191	417	2.9%	-0.10 [-0.20 , -0.00]
Muros 2015	-0.1528	0.4307	73	62	0.7%	-0.15 [-1.00 , 0.69]
Martinez-Vizcaino 2014	-0.098	0.1072	420	492	2.6%	-0.10 [-0.31 , 0.11]
Nogueira 2014	0.3	0.2795	155	85	1.3%	0.30 [-0.25 , 0.85]
Fairclough 2013	0.01	0.1939	107	123	1.9%	0.01 [-0.37 , 0.39]
Ford 2013	-0.06	0.0994	77	75	2.6%	-0.06 [-0.25 , 0.13]
Grydeland 2013	-0.1	0.072	465	859	2.8%	-0.10 [-0.24 , 0.04]
Sacchetti 2013	-0.5	0.1425	212	216	2.3%	-0.50 [-0.78 , -0.22]
Siegrist 2013	-0.1	0.0742	422	297	2.8%	-0.10 [-0.25 , 0.05]
Aburto 2011	0.7979	0.3348	483	216	1.1%	0.80 [0.14 , 1.45]
de Heer 2011	-0.05	0.1449	242	326	2.3%	-0.05 [-0.33 , 0.23]
Jansen 2011	-0.0387	0.0695	1240	1382	2.8%	-0.04 [-0.17 , 0.10]
Magnusson 2011	0.31	0.2398	90	76	1.6%	0.31 [-0.16 , 0.78]
Thivel 2011	-0.327	0.1635	169	187	2.1%	-0.33 [-0.65 , -0.01]
Kriemler 2010	-0.12	0.0357	297	205	3.0%	-0.12 [-0.19 , -0.05]
Angelopoulos 2009	-1.2	0.0834	321	325	2.7%	-1.20 [-1.36 , -1.04]
Donnelly 2009	0	0.0986	814	713	2.6%	0.00 [-0.19 , 0.19]
Gentile 2009	0	0.0361	685	674	3.0%	0.00 [-0.07 , 0.07]
Neumark-Sztainer 2009	-0.2	0.4	51	45	0.8%	-0.20 [-0.98 , 0.58]
Reed 2008	0.1	0.1427	156	81	2.3%	0.10 [-0.18 , 0.38]
Wang 2008	-0.16	0.1122	182	265	2.5%	-0.16 [-0.38 , 0.06]
Barbeau 2007	-0.45	0.1735	118	83	2.0%	-0.45 [-0.79 , -0.11]
Simon 2004	-0.26	0.0867	479	475	2.7%	-0.26 [-0.43 , -0.09]
Stone 2003	-0.2	0.1531	727	682	2.2%	-0.20 [-0.50 , 0.10]
Luepker 1996	0.07	0.064	2332	1627	2.9%	0.07 [-0.06 , 0.20]
Bush 1989	0.23	0.1576	283	148	2.2%	0.23 [-0.08 , 0.54]
Walter 1988	-0.1	0.102	590	625	2.6%	-0.10 [-0.30 , 0.10]
Subtotal (95% CI)			**13248**	**12199**	**78.5%**	**-0.11 [-0.19 , -0.02]**
Heterogeneity: Tau² = 0.05; Chi² = 237.41, df = 37 (P < 0.00001); I² = 84%						
Test for overall effect: Z = 2.38 (P = 0.02)						
1.13.2 Adolescents						
Leahy 2019	0.4	0.1766	38	30	2.0%	0.40 [0.05 , 0.75]
Sutherland 2016	-0.28	0.1071	560	425	2.6%	-0.28 [-0.49 , -0.07]
Melnyk 2013	-0.2	0.0765	286	341	2.8%	-0.20 [-0.35 , -0.05]
Neumark-Sztainer 2010	-0.5	0.4693	182	163	0.7%	-0.50 [-1.42 , 0.42]
Dorgo 2009	0.7353	0.0837	93	129	2.7%	0.74 [0.57 , 0.90]
Peralta 2009	-0.2	0.3061	16	17	1.2%	-0.20 [-0.80 , 0.40]
Webber 2008	-0.2	0.2041	1751	1751	1.8%	-0.20 [-0.60 , 0.20]
Weeks 2008	0.0837	0.5191	43	38	0.6%	0.08 [-0.93 , 1.10]
Haerens 2006	-0.1482	0.3034	1700	591	1.2%	-0.15 [-0.74 , 0.45]
Young 2006	0.1	0.0269	109	97	3.0%	0.10 [0.05 , 0.15]
Bayne-Smith 2004	0.1	0.1	310	132	2.6%	0.10 [-0.10 , 0.30]
Ewart 1998	0.3	0.7299	44	44	0.3%	0.30 [-1.13 , 1.73]



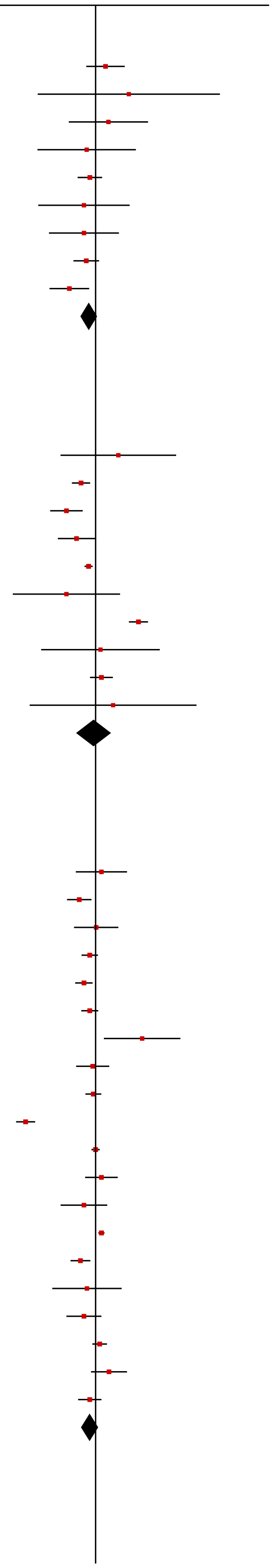
Analysis 1.13. (Continued)

Bayne-Smith 2004	0.1	0.1	310	132	2.6%	0.10 [-0.10 , 0.30]
Ewart 1998	0.3	0.7299	44	44	0.3%	0.30 [-1.13 , 1.73]
Subtotal (95% CI)			**5132**	**3758**	**21.5%**	**0.05 [-0.16 , 0.25]**
Heterogeneity: Tau² = 0.09; Chi² = 93.97, df = 11 (P < 0.00001); I² = 88%						
Test for overall effect: Z = 0.43 (P = 0.67)						
Total (95% CI)			**18380**	**15957**	**100.0%**	**-0.07 [-0.15 , 0.01]**
Heterogeneity: Tau² = 0.06; Chi² = 394.98, df = 49 (P < 0.00001); I² = 88%						
Test for overall effect: Z = 1.63 (P = 0.10)						
Test for subgroup differences: Chi² = 1.75, df = 1 (P = 0.19), I² = 43.0%						



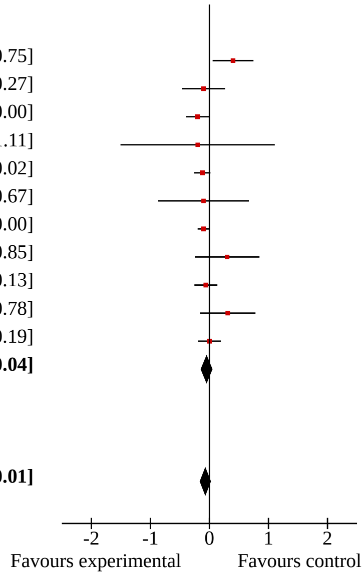
Analysis 1.14. Comparison 1: PA programme vs no PA programme, Outcome 14: BMI by intervention type: meta-analysis [kg/m2]

Study or Subgroup	MD	SE	Experimental Total	Control Total	Weight	Mean Difference IV, Random, 95% CI
1.14.1 Before and after school programmes						
Jago 2019	0.17	0.1684	113	139	2.1%	0.17 [-0.16 , 0.50]
Pablos 2018	0.57	0.7969	82	76	0.3%	0.57 [-0.99 , 2.13]
Lau 2016	0.22	0.3469	40	40	1.0%	0.22 [-0.46 , 0.90]
Muros 2015	-0.1528	0.4307	73	62	0.7%	-0.15 [-1.00 , 0.69]
Martinez-Vizcaino 2014	-0.098	0.1072	420	492	2.6%	-0.10 [-0.31 , 0.11]
Neumark-Sztainer 2009	-0.2	0.4	51	45	0.8%	-0.20 [-0.98 , 0.58]
Peralta 2009	-0.2	0.3061	16	17	1.2%	-0.20 [-0.80 , 0.40]
Wang 2008	-0.16	0.1122	182	265	2.5%	-0.16 [-0.38 , 0.06]
Barbeau 2007	-0.45	0.1735	118	83	2.0%	-0.45 [-0.79 , -0.11]
Subtotal (95% CI)			**1095**	**1219**	**13.3%**	**-0.12 [-0.25 , 0.01]**
Heterogeneity: Tau² = 0.00; Chi² = 8.58, df = 8 (P = 0.38); I² = 7%						
Test for overall effect: Z = 1.78 (P = 0.08)						
1.14.2 Enhanced PE						
Ordóñez Dios 2019	0.39	0.5058	89	44	0.6%	0.39 [-0.60 , 1.38]
Jarani 2016	-0.25	0.0799	512	248	2.8%	-0.25 [-0.41 , -0.09]
Sacchetti 2013	-0.5	0.1425	212	216	2.3%	-0.50 [-0.78 , -0.22]
Thivel 2011	-0.327	0.1635	169	187	2.1%	-0.33 [-0.65 , -0.01]
Kriemler 2010	-0.12	0.0357	297	205	3.0%	-0.12 [-0.19 , -0.05]
Neumark-Sztainer 2010	-0.5	0.4693	182	163	0.7%	-0.50 [-1.42 , 0.42]
Dorgo 2009	0.7353	0.0837	93	129	2.7%	0.74 [0.57 , 0.90]
Weeks 2008	0.0837	0.5191	43	38	0.6%	0.08 [-0.93 , 1.10]
Bayne-Smith 2004	0.1	0.1	310	132	2.6%	0.10 [-0.10 , 0.30]
Ewart 1998	0.3	0.7299	44	44	0.3%	0.30 [-1.13 , 1.73]
Subtotal (95% CI)			**1951**	**1406**	**17.6%**	**-0.04 [-0.32 , 0.24]**
Heterogeneity: Tau² = 0.14; Chi² = 115.14, df = 9 (P < 0.00001); I² = 92%						
Test for overall effect: Z = 0.25 (P = 0.81)						
1.14.3 Multi-component interventions						
Siegrist 2018	0.1	0.2241	243	191	1.7%	0.10 [-0.34 , 0.54]
Sutherland 2016	-0.28	0.1071	560	425	2.6%	-0.28 [-0.49 , -0.07]
Fairclough 2013	0.01	0.1939	107	123	1.9%	0.01 [-0.37 , 0.39]
Grydeland 2013	-0.1	0.072	465	859	2.8%	-0.10 [-0.24 , 0.04]
Melnyk 2013	-0.2	0.0765	286	341	2.8%	-0.20 [-0.35 , -0.05]
Siegrist 2013	-0.1	0.0742	422	297	2.8%	-0.10 [-0.25 , 0.05]
Aburto 2011	0.7979	0.3348	483	216	1.1%	0.80 [0.14 , 1.45]
de Heer 2011	-0.05	0.1449	242	326	2.3%	-0.05 [-0.33 , 0.23]
Jansen 2011	-0.0387	0.0695	1240	1382	2.8%	-0.04 [-0.17 , 0.10]
Angelopoulos 2009	-1.2	0.0834	321	325	2.7%	-1.20 [-1.36 , -1.04]
Gentile 2009	0	0.0361	685	674	3.0%	0.00 [-0.07 , 0.07]
Reed 2008	0.1	0.1427	156	81	2.3%	0.10 [-0.18 , 0.38]
Webber 2008	-0.2	0.2041	1751	1751	1.8%	-0.20 [-0.60 , 0.20]
Young 2006	0.1	0.0269	109	97	3.0%	0.10 [0.05 , 0.15]
Simon 2004	-0.26	0.0867	479	475	2.7%	-0.26 [-0.43 , -0.09]
Haerens 2006	-0.1482	0.3034	1700	591	1.2%	-0.15 [-0.74 , 0.45]
Stone 2003	-0.2	0.1531	727	682	2.2%	-0.20 [-0.50 , 0.10]
Luepker 1996	0.07	0.064	2332	1627	2.9%	0.07 [-0.06 , 0.20]
Bush 1989	0.23	0.1576	283	148	2.2%	0.23 [-0.08 , 0.54]
Walter 1988	-0.1	0.102	590	625	2.6%	-0.10 [-0.30 , 0.10]
Subtotal (95% CI)			**13181**	**11236**	**47.4%**	**-0.10 [-0.24 , 0.03]**
Heterogeneity: Tau² = 0.07; Chi² = 254.71, df = 19 (P < 0.00001); I² = 93%						
Test for overall effect: Z = 1.51 (P = 0.13)						
1.14.4 Schooltime PA						
Leahy 2019	0.4	0.1766	38	30	2.0%	0.40 [0.05 , 0.75]



Analysis 1.14. (Continued)

1.14.4 Schooltime PA						
Leahy 2019	0.4	0.1766	38	30	2.0%	0.40 [0.05 , 0.75]
Seljebotn 2019	-0.1	0.1867	189	188	1.9%	-0.10 [-0.47 , 0.27]
Have 2018	-0.2	0.1	275	186	2.6%	-0.20 [-0.40 , -0.00]
Torbeyns 2017	-0.2	0.6668	21	23	0.4%	-0.20 [-1.51 , 1.11]
de Greeff 2016	-0.12	0.07	249	250	2.8%	-0.12 [-0.26 , 0.02]
Drummy 2016	-0.1	0.3916	54	53	0.9%	-0.10 [-0.87 , 0.67]
Tarp 2016	-0.1	0.051	191	417	2.9%	-0.10 [-0.20 , -0.00]
Nogueira 2014	0.3	0.2795	155	85	1.3%	0.30 [-0.25 , 0.85]
Ford 2013	-0.06	0.0994	77	75	2.6%	-0.06 [-0.25 , 0.13]
Magnusson 2011	0.31	0.2398	90	76	1.6%	0.31 [-0.16 , 0.78]
Donnelly 2009	0	0.0986	814	713	2.6%	0.00 [-0.19 , 0.19]
Subtotal (95% CI)			**2153**	**2096**	**21.7%**	**-0.05 [-0.14 , 0.04]**
Heterogeneity: Tau² = 0.01; Chi² = 14.47, df = 10 (P = 0.15); I² = 31%						
Test for overall effect: Z = 1.07 (P = 0.28)						
Total (95% CI)			**18380**	**15957**	**100.0%**	**-0.07 [-0.15 , 0.01]**
Heterogeneity: Tau² = 0.06; Chi² = 394.98, df = 49 (P < 0.00001); I² = 88%						
Test for overall effect: Z = 1.63 (P = 0.10)						
Test for subgroup differences: Chi² = 1.01, df = 3 (P = 0.80), I² = 0%						



Analysis 1.15. Comparison 1: PA programme vs no PA programme, Outcome 15: BMI: additional data

