

Effectiveness of School-based Physical Activity Interventions in Children and Youth: Rapid Review of the Evidence

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Key Messages

1. Based on one recent Cochrane systematic review, school-based interventions have a modest positive effect in increasing children's physical activity rates, physical activity duration and cardiorespiratory fitness.
2. Elementary school-based interventions should incorporate, at a minimum, both printed educational materials and changes to the school curriculum that promote physical activity during school hours.
3. The evidence is less promising in adolescents, as most interventions did not show a positive effect in increasing physical activity or cardiorespiratory fitness.

Executive Summary

Research Question

What are the most effective school-based interventions for increasing physical activity and fitness in children and youth aged four to 18 years?

Issue and Context

Childhood physical inactivity and low fitness are significant health burdens in Peel. Schools are an ideal setting for children and youth to adopt and maintain an active lifestyle. The potential reach is considerable: In total, the Dufferin-Peel Catholic District and Peel District School Boards serve 156,900 elementary school students and 75,100 secondary school students. To address this issue, Peel Health introduced the *Playground Activity Leaders in Schools (PALS)* program into elementary schools. Two objectives of PALS are to;

- a) increase physical activity, and
- b) decrease school-yard conflict.

However, the impact on physical activity has not been evaluated. Also, no formal review of the published literature has been conducted to examine the effect of school-based physical activity interventions.

Methods

A search of the published literature resulted in 65 systematic reviews. Of these, 62 were excluded based on relevance assessment. Three systematic reviews met the relevance criteria, one of which met quality criteria, and was included in the rapid review.

Key Findings

In elementary school children, school-based interventions (n=15/24) have a modest positive effect in increasing physical activity rates, physical activity duration and cardiorespiratory fitness. Children exposed to these interventions;

- a) are approximately three times more likely to participate in moderate to vigorous physical activity during the school day,
- b) increase their physical activity from five to 45 minutes more per week, and
- c) increase their aerobic capacity between 1.6 to 3.7 mL/kg per min.

In general, these interventions used a combination of enhancements to the health promotion curriculum (e.g., increase physical education lessons and focus on non-competitive play) and provided printed educational materials (e.g., use “activity cards” to demonstrate how to use play equipment during recess and educate teachers about physical activity).

The evidence is less promising in adolescents, as most interventions (n=5/6) did not show a positive effect in increasing physical activity or cardio respiratory fitness.

Recommendations

1. Support and promote school-based physical activity interventions in elementary school children.
2. Implement, at a minimum, both printed educational materials and changes to the school curriculum that promote physical activity during school hours. This could include:
 - Increasing physical education lessons that focus on skill development and non-competitive sport;
 - Using “activity cards” to demonstrate how to use play equipment during recess; and
 - Educating teachers about physical activity.
3. At this time, no recommendations from this paper can be made for secondary school-aged youth.

1. Issue

In 2003, Peel Public Health introduced the *Playground Activity Leaders in Schools (PALS)* program into elementary schools. Two objectives of PALS are to;

- a) increase physical activity, and
- b) decrease school-yard conflict.

Since its inception, PALS has been implemented in 229 Peel elementary schools. Although the initiative has shown high participation and satisfaction among students and teachers, the actual impact on physical activity has not been evaluated. Also, no formal review of the published literature has been conducted to examine the effect of school-based physical activity interventions.

Anecdote

In the summer of 2012, the PALS committee members met with School Health management to discuss the future of the PALS program. Throughout the discussion, several key questions were raised:

- What is the effectiveness of school-based interventions at increasing physical activity in children and youth? And are they feasible?
- What are the most effective components of these interventions?
- How can we evaluate the overall effectiveness of PALS?

2. Context

Childhood physical inactivity and low fitness are significant health burdens in Peel. In 2011, 41% of Peel grade nine students failed to meet current standards of acceptable cardiorespiratory fitness and 76% had musculoskeletal fitness levels that were associated

with 'some' to 'considerable' health risks.¹ Currently, it is unclear how many minutes per day of physical activity Peel students are achieving. National estimates indicate only seven per cent of children age five to 11 and youth age 12 to 17 meet Canada's guidelines of 60 minutes of moderate to vigorous physical activity (MVPA) per day.² The guidelines recommend vigorous-intensity activities at least three days per week. As well activities that strengthen muscle and bone are recommended at least three days per week, with more activity providing greater health benefits.³ The evidence that informs these guidelines demonstrates that physical activity produces physical, cognitive, emotional and social benefits.⁴

In 2009, Peel Public Health's 10-Year Strategic Plan identified *Supportive Environments for Healthy Living* as a program priority to address the inactivity issue.⁵ The overall goal of this priority is to use multipronged strategies to prevent, or slow the rise in the rate of, chronic diseases related to diet and inactivity. These strategies involve modifications to the built environment, the food environment and active transportation. One component incorporated within these strategies is to increase physical activity among children and youth during school hours. The Dufferin-Peel Catholic District School Board and the Peel District School Board are seeking guidance from Peel Public Health to support the physical activity needs of school-aged children and youth. The potential reach is considerable: In total, the two boards serve 156,900 elementary school students and 75,100 secondary school students. To determine whether school-based interventions are effective in increasing children's physical activity and fitness levels, we conducted a rapid review of the evidence.