BMI: additional data

Study	Study population	Intervention group	Control Group	Measurement period	Overall effect	Comment
Before or after school programme						
Carlin 2018	Female students, aged 11 to 13 years old	Brisk walking intervention	Continued with normal PA habits	12 weeks	No between group differences	BMI values not reported
				6 months	No between group differences	
Enhanced PE						
Ardoy 2011	Students age 12 to 14, enrolled in first year of secondary school	I1: 4 sessions/week of PE I2: 4 sessions/week of PE with emphasis on increasing intensity	2 sessions/week of PE	16 weeks	No between group differences	BMI values not reported
Multi-component intervention						
Burke 1998	—	I1: standard PA and nutrition program including classroom lessons, fitness sessions daily, and nutrition program I2: I1 plus a PA enrichment program for higher-risk children	No program	9 months	Significant difference between I1 and control group in boys only, P = 0.016 No significant difference between I1 and control in girls, or I2 and control	No BMI values reported
				15 months	No significant differences between groups for boys or girls	
Ickovics 2019	Grades 5 and 6 students	I1: PA school wellness policy I2: PA + nutrition school wellness policy	C1: Nutrition school wellness policy C2: delayed control	3 years	No significant group by time interaction P = 0.94	No BMI values reported

Salmon 2008	Grade 5 students (approximately 10 to 11 years old)	I1: behavioral modification group I2: fundamental motor skills group I3: combined behavioral modification and fundamental motor skills group	Usual classroom lessons	1 school year	Adjusted BMI/sex-age population median I1: MD -0.40 (95% CI -1.11, 0.30) kg/m^2 I2: MD -0.50 (95% CI -1.25, 0.25) kg/m^2 I3: MD -1.30 (95% CI -2.29, -0.31) kg/m^2	BMI/sex-age population median not kg/m2 or z-score
Suchert 2015	Students age 12 to 17 years	Multilevel intervention targeting students, classrooms, schools, and parents	No intervention	12 weeks	—	BMI percentile, not kg/m2 or z-score
				1 year	BMI percentile: MD 1.09 (95% CI −0.64, 2.82), P = 0.215	
Schooltime PA						
Donnelly 2017	Grades 2 and 3 students	Academic Achievement and Physical Activity Across the Curriculum lessons, 160 min/week of MV-PA	Traditional classroom instruction and typical PE schedule	3 years	BMI percentile (change from baseline): MD -2.3, 95% CI: -4.8, 0.2	BMI percentile, not kg/m2 or z-score
Kobel 2014	Pupils at primary school, grades 1 and 2	Teacher training, PA education, and active breaks	No intervention	1 year	Adjusted BMI percentile (change from baseline): MD 0.5, 95% CI: -0.5, 1.5	BMI percentile, not kg/m2 or z-score
Williamson 2007	Students in grades 2 to 6	Healthy Eating and Exercise program to increase PA during the school day and at home	Alcohol/Drug/Tobacco abuse prevention program	2 years	No between group differences, P = 0.5458	BMI values not reported

Analysis 1.16. Comparison 1: PA programme vs no PA programme, Outcome 16: Health-related quality of life: all data

Health-related quality of life: all data

Study	Study population	Intervention group	Control Group	Measurement period	Overall effect	Comment
Children						
Adab 2018	Year 1 students (aged 5 to 6 years)	30 min of additional MVPA on each school day, cooking workshops, a 6-week healthy eating program, and information sheets for families	Ongoing year 2 health related activities and education resources, excluding topics related to healthy eating and PA	15 months 30 months	MD −0.630 (95% CI −4.385, 3.124) points MD 1.248 (95% CI −2.301, 4.796) points	Measured using Pediatric quality of life inventory
Breheny 2020	Year 3 (aged 7-8 years) and 5 (9-10 years) students	Daily Mile, 15 minutes of running/walking within the school grounds during the school day, not to replace PE	Usual school	12 months	MD 0.010 (95% CI -0.002, 0.04)	Measured using Child Health Utility 9D
Jago 2015	Year 7 female students	After-school dance classes	Provided data only	Baseline T1 T2	Baseline MD 0.01 points, P = 0.309 T1 MD 0.0 points, P = 0.667 T2 MD 0.0 points, P = 0.382	Meausured using European Quality of Life-5 Dimensions Youth survey
Jago 2019	Year 3 and 4 students, 7 to 9 years old	Action 3:30R after school PA club	—	End of study	No difference in utility scores or z-scores between groups	Measured using KIDSCREEN-10

Resaland 2016	Grade 5 and 6	Physically active Norwegian, mathematics, and English lessons on the playground; PA breaks and PA homework	Curriculum-prescribed PE and PA	End of study	No significant differences found (no data shown)	Measured using KIDSCREEN-10
Adolescents						
Harrington 2018	Female students in years 7 to 9, 11 to 14 years old	Support for PA, PE, and school sport culture and practices with the support of the Youth Sport Trust and a hub school	Continued with normal PA habits	End of study	No significant differences found (no data shown)	Measured using Child Health Utility 9D
Leahy 2019	Grade 11 students	Burn2Learn, multi component high intensity interval training	Usual school activities	14 weeks	MD −2.1 (95% CI −4.0, −0.3) points, P = 0.02	Measured using Strengths and Difficulties Questionnaire; lower score indicates fewer perceived difficulties

Analysis 1.17. Comparison 1: PA programme vs no PA programme, Outcome 17: Adverse events: all data

Adverse events: all data

Study	Participants with at least one adverse event (N)	Participants discontinuing trial due to an adverse event (N)
Andrade 2014	0	0
Breheny 2020	0	0
Cohen 2015	0	0
Ford 2013	0	0
Harrington 2018	0	0
Ickovics 2019	0	0
Jago 2011	Baseline: 205 events End of Study: 141 events	0
Jago 2015	0	0
Ketelhut 2020	0	0
Leahy 2019	0	0
Martinez-Vizcaino 2014	0	0
Müller 2019	0	0
Nogueira 2014	1	0
Okely 2011	0	0
Salmon 2008	0	0
Wang 2008	Year 1: 24 events	0

ADDITIONAL TABLES

Table 1. Overview of study populations

Trial ID (design)	Interventions and comparators	Screened/eligible (N)	Randomised (N)	Finishing trial (N)	Randomised finishing trial (%)
Breheny 2020	I: Daily Mile	—/—	1153	1107	96.0
	C: usual school routine		1127	1070	94.9
	total:		**2280**	**2177**	**95.5**

Table 1. Overview of study populations *(Continued)*

Ketelhut 2020	I: high-intensity interval training during PE	—/—	—	22	—
	C: usual PE			24	
	total:		**—**	**46**	**—**
Belton 2019 (cluster-RCT)	I: multi-component PE, whole-school and parent-targeted intervention	564/534	275	123	44.7
	C: usual care		259	126	48.6
	total:		**534**	**249**	**46.6**
Corepal 2019 (cluster-RCT)	I: pedometer challenge	—/—	142	136	95.8
	C: usual school		82	81	98.8
	total:		**224**	**217**	**96.9**
Ickovics 2019 (cluster-RCT)	I1: PA school wellness policy	—/756	413	330	79.9
	I2: PA + nutrition school wellness policy				
	C1: nutrition school wellness policy		305	265	86.9
	C2: delayed control				
	total:		**718**	**595**	**82.9**
Jago 2019 (cluster-RCT)	I: Action 3:30R after-school PA club	1139/1125	170	113	66.5
	C: —		165	139	84.2
	total:		**335**	**252**	**75.2**
Leahy 2019 (cluster-RCT)	I: Burn2Learn, multi-component high-intensity interval training	—/68	38	32	84.2
	C: usual school activities		30	29	96.7
	total:		**68**	**61**	**89.7**
Lonsdale 2019a (cluster-RCT)	I: teacher PE training	—/1806	693	630	90.9
	C: standard teaching		728	628	86.3
	total:		**1421**	**1258**	**88.5**
Müller 2019 (cluster-RCT)	I1: PA only	1009/944	—	265	—
	I2: PA + health education				
	I3: PA + health education + nutrition				
	C1: health education + nutrition		—	398	—

Table 1. Overview of study populations *(Continued)*

	C2: no PA				
	total:		**944**	**663**	**70.2**
Ordóñez Dios 2019	I: 2 x 45-minute PE sessions per week and daily run	—/—	—	45	—
	C: 2 x 45-minute PE sessions per week		—	44	—
	total:		**—**	**89**	**—**
Seibert 2019	I: 4 core strategies to increase PA	—/—	2495	—	—
	C: usual PE		2399	—	—
	total:		4894	—	—
Seljebotn 2019 (cluster-RCT)	I: physically active lessons, active homework, physically active recess	—/473	228	224	98.2
	C: continued normal routine, approximately 135 minutes/week of PA		219	218	99.5
	total:		**447**	**442**	**98.9**
Zhou 2019 (cluster-RCT)	I1: modified PE	—/—	204	163	79.9
	I2: after school PA programme		200	180	90.0
	I3: modified PE and after school PA programme		178	168	94.4
	C: regular PE		176	170	96.6
	total:		**758**	**681**	**89.8**
Adab 2018 (cluster-RCT)	I: 30 minutes of additional MVPA on each school day, cooking workshops, a 6-week healthy eating programme, information sheets for families	—/—	1134	660	58.2
	C: ongoing Year 2 health-related activities and education resources, excluding topics related to healthy eating and PA		1328	732	55.1
	total:		**2462**	**1392**	**56.5**
Carlin 2018 (cluster-RCT)	I: brisk walking intervention	—/—	101	100	99.0
	C: continued with normal PA habits		98	97	99.0
	total:		**199**	**197**	**99.0**
Harrington 2018 (cluster-RCT)	I: support for PA, PE, and school sport culture and practices with support of the Youth Sport Trust and a hub school	—/1753	867	735	84.8

Table 1. Overview of study populations *(Continued)*

	C: usual practice of PE and sport		885	626	70.7
	total:		**1752**	**1361**	**77.7**
Have 2018 (cluster-RCT)	I: active math lessons	—/557	294	268	91.2
	C: regular classroom instruction		211	182	86.3
	total:		**505**	**450**	**89.1**
Pablos 2018 (cluster-RCT)	I: lunchtime extracurricular PA	—/210	100	82	82.0
	C: continued with daily activities		90	76	84.4
	total:		**190**	**158**	**83.2**
Robbins 2018 (cluster-RCT)	I: an after school PA club, counselling, interactive Internet-based sessions	4192/1543	766	706	92.2
	C: no additional after school programming		777	680	87.5
	total:		**1543**	**1386**	**89.8**
Siegrist 2018 (cluster-RCT)	I: weekly lifestyle lessons	792/—	331	243	73.4
	C: usual activities		257	191	74.3
	total:		**588**	**434**	**73.8**
Ten Hoor 2018 (cluster-RCT)	I: strength training and motivational interviewing	—/808	353	262	74.2
	C: usual curriculum		342	246	71.9
	total:		**695**	**508**	**73.1**
Donnelly 2017 (cluster-RCT)	I: Academic Achievement and Physical Activity Across the Curriculum lessons, 160 minutes/week of MVPA	—/698	316	244	77.2
	C: traditional classroom instruction and typical PE schedule		268	204	76.1
	total:		**584**	**448**	**76.7**
Farmer 2017 (cluster-RCT)	I: school-specific playground action plan	—/—	812	344	42.4
	C: no change to school play spaces		851	325	38.2
	total:		**1663**	**669**	**40.2**
Sutherland 2017 (cluster-RCT)	I: modified Supporting Children's Outcomes using Rewards, Exercise and Skills programme	—/1959	571	—	—

Table 1. Overview of study populations *(Continued)*

	C: delivered school PA practices according to the curriculum		568	—	—
	total:		**1139**	**—**	**—**
Torbeyns 2017 (RCT)	I: cycling desks	—/—	28	21	75.0
	C: no lifestyle change		28	23	82.1
	total:		**56**	**44**	**78.6**
Daly 2016 (cluster-RCT)	I: specialist-taught PE intervention	—/—	457	273	59.7
	C: usual PE programme		396	267	67.4
	total:		**853**	**540**	**63.3**
de Greeff 2016 (cluster-RCT)	I: physically active mathematics and language lessons	—/—	—	181	—
	C: usual curriculum		—	195	—
	total:		**388**	**376**	**96.9**
Drummy 2016 (cluster-RCT)	I: teacher-led activity break	—/150	—	54	—
	C: normal daily routine		—	53	—
	total:		**120**	**107**	**89.2**
Jarani 2016 (cluster-RCT)	I1: group circuit training-based PE	—/767	261	253	96.9
	I2: games-based PE		251	243	96.8
	C: traditional PE school		255	240	94.1
	total:		**767**	**736**	**96.0**
Kocken 2016 (cluster-RCT)	I: theory and practical lessons on nutrition and PA	—/—	615	367	59.7
	C: regular school programme or curriculum on nutrition and PA		497	496	99.8
	total:		**1112**	**863**	**77.6**
Lau 2016 (RCT)	I: Xbox 260 Kinect gaming sessions after school	152/84	40	40	100.0
	C: regular PA and PE class		40	40	100.0
	total:		**80**	**80**	**100.0**
Resaland 2016 (cluster-RCT)	I: physically active Norwegian, mathematics, and English lessons on the playground; PA breaks and PA homework	1395/1202	620	593	95.6

Table 1. Overview of study populations *(Continued)*

	C: curriculum-prescribed PE and PA		582	530	91.1
	total:		**1202**	**1123**	**93.4**
Sutherland 2016 (cluster-RCT)	I: 7 PA intervention strategies and 6 implementation strategies	—/1468	696	250	35.9
	C: only measurement components of the trial: regular PA and PE		537	191	35.6
	total:		**1233**	**441**	**35.8**
Tarp 2016 (cluster-RCT)	I: 60 minutes of PA during schooltime, PA homework	869/855	215	194	90.2
	C: normal practice		490	438	89.4
	total:		**705**	**632**	**89.6**
Cohen 2015 (cluster-RCT)	I: teacher learning, PA policies, school-community linkages	—/—	199	166	83.4
	C: usual PE and school sport programmes		261	217	83.1
	total:		**460**	**383**	**83.3**
Jago 2015 (cluster-RCT)	I: after school dance classes	—/663	284	—	—
	C: provided data only		287	—	—
	total:		**571**	**508**	**89.0**
Madsen 2015 (cluster-RCT)	I: nutrition education curriculum, Playworks structured recess before or after school activities, PA and games implemented by teachers	—/—	583	446	76.5
	C: —		296	230	77.7
	total:		**879**	**676**	**76.9**
Muros 2015 (cluster-RCT)	I1: extracurricular PA sessions	242/162	28	28	100.0
	I2: PA and nutrition		21	21	100.0
	I3: PA and nutrition and extra virgin olive oil during the final month		25	25	100.0
	C1: nutrition and lifestyle education sessions		41	41	100.0
	C2: usual activities				
	total:		**135**	**135**	**100.0**
Suchert 2015 (cluster-RCT)	I: multi-level intervention targeting students, classrooms, schools, and parents	—/1489	790	702	88.9

Table 1. Overview of study populations *(Continued)*

	C: no intervention		506	460	90.9
	total:		**1296**	**1162**	**89.7**
Andrade 2014 (cluster-RCT)	I: ACTIVITAL individual- and environment-based intervention	—/—	700	550	78.6
	C: standard curriculum		740	533	72.0
	total:		**1440**	**1083**	**75.2**
Jago 2014 (cluster-RCT)	I: Action 3:30 activity club	—/—	284	153	53.9
	C: schools provided data only		255	157	61.6
	total:		**539**	**310**	**57.5**
Kipping 2014 (cluster-RCT)	I: PA education intervention	2242/2221	1064	—	—
	C: continued standard education provision		1157	—	—
	total:		**2221**	**1252**	**56.4**
Kobel 2014 (cluster-RCT)	I: teacher training, PA education, active breaks	3159/1968	—	—	—
	C: no intervention		—	—	—
	total:		**1964**	**1724**	**87.8**
Martinez-Vizcaino 2014 (cluster-RCT)	I: MOVI-2 extracurricular PA programme	—/—	769	420	54.6
	C: standard PE curriculum		823	492	59.8
	total:		**1592**	**912**	**57.3**
Nogueira 2014 (cluster-RCT)	I: high-intensity capoeira sessions	341/339	185	176	95.1
	C: usual school activities		154	135	87.7
	total:		**339**	**138**	**40.7**
Santos 2014 (cluster-RCT)	I: healthy buddies, healthy living lessons, structured aerobic exercise	—/—	340	310	91.2
	C: standard curriculum		347	273	78.7
	total:		**687**	**583**	**84.9**
Toftager 2014 (cluster-RCT)	I: physical and organisational environmental changes	—/—	623	551	88.4
	C: —		725	608	83.9
	total:		**1348**	**1159**	**86.0**

Table 1. Overview of study populations *(Continued)*

Fairclough 2013 (cluster-RCT)	I: weekly lesson plans, worksheets, homework tasks, lesson resources	420/318	166	117	70.5
	C: normal instruction		152	89	58.6
	total:		**318**	**196**	**61.6**
Ford 2013 (RCT)	I: accumulated brisk walking programme	—/174	—	77	—
	C: normal school lessons		—	75	—
	total:		**174**	**152**	**87.4**
Grydeland 2013 (cluster-RCT)	I: structured lessons, PA breaks, PA promotion	—/—	784	519	66.2
	C: —		1381	945	68.4
	total:		**2165**	**1464**	**67.6**
Melnyk 2013 (cluster-RCT)	I: goal-setting, education, PA homework	1560/807	374	286	76.5
	C: Healthy Teens attention control curriculum was intended to promote knowledge of common adolescent health topics and health literacy		433	341	78.8
	total:		**807**	**627**	**77.7**
Sacchetti 2013 (cluster-RCT)	I: daily PA in schoolyard and classroom	521/521	247	212	85.8
	C: standard programme of PE		250	216	86.4
	total:		**497**	**428**	**86.1**
Siegrist 2013 (cluster-RCT)	I: JuvenTUM educational and environmental intervention	—/902	486	427	87.9
	C: continued with usual school activities		340	297	87.4
	total:		**826**	**724**	**87.7**
Aburto 2011 (cluster-RCT)	I1: basic intervention of environmental and policy-level changes	—/—	262	241	92.0
	I2: plus intervention adding additional resources and daily morning exercise		264	242	91.7
	C: no change to standard practices		338	216	63.9
	total:		**864**	**699**	**80.9**
Ardoy 2011 (cluster-RCT)	I1: 4 sessions/week of PE	70/67	26	25	96.2
	I2: 4 sessions/week of PE with emphasis on increasing intensity		23	23	100.0

Table 1. Overview of study populations *(Continued)*

	C: 2 sessions/week of PE		18	18	100.0
	total:		**67**	**66**	**98.5**
de Heer 2011 (cluster-RCT)	I: Bienstar intervention of health education and 45 to 60 minutes of after school PA	1720/901	292	242	82.9
	C1: Grade 4 health workbooks and incentives		251	236	94.0
	C2: spillover control group		354	326	92.1
	total:		**897**	**804**	**89.6**
Jago 2011 (cluster-RCT)	I: education, social marketing, food environment, PE curriculum, equipment provision	—/11158	5571	2060	37.0
	C: recruitment and data collection only		5587	2003	35.9
	total:		**11158**	**4063**	**36.4**
Jansen 2011 (cluster-RCT)	I: 3 PE sessions/week, additional after school sport and play, classroom education, parent health promotion	—/—	1271	1149	90.4
	C: continued with usual curriculum		1499	1267	84.5
	total:		**2770**	**2416**	**87.2**
Magnusson 2011 (cluster-RCT)	I: students engaged in PA during PE lessons, during recess, and during classes; schools had access to PA equipment to use in school lessons; teaching materials promoting PA were provided	—/321	151	138	91.4
	C: followed the general PA curriculum		170	116	68.2
	total:		**321**	**254**	**79.1**
Okely 2011 (cluster-RCT)	I: PA action plan	—/1769	771	566	73.4
	C: continuation of usual programmes		747	633	84.7
	total:		**1518**	**1199**	**79.0**
Thivel 2011 (cluster-RCT)	I: 120 minutes of additional supervised PE	—/—	229	229	100.0
	C: habitual 2 hours of PE/week		228	228	100.0
	total:		**457**	**457**	**100.0**
Wilson 2011 (cluster-RCT)	I: Active by Choice Today programme, PA homework, in-school PA, motivational skills training		729	673	92.3
	C: General Health Education Programme		693	635	91.6

Table 1. Overview of study populations *(Continued)*

	total:		**1422**	**1308**	**92.0**
Kriemler 2010 (cluster-RCT)	I: 2 additional 45-minute PE lessons/week, activity breaks, PA homework		305	297	97.4
	C: usual mandatory PE lessons		235	205	87.2
	total:		**540**	**502**	**93.0**
Neumark-Sztainer 2010 (cluster-RCT)	I: New Moves curriculum (nutrition and self-empowerment, motivational interviewing, lunch meetings, parent outreach)	687	182	177	97.3
	C: participation in all-girls PE class		174	159	91.4
	total:		**356**	**336**	**94.4**
Angelopoulos 2009 (cluster-RCT)	I: educational intervention covering self-esteem, body image, nutrition, PA, fitness, and environmental issues, with motivational methods to increase knowledge, skills, self-efficacy, self-monitoring, and social influence		—	321	—
	C: —		—	325	—
	total:		**—**	**646**	**—**
Donnelly 2009 (cluster-RCT)	I: 90 minutes/week of moderate to vigorous physically active academic lessons		814	792	97.3
	C: regular classroom instruction		713	698	97.9
	total:		**1527**	**1490**	**97.6**
Dorgo 2009 (cluster-RCT)	I1: PE manual resistance training programme		141	93	66.0
	I2: PE manual resistance training plus cardiovascular endurance training				
	C: regular PE programme that followed the usual school curriculum		232	129	55.6
	total:		**373**	**222**	**59.5**
Gentile 2009 (cluster-RCT)	I: 'Switch' programme: promoted healthy lifestyles targeting family, school, and community		670	—	—
	C: no intentional exposure to the Switch programme		653	—	—
	total:		**1323**	**1029**	**77.8**

Table 1. Overview of study populations *(Continued)*

Neumark-Sztainer 2009 (cluster-RCT)	I: after school theatre sessions, booster sessions, family outreach	56	51	91.1
	C: a theatre-based control condition	52	45	86.5
	total:	**108**	**96**	**88.9**
Peralta 2009 (RCT)	I: curriculum and peer-facilitated lunchtime PA session, parent newsletters	16	16	100.0
	C: PA curriculum	17	16	94.1
	total:	**33**	**32**	**97.0**
Walther 2009 (cluster-RCT)	I: 1 unit of physical exercise (45 minutes) with at least 15 minutes of endurance training/school day, plus lessons on healthy lifestyle once/month	112	109	97.3
	C: German standards, 2 units (each 45 minutes) of PE/week, 12 units (45 minutes/unit) of high-level endurance exercise training/week plus participation in competitive sporting events	76	73	96.1
	total:	**188**	**182**	**96.8**
Reed 2008 (cluster-RCT)	I: Action Schools!BC whole-school PA approach	178	156	87.6
	C: regular programme of PE and school-based PA	90	81	90.0
	total:	**268**	**237**	**88.4**
Salmon 2008 (cluster-RCT)	I: 1, 2, 3 behavioural modification group; fundamental motor skills group; combined behavioural modification and fundamental motor skills group	233	213	91.4
	C: usual classroom lessons	62	55	88.7
	total:	**295**	**268**	**90.8**
Wang 2008 (cluster-RCT)	I: 'FitKid' after school intervention sessions	603	260	43.1
	C: —	584	265	45.4
	total:	**1187**	**525**	**44.2**
Webber 2008 (cluster-RCT)	I: health education lessons to enhance behavioural skills known to influence PA participation (self-monitoring, setting goals for behaviour change)	—	—	—
	C: —	—	—	—

Table 1. Overview of study populations *(Continued)*

	total:	**3502**	**3378**	**96.5**
Weeks 2008 (RCT)	I: directed jumping activity at the beginning of every PE class	52	43	82.7
	C: regular PE warm-ups and stretching at the beginning of every PE class	47	38	80.9
	total:	**99**	**81**	**81.8**
Barbeau 2007 (RCT)	I: after school PA programme	—	—	81
	C: —	—	—	84
	total:	**—**	**—**	**—**
Williamson 2007 (cluster-RCT)	I: Healthy Eating and Exercise programme to increase PA during the school day and at home	313	282	90.1
	C: Alcohol/Drug/Tobacco abuse prevention programme	348	304	87.4
	total:	**661**	**586**	**88.7**
Haerens 2006 (cluster-RCT)	I1: a computer-tailored intervention to increase MVPA to 60 minutes/d, increase fruit consumption, increase water consumption, and reduce fat	2105	—	—
	I2: group 1 plus parental involvement			
	C: no PA and nutrition intervention	735	—	—
	total:	**2840**	**2434**	**85.7**
Young 2006 (RCT)	I: PE curriculum taught 5 days/week and family	116	111	95.7
	C: standard PE class	105	99	94.3
	total:	**221**	**210**	**95.0**
Bayne-Smith 2004 (RCT)	I: Physical Activity and Teenage Health programme, education sessions plus 20 to 25 minutes of PA	—	310	—
	C: same frequency or duration of PE classes, but without lecture or discussion	—	132	—
	total:	**—**	**442**	**—**
Simon 2004 (cluster-RCT)	I: an educational component focusing on PA and sedentary behaviours and new opportunities for PA during and after school hours	—	475	—

Table 1. Overview of study populations *(Continued)*

	C: —	—	479	—
	total:	**1046**	**954**	**91.2**
Trevino 2004 (cluster-RCT)	I: health programming regarding 3 health behaviour messages associated with diabetes mellitus control and goal-setting	969	619	63.9
	C: —	1024	602	58.8
	total:	**1993**	**1221**	**61.3**
Stone 2003 (cluster-RCT)	I: food service, skills-based classroom curricula, family, and PE	879	644	73.3
	C: —	825	653	79.2
	total:	**1704**	**1297**	**76.1**
Burke 1998 (cluster-RCT)	I1: standard PA and nutrition programme including classroom lessons, fitness sessions daily, and nutrition programme	—	—	—
	I2: I1 plus a PA enrichment programme for higher-risk children			
	C: no programme	—	—	—
	total:	**800**	**720**	**90.0**
Ewart 1998 (RCT)	I: 50-minute 'Project Heart' aerobic exercise classes	45	44	97.8
	C: 50-minute standard PE classes	54	44	81.5
	total:	**99**	**88**	**88.9**
Luepker 1996 (cluster-RCT)	I1: school food service modifications, PE interventions, and Child and Adolescent Trial for Cardiovascular Health curricula	3651	3297	90.3
	I2: I1 plus a family-based programme			
	C: usual health curricula, PE, and food service programmes	1455	722	49.6
	total:	**5106**	**4019**	**78.7**
Bush 1989 (cluster-RCT)	I1: 'Know Your Body' curriculum focusing on nutrition, fitness, prevention of smoking, a personalised health screening, and results on a 'health passport' for parentsg	—	—	—
	I2: 'Know Your Body' curriculum and			

Table 1. Overview of study populations *(Continued)*

	health screening, but students do not receive the results of their screening; only parents receive the results				
	C: health screening only		—	—	—
	total:		**892**	**431**	**48.3**
Walter 1988 (cluster-RCT)	I: special curriculum targeting voluntary changes in risk behaviour in the areas of diet, PA, and smoking	— / 3388	2075	1104	53.2
	C: —		1313	665	50.6
	total:		**3388**	**1769**	**52.2**
Grand total	***All interventions***		**46 073**	**28 089**	
	All comparators		**40 566**	**23 639**	
	All interventions and comparators [b]		**96 740**	**66 752**	

—: denotes not reported.
[a]Follow-up under randomised conditions until end of trial (= duration of intervention + follow-up post intervention or identical to duration of intervention); extended follow-up refers to follow-up of participants once the original trial was terminated as specified in the power calculation.
[b]Note that numbers from all interventions and all interventions and comparators are greater than the sum of interventions only and comparators only, as some studies reported only the total number of included participants and did not note numbers within each group.
C: comparator; **I:** intervention; **MVPA:** moderate to vigorous physical activity; **NA:** not applicable; **PA:** physical activity; **PE:** physical education; **RCT:** randomised controlled trial.

APPENDICES

Appendix 1. Search strategies

Cochrane Central Register of Controlled Trials (the Cochrane Library)

Update search, via Cochrane Library: October 1 2011 to June 1, 2020 (search conducted 17 February 2021)

Details from previous searches can be found in the last update Dobbins 2013.

#1 Exercise OR physical education OR physical training OR physical activity OR physical inactivity OR physical fitness OR fitness OR sedentary OR lifestyle OR sport* OR walk* OR danc*
#2 child* OR adolescen*
#3 school*
#4 #1 and #2 and #3 with Publication Year from 2011 to 2020, with Cochrane Library publication date Between Oct 2011 and Jun 2020, in Trials

MEDLINE

Update search, via Ovid: October Week 1 2011 to June Week 1 2020 (search conducted 17 February 2021)

Details from previous searches can be found in the last update Dobbins 2013.

1. randomised controlled trial.pt.

(Continued)

2. controlled clinical trial.pt.

3. randomized.ab.

4. placebo.ab.

5. clinical trials as topic.sh.

6. randomly.ab.

7. trial.ti.

8. 1 or 2 or 3 or 4 or 5 or 6 or 7

9. exp animals/ not humans.sh.

10. 8 not 9

11. exercise/ or circuit-based exercise/ or gymnastics/ or high-intensity interval training/ or physical conditioning, human/ or plyometric exercise/ or resistance training/ or running/ or swimming/ or walking/

12. physical inactivity.mp.

13. exp Motor Activity/

14. exp "Physical Education and Training"/

15. Phys* ed*.mp.

16. exp Physical Fitness/

17. sedentary.ab. or sedentary.ti.

18. screen time.mp.

19. exp Sedentary Lifestyle/

20. exp Life Style/

21. (("lifestyle" or life-style) adj5 activ$).tw.

22. (("lifestyle" or life-style) adj5 physical$).tw.

23. leisure activities/ or recreation/

24. exp Walking/

25. exp Sports/

26. exp Dancing/

27. walk$.tw.

28. sport$.tw.

29. cycl$.tw.

30. dancing.mp.

31. exercise therapy/ or plyometric exercise/ or resistance training/

32. (exercise$ adj aerobic$).tw.

33. (physical$ adj5 (fit$ or train$ or activ$ or endur$)).tw.

34. (exercis$ adj5 (train$ or physical$ or activ$)).tw.

35. exp Child/

(Continued)

36. Child*.mp.

37. exp Adolescent/

38. Youth.mp.

39. Adolescen*.mp.

40. Teen*.mp.

41. 35 or 36 or 37 or 38 or 39 or 40

42. Schools/

43. School$.tw.

44. school-based.mp.

45. elementary school.mp.

46. middle school.mp.

47. high-school.mp.

48. grade school.mp.

49. 42 or 43 or 44 or 45 or 46 or 47 or 48

50. 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34

51. 10 and 41 and 49 and 50

52. limit 51 to ed=20111001-20200601

Embase

Update search, via Ovid Week 41 2011 to Week 23 2020 (search conducted 17 February 2021)

Details from previous searches can be found in the last update Dobbins 2013.

1. exercise/ or aerobic exercise/ or anaerobic exercise/ or aquatic exercise/ or circuit training/ or dynamic exercise/ or endurance training/ or exercise intensity/ or high intensity interval training/ or leg exercise/ or muscle exercise/ or pilates/ or plyometrics/ or resistance training/

2. physical activity/ or cycling/ or jogging/ or jumping/ or lifting effort/ or running/ or swimming/ or walking/ or weight bearing/ or weight lifting/

3. physical inactivity.mp. or physical inactivity/

4. exp fitness/

5. exp physical education/

6. Phys* ed*.mp.

7. exp sport/

8. Exertion.mp.

9. recreation/ or dancing/ or recreational game/

10. exp lifestyle/

11. exp dancing/

12. walking/

(Continued)

13. walking/
14. sedentary lifestyle/
15. sedentary behavio?r.af.
16. screen time.mp.
17. kinesiotherapy/ or dynamic exercise/ or leg exercise/ or movement therapy/ or muscle training/ or pilates/ or plyometrics/
18. exp Exercise therapy/
19. (physical$ adj5 activ$).tw.
20. (physical$ adj5 fit$).tw.
21. (physical$ adj5 lifestyle$).tw.
22. (physical$ adj5 train$).tw.
23. walk.tw.
24. (aerobics or physical activity or physical inactivity).af.
25. (fitness adj (class$ or regime$ or program$)).af.
26. (aerobics or physical training or physical education).af.
27. (fitness adj (class$ or regime$ or program$)).af.
28. (aerobics or physical training or physical education).af.
29. dance therapy.af.
30. or/1-29
31. child/
32. child*.mp.
33. adolescent/
34. adolescen*.mp.
35. juvenile/
36. teen*.mp.
37. exp middle school student/ or exp high school/ or exp high school student/ or exp primary school/ or exp school/
38. high school/ or middle school/ or primary school/
39. school health service/ or exp school health education/
40. school*.tw.
41. 31 or 32 or 33 or 34 or 35 or 36
42. 37 or 38 or 39 or 40
43. randomised controlled trial/
44. randomisation/
45. random allocation.mp.
46. double blind procedure/

(Continued)

47. single blind procedure/

48. clinical trial/

49. (clinic$ adj trial$1).tw.

50. ((singl$ or doubl$ or treb$ or tripl$) adj (blind$3 or mask$3)).tw.

51. placebo/

52. Placebo$.tw.

53. Randomly allocated.tw.

54. (allocated adj2 random).tw.

55. 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54

56. case report.tw.

57. letter.pt.

58. 56 or 57

59. 55 not 58

60. 30 and 41 and 42 and 59

61. limit 60 to em=201141-202023

BIOSIS

Update search, via Web of Science: October 2011 to June 2020 (search conducted 17 February, 2021)

Details from previous searches can be found in the last update Dobbins 2013.

1. TS=("physical activity" OR exercise)

2. TS=("physical fitness" OR fitness)

3. TS=(sedentary or screen-time)

4. TS=(school* OR "physical education" OR student*)

5. TS=(child* OR adolescent*)

6. #1 OR #2 OR #3

7. TS=(random* and trial)

8. TS=(control* and trial)

9. #7 OR #8

10. #4 and #5 AND #6 AND #9

CINAHL

Update search, via EBSCO Host Research Databases: October 2011 to June 2020 (search conducted 17 February, 2021)

Details from previous searches can be found in the last update Dobbins 2013.

S1 (MH "Exercise+") or (MH "Aerobic Exercises+")

S2 ""physical inactivity""

(Continued)

S3 (MH "Life Style, sedentary")

S4 ("physical education") or (MH "Physical Education and Training") or ("phys* ed*)

S5 ("physical activity" or (MH "Physical activity")

S6 ("physical fitness") or (MH "Physical Fitness+") or ("fitness")

S7 ("walk") or (MH "walking") or (MH "Sports")

S8 ""sport*""

S9 S1 OR S2 OR S3 OR S4 OR S5 OR S6 OR S7 OR S8

S10 ((MH "Schools+") or (MH "Schools, Elementary") or (MH "Schools, Middle") or ("school*"))

S11 (MH "Child")

S12 "adolescen*"

S13 "teen*"

S14 "youth*"

S15 "child*"

S16 S10 OR S11 OR S12 OR S13 OR S14 OR S15

S17 MH randomised controlled trials

S18 MH double-blind studies

S19 MH single-blind studies

S20 MH random assignment

S21 MH pretest-posttest design

S22 MH cluster sample

S23 TI (randomised OR randomised)

S24 AB (random*)

S25 TI (trial)

S26 MH (sample size) AND AB (assigned OR allocated OR control)

S27 MH (placebos)

S28 PT (randomised controlled trial)

S29 AB (control W5 group)

S30 MH (crossover design) OR MH (comparative studies)

S31 AB (cluster W3 RCT)

S32 MH animals+

S33 MH (animal studies)

S34 TI (animal model*)

S35 S32 OR S33 OR S34

S36 MH (human)

(Continued)

S37 S35 NOT S36

S38 S17 OR S18 OR S19 OR S20 OR S21 OR S22 OR S23 OR S24 OR S25 OR S26 OR S27 OR S28 OR S29 OR S30 OR S31

S39 S38 NOT S37

S40 S9 AND S16 AND S39 *Limiters - Publication from: 20111001 - 20200631*

SPORTDiscus

Updated search, via EBSCO Host Research Databases: October 2011 to June 2020 (search conducted 17 February, 2021)

Details from previous searches can be found in the last update Dobbins 2013.

S1. control group OR randomi* control* trial OR effect* OR random sample* or control subject*

S2. physical activity OR physical inactivity OR exercise OR fitness OR sport* or danc* OR walk* or physical education OR obesity OR body weight

S3. child* OR adolescen*

S4. School*

S5. S1 AND S2 AND S3 AND S4 *Limit 20111001 - 20200601*

PsycINFO

Updated search, via Ovid: October Week 3 2011 to June Week 1 2020 (search conducted 17 February, 2021)

Details from previous searches can be found in the last update Dobbins 2013.

1. Randomized controlled trial.mp.

2. random allocation.mp.

3. double blind method.mp.

4. single blind method.mp.

5. Clinical trial.mp. or exp Clinical Trials/

6. (clinic$ adj trial$1).tw.

7. ((singl$ or doubl$ or treb$ or tripl$) adj (blind$3 or mask$3)).tw.

8. placebo/

9. Placebo$.tw.

10. (allocated adj2 random).tw.

11. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10

12. case report.tw.

13. historical article.mp.

14. letter.mp.

15. 12 or 13 or 14

16. 11 not 15

17. exercise/ or aerobic exercise/ or weightlifting/

18. physical activity/ or exercise/

(Continued)

19. physical inactivity.mp.

20. exercise.mp.

21. physical activity.mp.

22. motor activity.mp.

23. exp Physical Education/

24. phys* ed*.mp.

25. exp physical fitness/

26. physical endurance/

27. exp aerobic exercise/

28. exp SEDENTARY BEHAVIOR/

29. screen time/

30. sedentary.ab. or sedentary.ti.

31. screen time.mp.

32. exp lifestyle/

33. lifestyle changes/

34. (("lifestyle" or life-style) adj5 activ$).tw.

35. (("lifestyle" or life-style) adj5 physical$).tw.

36. leisure time/ or recreation/

37. walking.mp. or exp WALKING/

38. sports/ or baseball/ or basketball/ or football/ or judo/ or martial arts/ or soccer/ or swimming/ or tennis/ or weightlifting/

39. exp Dance Therapy/ or exp Dance/ or dancing.mp.

40. walk$.tw.

41. sport$.tw.

42. cycl$.tw.

43. exercise therapy.mp.

44. (exercise$ adj aerobic$).tw.

45. (physical$ adj5 (fit$ or train$ or activ$ or endur$)).tw.

46. (exercis$ adj5 (train$ or physical$ or activ$)).tw.

47. 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46

48. child*.mp.

49. Adolescen*.mp.

50. Teen*.mp.

51. Youth.mp.

52. 48 or 49 or 50 or 51

(Continued)

53. school*.tw.

54. exp Elementary Schools/

55. exp Middle Schools/

56. exp High Schools/

57. secondary school*.mp.

58. primary school*.mp.

59. grade school*.mp.

60. 53 or 54 or 55 or 56 or 57 or 58 or 59

61. 16 and 47 and 52 and 60

62. limit 61 to up=20111021-20200601

Sociological abstracts

Update search, via ProQuest: October 21 2011 to June 01 2020 (search conducted 17 February, 2020)

Details from previous searches can be found in the last update Dobbins 2013.

Control group OR randomi* control* trial OR effect* OR random sample* OR control subject*

AND

Physical activity OR physical inactivity OR exercise OR physical fitness OR fitness OR sport* OR danc* OR walk* OR physical education OR obesity OR body weight

AND

Child* OR Adolescen*

AND

School*

pd(20110101-20200601)

Appendix 2. Baseline characteristics

Trial ID	Interventions and comparators	Trial period	Ethnic groups (%)	Sex (% female)	Age, years (mean (SD)/ range)	BMI, kg/m² (mean (SD))
Breheny 2020	I: Daily Mile C: usual school routine	2016 to 2018	52 White British 16 South Asian 8 Black African Caribbean	48	8.9 (1.0)	—

(Continued)

			24 Other/unknown			
Ketelhut 2020	I: high-intensity interval training during PE	—	—	50	10.8 (0.6)	19.6 (4.6)
	C: usual PE			41.7	10.7 (0.7)	19.7 (4.0)
Belton 2019	I: multi-component PE, whole-school and parent-targeted intervention	2013 to 2015	—	51	12.8 (0.4)	Male: 20.0 (3.1) Female: 20.8 (3.5)
	C: usual care			50	12.8 (0.4)	Male: 19.3 (3.2) Female: 20.3 (2.8)
Corepal 2019	I: pedometer challenge	2015 to 2016	—	53	—	—
	C: usual school					
Ickovics 2019	I1: PA school wellness policy	2011 to 2015	47 Hispanic 35 Non-Hispanic black 18 Non-Hispanic white	62	10.9 (0.6)	—
	I2: PA + nutrition school wellness policy			50		
	C1: nutrition school wellness policy			50		
	C2: delayed control			50		
Jago 2019	I: Action 3:30R after school PA club	2017 to 2018	—	49	8.4/8-10	16.9 (2.5)
	C: —					17.2 (2.4)
Leahy 2019	I: Burn2Learn, multi-component high-intensity interval training	2017	71 Australian 19 European 6 Asian 4 other	46	16.2 (0.4)	22.2 (3.0)
	C: usual school activities					
Lonsdale 2019a	I: teacher PE training	2015 to 2016	58 English and European 9 Aboriginal or Torres Strait Islander 33 Other	48	13.0 (0.6)	—
	C: standard teaching		57 English and European 10 Aboriginal or Torres Strait Islander 32 Other	41	12.9 (0.5)	—

(Continued)

Müller 2019	I1: PA only	2015 to 2016	"Colored children (mixed race ancestry), usually Afrikaans speaking, and black African children, mainly Xhosa speaking"	50	9.2 (0.9)	17.1
	I2: PA + health education					
	I3: PA + health education + nutrition					
	C1: health education + nutrition			50		
	C2: no PA					
Ordóñez Dios 2019	I: 2 x 45-minute PE sessions per week and daily run	—	—	—	—	19.1 (3.1)
	C: 2 x 45-minute PE sessions per week			—	—	20.1 (3.8)
Seibert 2019	I: 4 core strategies to increase PA	—	—	49	11.1 (—)	22.0 (—)
	C: usual PE			46	11.2 (—)	21.7 (—)
Seljebotn 2019	I: physically active lessons, active homework, physically active recess	2014 to 2015	—	48	9-10	17.6 (3.0)
	C: continued normal routine, approximately 135 minutes/week of PA			51		17.3 (2.9)
Zhou 2019	I1: enhanced PE	2015 to 2016	—	47	12.7 (0.6)	—
	I2: after school programme					
	I3: enhanced PE and after school programme					
	C: regular PE					
Adab 2018	I: 30 minutes of additional MVPA on each school day, cooking workshops, a 6-week healthy eating programme, information sheets for families	2011 to 2015	45 White British 31 South Asian 8 Black African Caribbean 16 other	51	6.3 (0.3)	—
	C: ongoing Year 2 health-related activities and education resources, excluding topics related to healthy eating and PA			47		
Carlin 2018	I: brisk walking intervention	2014	—	100	12.4 (0.6)	20.3 (3.9)
	C: continued with normal PA habits			100		19.3 (4.3)
Harrington 2018	I: support for PA, PE, and school sport culture and practices with support of the Youth Sport Trust and a hub school	2015 to 2016	77 White European 12 South Asian 11 other	100	12.8 (0.8)	—
	C: usual practice of PE and sport			100		
Have 2018	I: active math lessons	2012 to 2013	—	52	7.2 (0.3)	16.1 (1.7)

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	C: regular classroom instruction			48		15.7 (2.2)
Pablos 2018	I: lunchtime extracurricular PA	—	—	50	10.7 (0.7)	—
	C: continued with daily activities			54		
Robbins 2018	I: an after school PA club, counselling, interactive Internet-based sessions	2011 to 2016	56 Black 44 Non-Black 16 Hispanic or Latino 84 not Hispanic or Latino	100	12.1 (0.8)	22.9 (6.0)
	C: no additional after school programming		64 Black 36 Non-Black 13 Hispanic or Latino 87 not Hispanic or Latino	100		23.6 (6.1)
Siegrist 2013	I: weekly lifestyle lessons	—	"Mainly Caucasian"	40	11.1 (0.6)	19.1 (3.5)
	C: usual activities			47		
Ten Hoor 2018	I: strength training and motivational interviewing	2015 to 2016	—	52	13.0 (0.5)	19.7 (3.5)
	C: usual curriculum			47		
Donnelly 2017	I: Academic Achievement and Physical Activity Across the Curriculum lessons, 160 minutes/week of MVPA	—	85 not Hispanic or Latino 11 Hispanic or Latino 2 unknown 2 refused or missing	49	8.1 (0.6)	17.4 (3.1)
	C: traditional classroom instruction and typical PE schedule			54	8.1 (0.6)	
Farmer 2017	I: school-specific playground action plan	2011 to 2013	19 Māori 12 Pacific 7 Asian 46 New Zealand 16 unknown	47	8.0 (1.2)	17.4 (2.8)
	C: no change to school play spaces		14 Māori 11 Pacific 9 Asian 52 New Zealand 13 unknown	53	7.9 (1.1)	17.4 (2.7)
Sutherland 2017	I: modified Supporting Children's Outcomes using Rewards, Exercise, and Skills programme	2014 to 2015	—	51	10.2	—
	C: delivered school PA practices according to the curriculum				10.1	

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Torbeyns 2017	I: cycling desks	2014 to 2015	—	50	14.3 (0.6)	19.7 (3.5)
	C: no lifestyle change			46		20.1 (3.7)
Daly 2016	I: specialist-taught PE intervention	2005 to 2009	92 Caucasian 6 Asian 1 Indigenous Australian or Polynesian descent 1 unknown	48	8.1 (0.4)	Girls: 17.2 (0.2) Boys: 16.9 (0.2)
	C: usual PE programme			49		Girls: 17.2 (0.2) Boys: 17.0 (0.2)
de Greeff 2016	I: physically active mathematics and language lessons	—	—	55	8.1 (0.7)	17.0 (2.8)
	C: usual curriculum			59		16.9 (2.6)
Drummy 2016	I: teacher-led activity break	—	—	—	9.5/9-10	19.4 (3.5)
	C: normal daily routine					18.3 (2.4)
Jarani 2016	I1: group circuit training-based PE	—	—	50	8.4 (1.6)	17.4 (3.2)
	I2: games-based PE			49	8.3 (1.6)	17.9 (3.3)
	C: traditional PE school			44	8.3 (1.6)	17.8 (3.4)
Kocken 2016	I: theory and practical lessons on nutrition and PA	2009 to 2011	87 Western 13 non-Western	52	9.2 (0.6)	—
	C: regular school programme or curriculum on nutrition and PA		85 Western 15 non-Western	51	9.1 (0.6)	—
Lau 2016	I: Xbox 260 Kinect gaming sessions after school	—	Asian	28	9.2 (0.5)	19.4 (3.6)
	C: regular PA and PE class			35		19.8 (3.6)
Resaland 2016	I: physically active Norwegian, mathematics, and English lessons on the playground; PA breaks and PA homework	2014 to 2015	—	47	10.2 (0.3)	18.0 (3.0)
	C: curriculum-prescribed PE and PA			49		18.1 (3.0)
Sutherland 2016	I: 7 PA intervention strategies and 6 implementation strategies	2012 to 2014	5 Aboriginal and/or Torres Strait Islander	52	12	19.9 (3.6)
	C: only measurement components of the trial, regular PA and PE		8 Aboriginal and/or Torres Strait Islander	51		20.2 (3.8)
Tarp 2016	I: 60 minutes of PA during school time, PA homework	2013 to 2014	Boys: 98 Danish 2 European	49	12.9 (0.6)	19.8 (2.9)

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			Girls: 96 Danish 2 European 1 other			
	C: normal practice		Boys: 94 Danish 2 European 4 other Girls: 91 Danish 2 European 7 other	52		19.3 (3.0)
Cohen 2015	I: teacher learning, PA policies, school-community linkages	2012 to 2013	14 Aboriginal or Torres Strait Islander 86 Australian 1 Asian 5 European 7 other	54	8.5 (0.6)	—
	C: usual PE and school sport programmes			54		
Jago 2015	I: after school dance classes	2013 to 2014	—	100	11-12	19.5 (3.4)
	C: provided data only			100		19.5 (3.7)
Madsen 2015	I: nutrition education curriculum, Playworks structured recess before or after school activities, PA and games implemented by teachers	2011 to 2013	6 White 9 Black 55 Latino 15 mixed 16 other	49	—	—
	C: —		6 White 13 Black 45 Latino 14 mixed 22 other	56		
Muros 2015	I1: extracurricular PA sessions	2012	—	54	10.7 (0.5)	19.7 (3.7)
	I2: PA and nutrition			44		
	I3: PA and nutrition and extra virgin olive oil during the final month			42		
	C1: nutrition and lifestyle education sessions			54		
	C2: usual activities			51		
Suchert 2015	I: multi-level intervention targeting students, classrooms, schools, and parents	2014 to 2015	—	47	13.7 (0.7)	—
	C: no intervention			49		
Andrade 2014	I: ACTIVITAL individual- and environment-based intervention	2009 to 2012	—	66	12.9 (0.8)	19.8 (3.4)

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	C: standard curriculum			59		19.7 (2.9)
Jago 2014	I: Action 3:30 activity club	2012 to 2013	—	59	10 (0.6)	18.8 (3.4)
	C: schools provided data only					18.4 (3.3)
Kipping 2014	I: PA education intervention	—	—	49	9.5 (0.3)	—
	C: continued standard education provision			52		—
Kobel 2014	I: teacher training, PA education, active breaks	2010 to 2014	31 migration background	53	7.1 (0.6)	15.98 (2.14)
	C: no intervention			49		
Martinez-Vizcaino 2014	I: MOVI-2 extracurricular PA programme	2010 to 2011	—	55	9.5 (0.7)	19.0 (3.68)
	C: standard PE curriculum			49		
Nogueira 2014	I: high-intensity capoeira sessions	—	Female: 97 Caucasian 3 Asian or Black Male: 96 Caucasian 4 Asian	41	10.6 (0.6)	18.5 (3.1)
	C: usual school activities			50		
Santos 2014	I: healthy buddies, healthy living lessons, structured aerobic exercise	2009 to 2010	25 First-Nations 75 non-First-Nations	48	9.3	—
	C: standard curriculum		31 First-Nations 69 non-First-Nations		8.8	—
Toftager 2014	I: physical and organisational environmental changes	2010 to 2012	91 Native Danish parents	51	12.5 (0.6)	18.9 (3.0)
	C: —		92 Native Danish parents	48	12.5 (0.6)	18.8 (3.0)
Fairclough 2013	I: weekly lesson plans, worksheets, homework tasks, lesson resources	2010 to 2011	95 White British	—	10.6 (0.3)	17.9 (3.0)
	C: normal instruction				10.7 (0.3)	18.1 (3.7)
Ford 2013	I: accumulated brisk walking programme	—	—	48	5-11	17.1 (3.3)
	C: normal school lessons			—		16.4 (2.9)
Grydeland 2013	I: structured lessons, PA breaks, PA promotion	2007 to 2009	—	54	11.2 (0.3)	17.8 (2.5)
	C: —			60		17.9 (2.6)

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Melnyk 2013	I: goal-setting, education, PA home-work	2010 to 2012	65 Hispanic or Latino	55	14.7 (0.7)	29.7 (7.1)
	C: Healthy Teens attention control curriculum was intended to promote knowledge of common adolescent health topics and health literacy			49		
Sacchetti 2013	I: daily PA in schoolyard and classroom	2006 to 2009	—	48	9-11	18.0 (2.9)
	C: standard programme of PE			48		17.8 (2.9)
Siegrist 2013	I: JuvenTUM educational and environ-mental intervention	2006 to 2007	—	48	8.4 (0.7)	17.4 (2.9)
	C: continued with usual school activi-ties					17.3 (3.0)
Aburto 2011	I1: basic intervention of environmental and policy-level change	2006 to 2007	Hispanic	50	10.2 (0.7)	19.8 (3.8)
	I2: plus intervention adding additional resources and daily morning exercise			55		
	C: no change to standard practices			50		
Ardoy 2011	I1: 4 sessions/week of PE	2007	—	35	13 (0.7)	22.3 (5.1)
	I2: 4 sessions/week of PE with empha-sis on increasing intensity			30		
	C: 2 sessions/week of PE			44		
de Heer 2011	I: Bienstar intervention of health ed-ucation and 45 to 60 minutes of after school PA	2008	Predominantly Hispanic	46	9.2 (1.0)	20.3 (4.4)
	C1: Grade 4 health workbooks and in-centives			45		20.0 (4.4)
	C2: spillover control group			51		19.5 (4.2)
Jago 2011	I: education, social marketing, food en-vironment, PE curriculum, equipment provision	2006 to 2009	59 Hispanic 20 Black 21 White	53	11.3 (0.6)	—
	C: recruitment and data collection only			52		
Jansen 2011	I: 3 PE sessions/week, additional after school sport and play, classroom edu-cation, parent health promotion	2006 to 2007	Grades 3 to 5: 14 Dutch 9 Surinam 6 Antillean 27 Moroccan 22 Turkish 4 Capeverdean 18 other or missing	Grades 3-5: 51 Grades 6-8: 53	9.2 (1.0)	Grades 3-5: 17.1 (2.8) Grades 6-8: 19.1 (3.8)

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			Grades 6 to 8: 14 Dutch 11 Surinam 5 Antillean 22 Moroccan 24 Turkish 5 Capeverdea 19 other or missing			
	C: continued with the usual curriculum		Grades 3 to 5: 7 Dutch 11 Surinam 4 Antillean 36 Moroccan 20 Turkish 4 Capeverdean 17 other or missing Grades 6 to 8: 8 Dutch 13 Surinam 3 Antillean 35 Moroccan 24 Turkish 5 Capeverdean 15 other or missing	Grades 3-5: 51 Grades 6-8: 49		Grades 3-5: 17.1 (2.8) Grades 6-8: 19.8 (4.1)
Magnusson 2011	I: students engaged in PA during PE lessons, during recess, and during classes; schools had access to PA equipment to use in school lessons; teaching materials promoting PA were provided	2006 to 2008	—	52	7.4 (0.2)	15.8 (1.1)
	C: followed the general PA curriculum			59		16.3 (1.0)
Okely 2011	I: PA action plan	2009 to 2010	—	100	13.6	—
	C: continuation of usual programmes			100		
Thivel 2011	I: 120 minutes of additional supervised PE	2003	—	51	6-10	Normal weight: 15.6 (1.1)
	C: habitual 2 hours of PE/week					Obese: 20.6 (2.6)
				49		Normal weight: 15.5 (1.1)
						Obese: 20.2 (1.8)

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Wilson 2011	I: Active by Choice Today programme: PA homework, in-school PA, motivational skills training	—	76 African American	56	11.3 (0.6)	22.8 (6.2)
	C: General Health Education Programme		69 African American	52	11.4 (0.6)	22.9 (5.9)
Kriemler 2010	I: 2 additional 45-minute PE lessons/week, activity breaks, PA homework	2005 to 2006	Migrant families Grade 1: 34 Grade 5: 25	Grade 1: 49 Grade 5: 55	Grade 1: 6.9 (0.3) Grade 5: 11 (0.5)	17.1 (2.5)
	C: usual, mandatory PE lessons		Migrant families Grade 1: 26 Grade 5: 24	Grade 1: 55 Grade 5: 46	Grade 1: 6.9 (0.3) Grade 5: 11.3 (0.6)	17.0 (2.6)
Neumark-Sztainer 2010	I: New Moves curriculum (nutrition and self-empowerment, motivational interviewing, lunch meetings, parent outreach)	2007 to 2009	32 African American 27 White 17 Asian 13 Hispanic 8 mixed/other 3 American Indian	100	15.7	25.9 (7.1)
	C: participation in all-girls PE class		24 African American 22 White 30 Asian 16 Hispanic 7 mixed/other 2 American Indian	100	15.8	25.5 (6.5)
Angelopoulos 2009	I: educational intervention covering self-esteem, body image, nutrition, PA, fitness, and environmental issues with motivational methods to increase knowledge, skills, self-efficacy, self-monitoring, and social influence	2005 to 2006	90 Greek 10 Immigrant	57	10.3 (0.4)	20.3 (3.6)
	C: —		88 Greek 12 Immigrants	54	10.3 (0.4)	20.1 (3.4)
Donnelly 2009	I: 90 minutes/week of moderate to vigorous physically active academic lessons	—	77 Caucasian 6 African American 10 Hispanic 2 Native American 1 Asian 4 multi-ethnic	52	Grade 2: 7.7 (0.3) Grade 3: 8.7 (0.4)	17.9 (3.1)
	C: regular classroom instruction				Grade 2: 7.8 (0.4) Grade 3: 8.7 (0.4)	18.0 (3.7)
Dorgo 2009	I1: PE manual resistance training programme	—	—	45	15.9 (1.2)	24.4 (6.1)

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	I2: PE manual resistance training plus cardiovascular endurance training				15.2 (1.2)	24.8 (5.9)
	C: regular PE programme that followed the usual school curriculum				15.8 (1.1)	24.9 (5.4)
Gentile 2009	I: 'Switch' programme: promoted healthy lifestyles targeting family, school, and community	2005 to 2006	90 White	53	9.6	18.4 (3.3)
	C: no intentional exposure to the 'Switch' programme			50	9.6	18.5 (3.5)
Neumark-Sztainer 2009	I: after school theatre sessions, booster sessions, family outreach	2006 to 2007	54 African American 13 Asian 7 White 3 Hispanic 23 other or mixed	—	10.3 (1.1)	20.9(5.1)
	C: theatre-based control condition (i.e. children participated in a play focused on environmental health issues using a prepared script)					
Peralta 2009	I: curriculum and peer-facilitated lunchtime PA session, parent newsletters	2007	—	0	12.5 (0.4)	22.8 (4.1)
	C: PA curriculum			0		20.4 (4.1)
Walther 2009	I: 1 unit of physical exercise (45 minutes) with at least 15 minutes of endurance training/school day, plus lessons on healthy lifestyle once/month	—	—	47	11.1	18.0 (2.6)
	C: German standards, 2 units (each 45 minutes) of PE/week, 12 units (45 minutes/unit) of high-level endurance exercise training/week plus participation in competitive sporting events			42	11.1	18.2 (2.8)
Reed 2008	I: Action Schools!BC whole-school PA approach	2003 to 2004	—	49	10.2 (0.6)	18.8 (3.5)
	C: regular programme of PE and school-based PA			50	10.2 (0.6)	19.1 (3.7)
Salmon 2008	I1: behavioural modification group	2002 to 2003	—	51	10 (0.4)	—
	I2: fundamental motor skills group			53		
	I3: combined behavioural modification and fundamental motor skills group			51		
	C: usual classroom lessons			51		
Wang 2008	I: 'FitKid' after school intervention sessions	2002 to 2006	61 Black 31 White 2 Asian 2 Hispanic	52	8.5 (0.6)	19.4 (4.7)
	C: —					19.3 (4.4)

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			5 other			
Webber 2008	I: health education lessons to enhance behavioural skills known to influence PA participation (self-monitoring, setting goals for behaviour change)	2003 to 2006	46 White 24 African American 12 Hispanic 18 other	100	12	20.7
	C: —			100		20.9
Weeks 2008	I: directed jumping activity at the beginning of every PE class	—	—	58	Girls: 13.7 (0.4) Boys: 13.8 (0.4)	Girls: 19.5 (3.5) Boys: 20.3 (3.6)
	C: regular PE warm-ups and stretching at the beginning of every PE class			49	Girls: 13.7 (0.5) Boys: 13.8 (0.4)	Girls: 19.5 (2.1) Boys: 21.5 (5.1)
Barbeau 2007	I: after school PA programme	—	100 Black	100	9.5/8-12	20.9 (5.0)
	C: —		100 Black	100	9.5/8-12	20.9 (5.6)
Williamson 2007	I: Healthy Eating and Exercise programme to increase PA during the school day and at home	—	95 White 2 Black 3 other	50	9.2 (4.1)	—
	C: Alcohol/Drug/Tobacco abuse prevention programme					
Haerens 2006	I1: a computer-tailored intervention to increase MVPA to 60 minutes/d, increase fruit consumption, increase water consumption, and reduce fat	2003 to 2005	—	37	13.1 (0.8)	Girls: 20.2 Boys: 19.2
	I2: group 1 plus parental involvement					Girls: 20.2 Boys: 19.3
	C: no PA and nutrition intervention					Girls: 19.1 Boys: 18.5
Young 2006	I: PE curriculum taught 5 days/week and family	—	83 African American	100	13.8 (0.5)	25.0 (6.9)
	C: standard PE class			100		25.2 (6.7)
Bayne-Smith 2004	I: Physical Activity and Teenage Health programme, education sessions plus 20 to 25 minutes of PA	1994 to 1996	13 White 46 African American 29 Hispanic 12 Asian American	100	16.2 (1.3)	22.8 (4.1)
	C: same frequency or duration of PE classes, but without lecture or discussion		5 White 45 African American 28 Hispanic	100	15.9 (1.2)	23.6 (5.0)

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			12 Asian American			
Simon 2004	I: an educational component focusing on PA and sedentary behaviours and new opportunities for PA during and after school hours	2002 to 2006	23 recomposed family	54	11.6 (0.6)	18.7 (3.7)
	C: —		26 recomposed family	48	11.7 (0.7)	18.9 (3.9)
Trevino 2004	I: health programming regarding 3 health behaviour messages associated with diabetes mellitus control and goal-setting	2001 to 2002	6 Asian 7 African American 83 Mexican American 5 other	50	9.8 (0.5)	20.6 (5.1)
	C: —		6 Asian 13 African American 77 Mexican American 4 other	49	9.8 (0.5)	20.3 (4.8)
Stone 2003	I: food service, skills-based classroom curricula, family, and PE	1993 to 2000	"American Indian"	48	7.6 (0.6)	—
	C: —					
Burke 1998	I1: standard PA and nutrition programme including classroom lessons, fitness sessions daily, and nutrition programme	1993 to 1994	—	49	11	Low-risk girls: 17.5 High-risk girls: 19.2
	I2: I1 plus a PA enrichment programme for higher-risk children					
	C: no programme					Low-risk boys: 16.8 High-risk boys: 21.1
Ewart 1998	I: 50-minute 'Project Heart' aerobic exercise classes	1991 to 1994	30 White 70 African American	100	—	24.8 (5.8)
	C: 50-minute standard PE classes			100		24.1 (5.0)
Luepker 1996	I1: school food service modifications, PE interventions, and Child and Adolescent Trial for Cardiovascular Health curricula	1991 to 1994	69 White 13 African American 14 Hispanic 4 other	48	8.8	17.6 (0.1)
	I2: I1 plus a family-based programme					
	C: usual health curricula, PE, and food service programmes		—			17.6 (0.1)

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Bush 1989	I1: 'Know Your Body' curriculum focusing on nutrition, fitness, prevention of smoking, a personalised health screening, and results on a 'health passport' for parents	1983 to 1988	"Predominantly black"	54	10.5	14.3
	I2: 'Know Your Body' curriculum and health screening, but students do not receive the results of their screening; only parents receive the results					
	C: health screening only					14
Walter 1988	I: special curriculum targeting voluntary changes in risk behaviour in the areas of diet, PA, and smoking	1980 to 1985	Bronx: 32 White 43 Black 25 other Westchester: 90 White 3 Black 7 other	Bronx: 49 Westchester: 46	Bronx: 9.0 Westchester: 8.9	Bronx: 11.8 (0.3) Westchester: 11.3 (0.3)
	C: —		Bronx: 29 White 49 Black 22 other Westchester: 79 White 15 Black 6 other	Bronx: 46 Westchester: 53	Bronx: 9 Westchester: 8.9	Bronx: 11.8 (0.3) Westchester: 11.9 (0.3)

Appendix 3. Definition of endpoint measurement

Trial ID	Physical Activity
Belton 2019	Actigraph accelerometer worn on the hip during all waking hours for 9 days; analysed using Evenson cut points for MVPA; reported in minutes/d
Corepal 2019	ActiGraph GT3X/+ accelerometers were worn for a minimum of 8 hours/d for at least 3 days. Activity counts were recorded using 1 second epochs, and were reintegrated in 60 second epochs before Evenson cut points were applied
Jago 2019	ActiGraph wGT3X-BT accelerometers worn for 7 consecutive days. Students who provided ≥ 3 valid days (500 minutes) of data were included in the analysis. MVPA was estimated using Evenson cut points. Total physical activity was derived from counts per minute
Lonsdale 2019a	ActiGraph accelerometers attached at the right hip worn for 5 weekdays and 2 weekend days. Accelerometers assessed students' moderate (38.26-66.85 counts) and vigorous (> 66.86 counts) intensity during leisure time
Seljebotn 2019	Actigraph accelerometers were worn on the right hip for 7 days during all waking time. Data were collected in 10 second epochs, and MVPA was calculated using Evenson cut points

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Zhou 2019	Actigraph GT3X+ on the right hip during waking hours for 7 consecutive days. Accelerometry data reduction followed procedures developed for Chinese children
Adab 2018	Actiheart accelerometer worn consecutively for 5 days, including a weekend. MVPA recorded as minutes/24 h of at least moderate intensity
Harrington 2018	A GENEActiv accelerometer was worn 24 hours/d for 7 days on their non-dominant wrist at all time points. Devices were initialised with a sampling frequency of 100 Hz and were set to start recording at midnight on the first day of data collection and to stop recording at midnight 7 days later. Hildebrand cut points were used to estimate MVPA
Have 2018	Total daily PA were assessed using accelerometer (ActiGraph, GT3X and GT3X+, ActiGraph LLC, Pensacola, FL, USA). PA data were collected for 8 days, with a valid measurement of total PA defined as a minimum of 4 days with at least 10 hours of recorded activity each day. Total PA was expressed as mean counts per minute and as mean daily minutes in moderate to vigorous physical activity defined using Evenson cut points
Robbins 2018	ActiGraph GT3X+ accelerometers worn on an elastic belt at the right hip for 7 consecutive days, including 5 weekdays and 2 weekend days. An imputation approach based on all available data in hour blocks on all 7 days was implemented and wear time was standardised to 14 hours per day
Ten Hoor 2018	Measured using accelerometer (Actigraph GT3x, Actigraph, Pensacola, FL, USA) worn on the lower back for 5 consecutive days during all waking hours. Actilife software (v6.13.3) was used to generate activity counts per minute. Only students who had worn the accelerometer at least 8 hours per day during waking hours (i.e. time awake and time to bed) for a minimum of 3 days were included in the analyses. MVPA cut points were determined as proposed by Mattocks and colleagues
Farmer 2017	All children wore an accelerometer (ActiGraph GT3X, Actigraph Corp, Pensacola, FL, USA) 24 hours a day for 7 days, positioned over the right hip. Accelerometers were initialised using ActiLife in uniaxial mode using 15 second epochs. Data were cleaned and scored using an automated script developed in MATLAB (MathWorks, Natick, MA, USA) that removes the appropriate sleep period for each day for each child individually, to avoid sleep being misclassified as sedentary time. A day was considered valid if there were at least 8 valid awake hours. Non-wear time (awake hours only) was defined as at least 20 minutes of consecutive zeros. Participants were excluded from analysis if less than 3 valid days of wear was obtained. Activity intensities were calculated using the Evenson cut points developed for children aged 5 to 8 years
Sutherland 2017	Accelerometers were used with non-wear time defined as 30 minutes of consecutive zeros. Counts were collected in 15-second epochs. The Evenson cut points were used to categorise the intensity of PA (moderate or vigorous)
Daly 2016	PA was measured by accelerometers (Actigraph GT1M, Pensacola, FL, USA) worn simultaneously, positioned on a belt around the waist. MVPA was defined as counts > 2296 per minute
Drummy 2016	Physical activity was measured using an Actigraph accelerometer (GT1M, Actigraph LLC, Pensacole, FL, USA) set to 5 second epochs. Children were asked to wear accelerometers over a 7-day period (5 weekdays and 2 weekend days), only to be removed when sleeping, bathing, swimming, and showering
Kocken 2016	MVPA was measured using a 1-dimensional accelerometer; the ActiGraph. Counts per minute were collected every 15 seconds. The Actigraph was worn on the child's right hip during at least 3 days and was removed when water was involved and during sleeping time
Lau 2016	MVPA was measured using the ActiGraph GT3X+ accelerometer for 7 continuous days. Non-wear time was determined as zero accelerometer counts for any continuous period of 20 minutes. Wear-time validation criterion was set at least 480 minutes/d for 4 days during the 7 assessment days. Cut points for MVPA (> 2296 counts per minute) developed by Evenson were applied to calculate MVPA time

(Continued)

Resaland 2016	Physical activity was measured by ActiGraph accelerometers (ActiGraph GT3X+, LLC, Pensacola, Florida, USA). Children were instructed to wear the accelerometer on the right hip at all times over 7 consecutive days, except during water-based activities or while sleeping. Wear time ≥ 480 minutes/day for ≥ 4 days was applied as a criterion for a valid measurement. Periods ≥ 20 minutes of zero counts were defined as non-wear time. Evenson cut points for MVPA were used (2296 counts per minute)
Sutherland 2016	Accelerometer non-wear time was defined as 30 minutes of consecutive zeroes. Counts were collected in 15-second epochs and counts per minute calculated by dividing total accelerometer counts by minutes of wear time. The Evenson cut points were used to categorise the intensity of physical activity (moderate or vigorous)
Tarp 2016	Physical activity levels were assessed by accelerometer (GT3X and GT3X+ devices by ActiGraph LLC, Pensacola, FL, USA). Devices were worn on the right hip every day during a 7-day period. The epoch was set to 2 seconds, but files were downloaded in 10 second epochs. A sequence of more than 30 minutes of consecutive zeroes was considered non-wear time and was not included in analyses. To be included, students had to obtain a minimum of 4 days with at least 10 hours of valid registration at both time points. Evenson cut points were used to calculate time spent in MVPA
Cohen 2015	ActiGraph GT3Xþ accelerometers (ActiGraph, LLC, Fort Walton Beach, FL) were used. Children were required to wear accelerometers during waking hours for 7 consecutive days, except while bathing and swimming. Data were collected and stored in 10 second epochs with a frequency of 30 Hz. Valid wear time for total physical activity was defined as a minimum of 3 weekdays and a weekend day with at least 8 hours (480 minutes/d) of total wear time recorded. Non-wear time was defined as strings of consecutive zeroes equating to 20 minutes. Evenson cut points were used to calculate time spent in sedentary (< 25 counts), light (26 to 573 counts), moderate (574 to 1002 counts), and vigorous (> 1003 counts) activity
Jago 2015	MVPA was assessed using an Actigraph GT3X+ accelerometer for 7 days. A valid day of accelerometer data was defined as a minimum of 500 minutes of data between 05:00 and 11.59 PM. Periods > 60 minutes in which zero values were recorded were interpreted as 'non-wear' time. For valid days, mean minutes engaged in MVPA (≥ 2296 counts per minute) were derived
Andrade 2014	Physical activity was assessed using accelerometers (type GT-256 and GT1M Actigraph, Florida USA) in a sub-sample of adolescents selected using a random number. A syntax in Stata was used for data reduction and to compute registered time, and time spent in moderate to vigorous physical activity (≥ 760 counts/min). Accelerometers were worn for 5 weekdays and measurements were excluded with less than 540 minutes of registered time per day. The proportion of adolescents who met the recommended 60 minutes of MVPA per day was calculated
Jago 2014	Physical activity was assessed using an ActiGraph accelerometer (Model GT3X+; ActiGraph LLC, FL, USA) set to collect data at 30 Hz for a maximum of 5 days including a weekend day. Periods ≥ 60 minutes of zero values were defined as accelerometer "non-wear". Participants were included if they provided at least 2 weekdays of valid accelerometer data (at least 500 minutes of data between 6 am and 11 pm). Mean minutes of MVPA on a weekday was derived using a cut point ≥ 2296 counts per minute
Kipping 2014	The ActiGraph GT3X+ accelerometers were used for 5 days of data collection (3 weekdays and 2 weekend days) during the day (except when bathing, swimming, or participating in contact sports such as karate). Time spent in MVPA was any time spent in activities that were at least 2296 counts per minute
Kobel 2014	Objective measurements of physical activity were performed using the Actiheart® activity sensor continuously over a period of at least 4 to 6 successive days (2 weekend days and 2 to 4 weekdays)
Fairclough 2013	Physical activity was objectively assessed for 7 consecutive days using ActiGraph GT1M accelerometers and 5 second epochs. Sustained 20 minute periods of zero counts were considered non-wear time. Valid wear time was at least 540 minutes on weekdays and 480 minutes on weekend days for

(Continued)

	a minimum of 3 days. Cut points ≥ 2160 counts per minutes and ≥ 4806 counts per minute classified moderate and vigorous intensity physical activity
Ford 2013	Physical activity levels were quantified using MTI accelerometers (Manufacturing Technologies Inc., Shalimar, FL) using a 1 minute epoch setting
Grydeland 2013	Children wore accelerometers (GT1M/CSA model 7164; ActiGraph, Fort Walton Beach, FL, USA) for 5 consecutive days and were instructed to wear the monitor continuously all awake hours except when doing water activities. Output was sampled every 10 seconds for 2 weekdays and 2 weekend days with valid wear time set at a minimum of 3 days and at least for 8 hours each day
Magnusson 2011	Accelerometers (Actigraph™ GT1M monitors) were worn during waking hours for 7 consecutive days - 5 weekdays and 2 weekend days - at a sampling epoch of 60 seconds. MVPA was defined as activity above 2000 CPM
Okely 2011	Participants wore an Actigraph accelerometer (7164 and GT1M models; Fort Walton Beach, FL) for 7 consecutive days attached to an adjustable elastic belt over the right hip. Data were collected in 30 second epochs. Thirty-second activity counts were uploaded to determine the amount of time spent in light (LPA; 1.5-2.9 METs) moderate (MPA; 4-6.9 METs), and vigorous (VPA; ≥ 7 METs) physical activity
Wilson 2011	Assessments of MVPA were obtained with omni-directional Actical accelerometers (Mini-Mitter, Bend, OR) over 7 consecutive days. Data were recorded in 1 minute epochs and were converted into time spent MVPA (3 to 9 METS) based on Actical-specific activity count thresholds where MVPA = 1500 to 6500 and VPA ≥ 6500
Kriemler 2010	PA was monitored with an accelerometer, which was worn continuously around the hip for 5 weekdays - at baseline and at the end of the intervention
Donnelly 2009	Accelerometers were worn over 4 consecutive days, which included 2 weekdays and 2 weekend days
Peralta 2009	Weekday MVPA (minutes/d). PA was measured over 7 consecutive days using MTI 7164 Actigraph accelerometers worn on belts at the right hip. Average minutes of moderate (MPA), vigorous (VPA), and MVPA were calculated using a composite method
Salmon 2008	PA was assessed using Manufacturing Technology Inc. AM7164-2.2C accelerometers. Children wore the MTI on a belt positioned over the right hip during waking hours, except when bathing or swimming, for 8 days at each of the 4 measurement points
Webber 2008	MET-weighted minutes of MVPA using accelerometers worn for 7 consecutive days except while bathing, swimming, or sleeping
Haerens 2006	Children wore the accelerometer for 6 days above the right hip bone, underneath the clothes. Accelerometers were set to measure activity counts in an epoch time of 1 minute. Cut points > 3200 moderate to vigorous minutes were used
Trial ID	**Sedentary time**
Corepal 2019	ActiGraph GT3X/+ accelerometers were worn for a minimum of 8 hours/d for at least 3 days. Activity counts were recorded using 1 second epochs and reintegrated to 60 second epochs before Evenson cut points were applied
Jago 2019	ActiGraph wGT3X-BT accelerometers worn for 7 consecutive days. Students who provided ≥ 3 valid days (500 minutes) of data were included in the analysis. Sedentary time was derived based on a cut point < 100 CPM

(Continued)

Lonsdale 2019a	ActiGraph accelerometers attached at the right hip worn for 5 weekdays and 2 weekend days. Accelerometers assessed students' sedentary behaviour (< 1.67 counts per 1 second) during leisure time
Seljebotn 2019	Actigraph accelerometers were worn on the right hip for 7 days during all waking time. Data were collected in 10 second epochs, and sedentary time was calculated using Evenson cut points
Zhou 2019	Actigraph GT3X+ accelerometer was worn on the right hip during waking hours for 7 consecutive days. Data reduction followed procedures developed for Chinese children
Adab 2018	Actiheart accelerometer worn consecutively for 5 days, including a weekend. Sedentary time reported in hours/d
Harrington 2018	A GENEActiv accelerometer was worn 24 hours/d for 7 days on the non-dominant wrist at all time points. Devices were initialised with a sampling frequency of 100 Hz and were set to start recording at midnight on the first day of data collection and to stop recording at midnight 7 days later. Hildebrand cut points were used to estimate sedentary time
Ten Hoor 2018	Measured using accelerometer (Actigraph GT3x, Actigraph, Pensacola, FL, USA) worn on the lower back for 5 consecutive days during all waking hours. Actilife software (v6.13.3) was used to generate activity counts per minute. Only students who had worn the accelerometer at least 8 hours per day during waking hours (i.e. time awake and time to bed) for a minimum of 3 days were included in the analyses. Sedentary time cut points were determined as proposed by Mattocks and colleagues, and were reported as % of time spent sedentary
Daly 2016	PA was measured by accelerometers (Actigraph GT1M, Pensacola, FL, USA) worn simultaneously, positioned on a belt around the waist. Sedentary activity was defined as < 100 counts per minute
Kocken 2016	Sedentary time was measured using a 1-dimensional accelerometer; the ActiGraph. Counts per minute were collected every 15 seconds. The Actigraph was worn on the child's right hip during at least 3 days and the ActiGraph was removed when water was involved and during sleeping time
Resaland 2016	Sedentary time was measured by ActiGraph accelerometers (ActiGraph GT3X+, LLC, Pensacola, Florida, USA). Children were instructed to wear the accelerometer on the right hip at all times over 7 consecutive days, except during water-based activities or while sleeping. Wear time ≥ 480 minutes/d for ≥ 4 days was applied as a criterion for a valid measurement. Periods ≥ 20 minutes of zero counts were defined as non-wear time. Evenson cut points for sedentary time (0 to 100 counts per minute) were used
Jago 2015	Sedentary time was assessed using an Actigraph GT3X+ accelerometer worn for 7 days. A valid day of accelerometer data was defined as a minimum of 500 minutes of data between 05:00 and 11.59 pm. Periods > 60 minutes in which zero values were recorded were interpreted as 'non-wear' time. Sedentary cut points used were not reported
Andrade 2014	Sedentary time was assessed using accelerometers (type GT-256 and GT1M Actigraph, Florida USA) in a sub-sample of adolescents selected using a random number. A syntax in Stata was used for data reduction and to compute registered time and time spent in sedentary activity (≤ 100 counts/min). Accelerometers were worn for 5 weekdays and measurements were excluded with less than 540 minutes of registered time per day
Kipping 2014	The ActiGraph GT3X+ accelerometers were used for 5 days of data collection (3 weekdays and 2 weekend days) during the day (except when bathing, swimming, or participating in contact sports such as karate). Time spent sedentary was time spent in activities between 0 and 100 counts per minute
Toftager 2014	Accelerometers were worn during all waking hours for 7 consecutive days except when doing water activities. Strings of 60 minutes or longer of consecutive zeroes, allowing for 2 epoch periods of non-zero interruptions, were interpreted to represent non-wear time. Valid data were at least 3

(Continued)

	days with at least 10 hours (600 minutes) of activity per day. Evenson activity cut points were used to calculate sedentary time (> 100 CPM) expressed as minutes per day
Fairclough 2013	Sedentary time was objectively assessed for 7 consecutive days using ActiGraph GT1M accelerometers and 5 second epochs. Sustained 20 minute periods of zero counts were considered non-wear time. Valid wear time was at least 540 minutes on weekays and 480 minutes on weekend days for a minimum of 3 days. Cut points of 100 counts per minute were classified as sedentary time
Grydeland 2013	Children wore accelerometers (GT1M/CSA model 7164; ActiGraph, Fort Walton Beach, FL, USA) for 5 consecutive days and were instructed to wear the monitor continuously all awake hours except when doing water activities. Output was sampled every 10 seconds for 2 weekdays and 2 weekend days with valid wear time set at a minimum of 3 days and for at least 8 hours each day
Okely 2011	Participants wore an Actigraph accelerometer (7164 and GT1M models; Fort Walton Beach, FL) for 7 consecutive days attached to an adjustable elastic belt over the right hip. Data were collected in 30 second epochs. Thirty second activity counts were uploaded to determine the amount of time spent in sedentary activity
Webber 2008	Minutes of sedentary time using accelerometers worn for 7 consecutive days except while bathing, swimming, or sleeping
Haerens 2006	Children wore the accelerometer for 6 days above the right hip bone, underneath the clothes. Accelerometers were set to measure activity counts in an epoch time of 1 minute. Cut points < 800 were used for sedentary time
Trial ID	**Physical fitness**
Breheny 2020	British Athletics Linear Track Test, children encouraged to run as far as they could in 2 minutes on a pre-measured 50 metre linear track
Ketelhut 2020	6-minute run test
Leahy 2019	20 metre PACER shuttle run test. The last successful stage was recorded and was converted into the number of 20 metre laps
Müller 2019	20 metre shuttle run test, adhering to a standard test protocol. Most schoolchildren wore school or street shoes, and some ran barefoot. The number of fully completed laps was recorded and was converted to VO2max values, according to a standard protocol
Ordóñez Dios 2019	Cardiorespiratory capacity was evaluated using a 1 km test
Seibert 2019	PACER 20 metre shuttle run test, terminated when the participant fails to complete the 20 metre run in the allotted time twice. PACER score expressed in number of laps completed and converted to a z-score for age and sex
Seljebotn 2019	Aerobic fitness was assessed by the Andersen test, a 10-minute interval running test. Results are expressed as distance run in 10 minutes on a 20 metre course
Zhou 2019	20 metre shuttle-run test was used to assess cardiorespiratory fitness
Carlin 2018	Queens College Step Test was used; participants wore a heart rate monitor during the step test, with heart rate recorded at baseline, and at 10 seconds, 15 seconds, and 20 seconds following completion of the step test and was used to estimate VO2max as mL/kg/min
Have 2018	Aerobic fitness was assessed using the Andersen test. Children were instructed to run as far as possible in 10 minutes back and forth between 2 lines 20 metres apart. The test score was total distance in metres run by each child

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Pablos 2018	20 metre shuttle-run test was used to determine the maximal oxygen consumption (VO2max). Indirect incremental multi-stage field test over a distance of 20 metres to exhaustion using the pace set by a CD emitting beep signals at preset intervals. The initial speed was set at 8.5 km/hr for the first minute and was increased by 0.5 km/hr each subsequent minute
Robbins 2018	The Progressive Aerobic CV Endurance Run (PACER) test, a 15 or 20 metre shuttle run was used. Participants ran from 1 line to another on a flat surface, according to audio cues, which increase in pace until participants can no longer complete laps in the time allotted. The number of laps completed is converted to estimated VO2 for analysis
Donnelly 2017	The Progressive Aerobic Cardiovascular Endurance Run (PACER) by Leger was used. Participants ran a 20 metre shuttle course with 1 minute stages, paced by an audible beep. The number of laps completed constituted the PACER score
Torbeyns 2017	The 20 metre shuttle run test involved running continuously between 2 points that are 20 metres apart from side to side. These runs are synchronised with a prerecorded CD, which beeps at set intervals. As the test proceeds, intervals between successive beeps decrease, forcing the athlete to increase speed over the course of the test, until it is impossible to keep in sync with the recording (or, on extremely rare occasions, until the athlete completes the test). The recording is structured into 21 'levels', each of which lasts around 62 seconds. The interval of beeps is calculated as requiring speed at the start of 8.5 km/hr, increasing by 0.5 km/hr with each level thereafter. The highest level reached was used as the outcome measure
de Greeff 2016	20 metre shuttle run, cardiorespiratory endurance, in number of completed stages from the EUROFIT fitness battery
Jarani 2016	The Andersen intermittent shuttle run test was used to estimate maximal oxygen uptake. Children had to run as fast as they could to cover the longest possible distance during the 10 minute test run, and this distance was the test result. To estimate child's VO2max, the equation: VO2max = 18.38 + (0.03301 × distance) – (5.92 × sex) [(boys = 0; girls = 1)] was used
Lau 2016	Assessed using the Progressive Aerobic Cardiovascular Endurance Run 20 metre shuttle run performance test by Leger. The number of laps completed for all participants was recorded and maximal shuttle run speed was calculated accordingly. Aerobic fitness was estimated using the most current cross-validated regression model for predicting VO2max
Resaland 2016	Aerobic fitness was measured with an Andersen intermittent practical running field test administered according to standard procedures: Children ran from one end line to another (20 metres apart) in an intermittent to-and-fro movement, with 15 second work periods and 15 second breaks (standing still), for a total duration of 10 minutes. We recorded the distance covered as the outcome for the analysis. To enable comparing of aerobic fitness level across studies, VO2peak was calculated using the equation suggested by Aadland
Tarp 2016	Cardiorespiratory fitness was assessed by the Andersen test, a 10-minute intermittent running test with total distance in metres used as the test result
Cohen 2015	Cardiorespiratory fitness was assessed using the Leger 20 metre multi-stage fitness test. Participants were required to run back and forth between 2 lines over a 20 metre distance within a set time limit. Running speed started at 8.5 km/hr and increased by 0.5 km/hr each minute. The test was completed when a participant failed to reach the line for 2 consecutive shuttles. Scores were recorded as the level and shuttle reached, which was converted to the number of 20 metre laps completed
Madsen 2015	Participants completed the 1 mile run as a measure of cardiorespiratory fitness, with results presented as minutes to completion
Muros 2015	Maximal oxygen uptake (VO2max) was estimated using a 20 metre incremental-maximum shuttle run field test, employing the equation proposed by Ruiz. The shuttle run test involves running to and from between 2 lines placed 20 metres apart. Participants start at an initial velocity of 8.5 kph

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	and increase their speed by 0.5 kph for every 20 metres covered as indicated by an audio recording played on a validated CD-ROM. The test concludes when the subject is unable to reach the line on 2 consecutive occasions at the speed demanded by the audio recording
Suchert 2015	The 20 metre shuttle run test (by Leger et al) was used. In this field test, participants run back and forth at a distance of 20 metres in a given time interval indicated by pre-recorded audio signals. The required running pace starts with 8.0 km/hr and continuously increases by 0.5 km/hr each minute. The test stops either when students abandon by themselves or when they fail to reach the line by the sound for the second time. The total number of completed laps was used for statistical analyses. In addition, maximal oxygen consumption (VO2max) was estimated using the quadratic model by Mahar
Andrade 2014	The EUROFIT test battery was used to assess cardiorespiratory endurance via the 20 metre shuttle run test
Nogueira 2014	The 20 metre shuttle run test (aka, the beep test) was used and VO2max was estimated according to the velocity associated with the level reached by the participant, by using the algorithm VO2max = 31.025 + (3.238 × velocity) − (3.248 × age) + (0.1536 × age × velocity). Participants ran on an indoor surface between 2 points marked on the ground 20 metres apart; once the participant was unable to meet the required speed on successive laps, the level achieved was recorded, and associated velocity was entered into the algorithm along with age
Toftager 2014	Aerobic fitness was measured using the Andersen test (20 metre shuttle run) expressed as metres completed
Fairclough 2013	VO2peak was assessed using an individually calibrated continuous incremental treadmill (H/P/Cosmos, Traunstein, Germany) test to volitional exhaustion, under ambient conditions, using an online gas analysis system (Jaeger Oxycon Pro; Viasys Healthcare, Warwick, UK)
Aburto 2011	Participants ran around a calibrated track for 9 minutes, and the distance travelled was recorded in metres
Ardoy 2011	A 20 yard or metre shuttle run was used to assess cardiorespiratory fitness
de Heer 2011	The Progressive Aerobic Cardiovascular Endurance Run (PACER) test requires participants to run up and down a 20 metre court. At each side of the court, a beep sounds to signal the student to turn around and run back. The test increases in speed every minute and is completed when a student fails to reach the other side in time for the signal for the second time. Total number of laps completed was reported
Jago 2011	Fitness was assessed by the 20 metre shuttle test (20 metre) using standard procedures by Leger
Jansen 2011	Fitness was measured using the 20 metre shuttle run following the EUROFIT protocol
Magnusson 2011	Cardiorespiratory fitness (W/kg) was measured with a Monark ergometer bike using the study protocol from the European Youth Heart study. This maximal ergometer test is run such that every 3 minutes, the weight on the wheel is increased by 20 to 25 W, depending on the participant's weight. Each participant keeps a steady pace on the bike until exhaustion, or until he or she can no longer keep a steady pace
Thivel 2011	The 20 metre shuttle run test developed by Léger was used. Children were instructed to run as long as possible between 2 lines 20 metres apart at an increasing speed imposed by emitted tones at intervals. The speed began at 8 km/hr and increased by 0.5 km/hr every minute. As soon as a child was not able to complete a whole stage, the test was stopped; the child's score corresponded to the last fully completed stage
Kriemler 2010	The Leger 20 metre shuttle run test was used, with results reported as number of laps completed

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Walther 2009	All participants underwent a graded treadmill test with spirometry until exhaustion, according to a modified Bruce protocol for children starting at 1.7 mph and 0 degrees
Reed 2008	Leger's 20 metre incremental shuttle run was used, which was designed for children and provides age and sex reference normative data. Children ran 20 metre laps at 8.5 km/hr^{-1}. Running speed then increased by 0.5 km hr^{-1} each minute. Children continued running until they could no longer maintain preset and standardised pace. Total laps were recorded
Wang 2008	Biological measurements were made in a mobile laboratory that was brought to the school sites. Fitness level was assessed by HR at completion of the bench-stepping test. Low HR at the end of 3 minutes of stepping indicates better CVF
Barbeau 2007	Oxygen consumption (VO_2) was measured using a Sensormedics Vmax 229 cardiopulmonary system (Yorba Linda, CA). The treadmill protocol began with a 4 minute warm-up at 0% grade and 2.0 mph. The speed was then increased by 0.5 mph every 2 minutes until reaching 3.0 mph, at which time the grade increased to 2% for 2 minutes, then increased an additional 3% every 2 minutes until reaching 20% grade or exhaustion
Bayne-Smith 2004	Measured fitness level as recovery from Queens College step test. Subjects stepped up and down a step for 3 minutes at 22 steps per minute. HRs were counted for 15 seconds beginning 5 seconds after stepping ended
Trevino 2004	Outcome was measured as physical fitness score using a modified Harvard step test. Baseline HR was recorded. Child then stepped on and off a stool with both feet for 5 minutes. The student was paced at 30 cycles per minute. A physical fitness score was calculated from the total time of exercise (in seconds) multiplied by 100 and was divided by the sum of 3 HR values measured at 0, 1, and 2 minutes after exercise
Burke 1998	Physical fitness was measured by laps completed in the Leger Shuttle Run, in which children ran 20 metre laps in time to a tape recording of beeps at a predetermined pace, continuing until they were unable to keep pace with the recording

Appendix 4. 'Risk of bias' assessment

'Risk of bias' domains

Random sequence generation (selection bias due to inadequate generation of a randomised sequence)

For each included trial, we described the method used to generate the allocation sequence in sufficient detail to allow an assessment of whether it should produce comparable groups.

- Low risk of bias: trial authors achieved sequence generation using computer-generated random numbers or a random numbers table. Drawing lots, tossing a coin, shuffling cards or envelopes, and throwing dice are adequate if an independent person performed this who was not otherwise involved in the trial. We will consider use of the minimisation technique as equivalent to being random
- Unclear risk of bias: insufficient information about the sequence generation process
- High risk of bias: the sequence generation method was non-random or quasi-random (e.g. sequence generated by odd or even date of birth; sequence generated by some rule based on date (or day) of admission; sequence generated by some rule based on hospital or clinic record number; allocation by judgment of the clinician; allocation by preference of the participant; allocation based on the results of a laboratory test or a series of tests; or allocation by availability of the intervention)

Allocation concealment (selection bias due to inadequate concealment of allocation prior to assignment)

We described for each included trial the method used to conceal allocation to interventions prior to assignment, and we assessed whether intervention allocation could have been foreseen in advance of or during recruitment or changed after assignment.

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- Low risk of bias: central allocation (including telephone, interactive voice-recorder, Internet-based and pharmacy-controlled randomisation); sequentially numbered drug containers of identical appearance; sequentially numbered, opaque, sealed envelopes
- Unclear risk of bias: insufficient information about allocation concealment
- High risk of bias: open random allocation schedule (e.g. a list of random numbers) used; assignment envelopes used without appropriate safeguards; alternation or rotation; date of birth; case record number; any other explicitly unconcealed procedure

We also evaluated trial baseline data to incorporate assessment of baseline imbalance into the 'Risk of bias' judgement for selection bias (Corbett 2014). Chance imbalances may also affect judgements on risk of attrition bias. In the case of unadjusted analyses, we distinguished between trials that we rated as being at low risk of bias on the basis of both randomisation methods and baseline similarity, and trials that we judged as being at low risk of bias on the basis of baseline similarity alone (Corbett 2014). We re-classified judgements of unclear, low, or high risk of selection bias as specified in Appendix 4.

Blinding of participants and study personnel (performance bias due to knowledge of allocated interventions by participants and personnel during the trial)

- Low risk of bias: blinding of participants and key study personnel was ensured, and it was unlikely that the blinding could have been broken; no blinding or incomplete blinding, but we judge that the outcome is unlikely to have been influenced by lack of blinding
- Unclear risk of bias: insufficient information about blinding of participants and study personnel
- High risk of bias: no blinding or incomplete blinding; outcome is likely to have been influenced by lack of blinding; blinding of trial participants and key personnel attempted, but likely that blinding could have been broken, and the outcome is likely to be influenced by lack of blinding

Blinding of outcome assessment (detection bias due to knowledge of allocated interventions by outcome assessment)

- Low risk of bias: blinding of outcome assessment is ensured, and it was unlikely that blinding could have been broken; no blinding of outcome assessment, but we judge that the outcome measurement was unlikely to have been influenced by lack of blinding
- Unclear risk of bias: insufficient information about blinding of outcome assessors
- High risk of bias: no blinding of outcome assessment, and outcome measurement was likely to have been influenced by lack of blinding; blinding of outcome assessment, but likely that blinding could have been broken, and the outcome measurement was likely to be influenced by lack of blinding

Incomplete outcome data (attrition bias due to quantity, nature, or handling of incomplete outcome data)

For each included trial or each outcome, or both, we described the completeness of data, including attrition and exclusions from analyses. We stated whether the trial reported attrition and exclusions, and we reported the number of participants included in the analysis at each stage (compared with the number of randomised participants per intervention/comparator groups). We also noted if the trial reported reasons for attrition or exclusion, and whether missing data were balanced across groups or were related to outcomes. We considered the implications of missing outcome data per outcome such as high dropout rates (e.g. above 15%) or disparate attrition rates (e.g. difference of 10% or more between trial arms).

- Low risk of bias: no missing outcome data; reasons for missing outcome data unlikely to be related to true outcomes (for survival data, censoring unlikely to introduce bias); missing outcome data balanced in numbers across intervention groups, with similar reasons for missing data across groups; for dichotomous outcome data, the proportion of missing outcomes compared with observed event risk was not enough to have a clinically relevant impact on the intervention effect estimate; for continuous outcome data, plausible effect size (mean difference or standardised mean difference) among missing outcomes was not enough to have a clinically relevant impact on observed effect size; appropriate methods, such as multiple imputations, were used to handle missing data
- Unclear risk of bias: insufficient information to assess whether missing data in combination with the method used to handle missing data were likely to induce bias
- High risk of bias: reason for missing outcome data was likely to be related to true outcome, with either imbalance in numbers or reasons for missing data across intervention groups; for dichotomous outcome data, the proportion of missing outcomes compared with observed event risk enough to induce clinically relevant bias in the intervention effect estimate; for continuous outcome data, plausible effect size (mean difference or standardised mean difference) among missing outcomes enough to induce clinically relevant bias in observed effect size; 'as-treated' or similar analysis done with substantial departure of the intervention received from that assigned at randomisation; potentially inappropriate application of simple imputation

Selective reporting (reporting bias due to selective outcome reporting)

We assessed outcome reporting bias by integrating results of the appendix 'Matrix of trial endpoints (publications and trial documents)' (Boutron 2014; Jones 2015a; Mathieu 2009), with those of the appendix 'High risk of outcome reporting bias according to the Outcome Reporting Bias In Trials (ORBIT) classification' (Kirkham 2010). This analysis formed the basis for the judgement of selective reporting.

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- Low risk of bias: the trial protocol was available and all the trial's pre-specified (primary and secondary) outcomes that were of interest to this review were reported in the pre-specified way; the study protocol was unavailable, but it is clear that published reports included all expected outcomes (ORBIT classification)
- Unclear risk of bias: insufficient information about selective reporting
- High risk of bias: not all the trial's pre-specified primary outcomes were reported; 1 or more primary outcomes were reported using measurements, analysis methods, or subsets of the data (e.g. sub-scales) that were not pre-specified; 1 or more reported primary outcomes were not pre-specified (unless clear justification for their reporting was provided, such as an unexpected adverse effect); 1 or more outcomes of interest in the Cochrane Review were reported incompletely, so that we could not enter them into a meta-analysis; the trial report failed to include results for a key outcome that we would expect to have been reported for such a trial (ORBIT classification)

Specific to cluster-RCTs: recruitment bias

For all cluster-RCTs, we assessed recruitment bias by assessing whether individual participants were recruited to the trial, and individual-level data were collected before or after clusters were randomised to an intervention or control group. This served as the basis for judgement of recruitment bias. Although the unit of randomisation is the cluster, bias could be introduced if individual participants knew whether the school or the classroom would receive the intervention or control condition prior to deciding whether or not to join the study.

- Low risk of bias: investigators describe a procedure in which all participants were recruited and data were collected before randomising clusters to intervention or control groups, or if individual participants were not recruited at all but were identified prior to randomisation
- Unclear risk of bias: insufficient information about the process to permit judgement
- High risk of bias: clusters were randomised before recruitment to the trial was complete, and knowledge of whether each cluster was an ‘intervention’ or ‘control’ cluster could affect types of participants recruited

Specific to cluster-RCTs: baseline imbalance

Often in cluster-randomised trials, individuals within a cluster are more similar than participants across clusters. Particularly when the number of clusters randomised is small, there may be differences in baseline characteristics across study groups even if randomisation was successful.

- Low risk of bias: investigators explored baseline imbalances and report that no imbalance was found or properly adjusted for any baseline balance in the analysis
- Unclear risk of bias: investigators did not explore baseline imbalances, or it Is unclear whether any baseline imbalances exist
- High risk of bias: baseline imbalances were observed between study groups and were not accounted for in the analysis

Specific to cluster-RCTs: loss of clusters

- Low risk of bias: no individual outcomes or clusters of missing data; reasons for clusters or outcomes missing unlikely to be related to intervention (for survival data, censoring unlikely to be introducing bias); missing outcome data balanced in numbers across clusters, with similar reasons for missing data across clusters; for dichotomous outcome data, the proportion of missing outcomes compared with observed event risk was not enough to have a clinically relevant impact on the intervention effect estimate; for continuous outcome data, plausible effect size (difference in means or standardised difference in means) among missing outcomes not enough to have a clinically relevant impact on observed effect size; missing data have been imputed using appropriate methods
- Unclear risk of bias: insufficient reporting of attrition/exclusions to permit judgement (e.g. number randomised not stated, no reason for missing data provided)
- High risk of bias: reason for missing outcome data likely to be related to true outcome, with either imbalance in numbers or reasons for missing data across intervention groups; for dichotomous outcome data, the proportion of missing outcomes compared with observed event risk enough to induce clinically relevant bias in intervention effect estimate; for continuous outcome data, plausible effect size (difference in means or standardised difference in means) among missing outcomes enough to induce clinically relevant bias in observed effect size; 'as-treated' analysis done with substantial departure of interventions received from that assigned at randomisation; potentially inappropriate application of simple imputation

Specific to cluster-RCTs: incorrect analysis

Because participants in any cluster are often more similar than participants across clusters and tend to respond to an intervention in a similar manner, their data cannot be assumed to be independent. Failing to account for this is often referred to as 'unit-of-analysis error' because the unit of analysis is different from the unit of allocation (Whiting-O'Keefe 1984), and many cluster-randomised trials have been incorrectly analysed in this manner (Eldridge 2008).

- Low risk of bias: investigators clearly describe consideration of the clustered nature of the data in their statistical analysis

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- Unclear risk of bias: insufficient reporting of statistical analysis procedures to permit judgement
- High risk of bias: data are analysed with the unit of analysis at the individual level, and investigators do not consider the clustered nature of data in the analysis

Appendix 5. Health-related quality of life: instruments

Instrument	Dimensions (sub-scales) (no. of items)	Validated instrument	Answer options	Scores	Minimum score Maximum score	Weighting of scores	Direction of scales	Minimal important difference
Strengths and Difficulties Questionnaire Employed in (Leahy 2019)	• Prosocial behavior (5) • Emotional symptoms (5) • Conduct problems (5) • Hyperactivity (5) • Peer problems (5)	Yes (Goodman 1998 and Goodman 2001)	3-point scale	Item scores range from 0 to 2 Scale scores range from 0 to 10	0 to 40	—	Higher scores indicate more psychological difficulties	—
Perceived Stress Scale Employed in (Leahy 2019)	10 items	Yes (Cohen 1983 and Chan 2013)	5-point scale	Item scores range from 0 to 4	0 to 40	—	Higher scores indicate a greater degree of subjective stress experienced by participants	—
KIDSCREEN **KIDSCREEN-10** Employed in (Jago 2019) **KIDSCREEN-27** Employed in Resaland 2016	KIDSCREEN-10: 10 items KIDSCREEN-27: • Physical Well-being (5) • Psychological Well-being (7) • Autonomy & Parent Relations (7) • Social Support & Peers (4) • School Environment (4)	Yes (Ravens-Sieberer 2006, Ravens-Sieberer 2010, and Ravens-Sieberer 2014)	5-point scale	Items are scored as Rasch scales, then translated into T-values with mean of 50 and standard deviation of 10	1 to 5	—	Higher T-scores indicate higher HRQoL	—
Child Health Utility 9D (CHU9D) Employed in Breheny 2020, Jago 2019, Harrington 2018	9 items	Yes (Stevens 2011 and Stevens 2012)	5-point scale	Item levels range from 1 to 5	1 to 5	Yes	Higher item scores indicate lower level of health	—
Pediatric quality of life inventory (PedsQL) Employed in	• Physical Functioning (8) • Emotional Functioning (5) • Social Functioning (5)	Yes (Varni 2003 and Varni 2017)	5-point scale (aged 8 to 18)	Item scores range from 0 to 4	0 to 100	No	Higher scores indicate better HRQoL	• Total score: 4.36

(Continued)

Adab 2018	• School Functioning (5)		3-point scale (aged 5 to 7)	Scale scores range from 0 to 100				• Physical Health: 6.66 • Psychosocial Health: 5.30 • Emotional Functioning: 8.94 • Social Functioning: 8.36 • School Functioning: 9.12
European Quality of Life-5 Dimensions Youth Survey (EQ-5D-Y) Employed in Jago 2015	Descriptive system • Mobility (1) • Self-care (1) • Everyday activities (1) • Pain/discomfort (1) • Happiness/worry/sadness (1) Visual analogue scale: no subscales	Yes (Ravens-Sieberer 2010 and van Reenen 2014)	Descriptive system: 3-level scale Visual analogue scale: vertical, continuous scale	Descriptive system: item levels range from 1 to 3 Visual analogue scale: 0 to 100	Descriptive system: 1 to 3 Visual analogue scale: 0 to 100	Yes	Descriptive system: higher scores indicate worse health states Visual analogue scale: higher scores indicate better perceived health state	—

WHAT'S NEW

Date	Event	Description
22 September 2021	New search has been performed	Search has been updated to June 2020 to include new studies. Inclusion criteria have been updated to include only studies with objective measures of physical activity and sedentary time. Previously included outcomes of television viewing time, blood pressure, and blood cholesterol have been removed. New outcomes have been added: sedentary time, body mass index z-scores, health-related quality of life, and adverse events. Appraisal of risk of bias has been updated according to the updated *Cochrane Handbook for Systematic Reviews of Interventions*, including additional considerations for cluster-randomised controlled trials. Meta-analyses have been conducted, with subgroup analyses by age (children vs adolescents) and by intervention type. The GRADE approach to interpretation of findings has been incorporated. Overall conclusions with respect to the impact of interventions on fitness and BMI have not changed. After limiting the included studies to only those that use objective measures of physical activity we now conclude that school-based physical activity interventions probably have minimal impact on time engaged in moderate to vigorous physical activity.
22 September 2021	New citation required and conclusions have changed	Overall conclusions with respect to the impact of interventions on fitness and BMI have not changed. However, after limiting the included studies to only those that use objective measures of physical activity we now conclude that school-based physical activity interventions probably have minimal impact on time engaged in moderate to vigorous physical activity.

HISTORY

Review first published: Issue 1, 2009

Date	Event	Description
21 October 2011	New search has been performed	Searches have been run for the update period (July 2007 to October 2011); 30 new project accounts have been identified and are included in the updated review
21 October 2011	New citation required but conclusions have not changed	This update has not impacted the conclusions and recommendations of the original review. One change to note is that the physical health status outcome blood cholesterol level (mg/dL) is no longer statistically significant
29 April 2010	Amended	Change in scope: 3 new relevance criteria have been added and applied to all included studies: (1) randomised controlled trials; (2) interventions implemented a minimum of 12 weeks; and (3) interventions aimed at the general population. This has resulted in exclusion from the update of 12 studies from the original review: 9 because they were not RCTs (Alexandrov 1988; Berenson 1993; Graf 2005; Klepp 1994; Lionis 1991; Manios 1999; Marcus 1987; Plotnikoff 1999; Sallis 1997); 2 because the intervention was shorter than 12 weeks (Eliakim 1996; Fardy 1996); and 1 be-

Date	Event	Description
		cause the study sample included overweight or obese children only (Carrel 2005a)
19 January 2010	Amended	Review author - RL LaRocca - has been added
21 May 2008	Amended	Review has been converted to new review format

CONTRIBUTIONS OF AUTHORS

All review authors contributed by reading and approving the final review draft.

Sarah Neil-Sztramko (SNS): as lead author, oversaw all aspects of the review update process. Was responsible for assisting with update of search strategies, screening search results, screening retrieved papers against inclusion criteria, appraising the quality of papers, extracting data from papers, analysing and interpreting data, and writing the review.

Hilary Caldwell (HC): was responsible for screening search results, organising retrieval of papers, screening retrieved papers against inclusion criteria, appraising the quality of papers, extracting data from papers, and assisting with writing and editing the final draft.

Maureen Dobbins (MD): as senior author and lead author of the original review, oversaw all aspects of the original and previous update review processes. Was responsible for conceiving and designing the review, providing a methodological perspective, assisting with interpretation of data, and editing and approving the manuscript.

DECLARATIONS OF INTEREST

SNS: declares no known conflict of interest.

MD: declares no known conflict of interest.

HC: declares no known conflict of interest.

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Internal sources

- No sources of support provided

External sources

- City of Hamilton Public Health Services, Canada

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- Canadian Institutes of Health Research, Canada

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DIFFERENCES BETWEEN PROTOCOL AND REVIEW

For this update, we have limited our inclusion criteria further to include only studies that include an objective measure of physical activity, physical fitness, or body composition. Due to advancements in technology since the original review was published, there now exist a wide variety of accurate and affordable options for objective measurement of physical activity, and researchers are no longer limited to reliance on self-report. Due to the large number of studies of school-based physical activity interventions, we are now able to limit our criteria to those who report objectively measured outcomes. In addition, we have added measures of sedentary time in place of television watching time. Measures related to blood pressure and cholesterol have been removed, and those related to health-related quality of life and adverse events have been added when reported. Assessments of risk of bias have been updated to align with the most recent *Cochrane Handbook for Systematic Reviews of Interventions*, including specific domains related to cluster-randomised controlled trials. Given the large number of included trials, subgroup analyses were conducted for children and adolescents and types of interventions when a sufficient number of trials were identified.

NOTES

Portions of the background and methods sections, the appendices, additional tables, and figures are based on a standard template established by the Cochrane Metabolic and Endocrine Disorders Group.

INDEX TERMS

Medical Subject Headings (MeSH)

*Exercise; Physical Fitness; *Quality of Life; Randomized Controlled Trials as Topic; Schools; Sedentary Behavior

MeSH check words

Adolescent; Child; Humans