3. Conceptual Framework

We adapted Elder's et al. (2006)⁶ model of physical activity promotion to develop a socio-ecological framework. It identifies the social and physical environments, and policy drivers that influence school-based physical activity (Appendix A). The model helps to identify opportunities to promote physical activity by recognizing the factors that influence an individual's behaviour. Efforts to change habitual physical activity behaviours are more likely to be successful when the multiple levels of influence are addressed at the same time.

4. Literature Review Question

The research question is:

“What are the most effective school-based interventions for increasing physical activity and fitness in children and youth aged four to 18 years?”

In PICO format the research question is:

Population (P)	School-aged children and youth (four to 18 years of age)
Intervention (I)	School-based physical activity and fitness interventions
Comparison (C)	None
Outcome of Interest (O)	Hours or minutes of physical activity or cardiorespiratory fitness measured by maximal oxygen uptake (VO ₂ max)

5. Literature Search

Four search strategies were applied to obtain relevant literature (Appendix B):

1. We searched four evidence registries for guidelines and systematic reviews from January 1, 2007 through June 26, 2013. The search strategy used the terms customized for the registry, including derivations of the terms “school-based,” “children,” “youth” and “physical activity.”
2. Electronic searches in PubMed, Cochrane Database of Systematic Reviews, Global Health, EBM Reviews, Ovid MEDLINE(R) and Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations for systematic reviews published between January 1, 2007 to June 26, 2013, using applicable Medical Subject Headings (MeSH) and key words.
3. An informal search of *Google Scholar* was done, using the same search terms as outlined in strategy one.
4. Reference lists of review articles selected for data extraction were searched for any relevant reviews not identified by the first three strategies.

6. Relevance Assessment

Two reviewers independently screened articles for eligibility, and differences were resolved by discussion with a third reviewer. Articles that qualified for full review were screened to determine eligibility using the following inclusion criteria:

- a) Published in the English language;
- b) Practice guidelines, systematic reviews or meta-analyses assessing the effectiveness of school-based physical activity interventions;
- c) Targeted children and youth from age four to 18 years; and

d) Included measurement outcomes of physical activity or cardiorespiratory fitness.

7. Results of the Search

Our search strategy identified 65 potentially relevant systematic reviews (Appendix C). No guidelines were identified. Fourteen reviews were excluded as duplicates; 48 did not meet the relevance criteria after title and abstract screening. Three systematic reviews met the relevance criteria based on title and abstract screening and were retrieved and independently assessed for inclusion. All three reviews met inclusion and were critically appraised.

8. Critical Appraisal

Two independent reviewers used the Health Evidence *Quality Assessment Tool - Review Articles*⁷ and its accompanying dictionary to assess the quality of the three systematic reviews. Differences were resolved through discussion with a third reviewer. The independent assessments rated the review by Dobbins et al. (2013)⁹ as 10/10 which is 'strong.' Kriemler et al. (2011)⁸ was rated 6/10 and Ickes et al. (2010)¹⁰ was rated 5/10. These 'moderate' rated reviews were excluded (Appendix E).

9. Description of Included Studies

Dobbins et al. (2013). School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6 to 18 (Appendix D).⁹

This updated Cochrane systematic review included 44 randomized controlled trials (RCTs): 14 from the original review in 2009 and 30 from the updated search. These RCTs aimed to increase physical activity and fitness in healthy children and adolescents ages six to 18 years. Most trials were conducted in the United States, Europe and Australia. The review authors reported on three primary outcomes (physical activity rates, duration of physical

activity, and time spent watching television) and six secondary outcomes, including cardiorespiratory fitness. This rapid review considers only the 30 RCTs that reported on the physical activity rates, duration of physical activity and cardiorespiratory fitness.

All trials had intervention components that were delivered in the school setting. Some trials provided additional components in the home, community, physician offices, and via the telephone and computer. Six intervention components were highlighted as either standalone or in combination:

- 1) Changes to school health promotion curriculum (e.g., increase physical education lessons and focus on non-competitive play);
- 2) Increase in the time students engaged in vigorous physical activity during physical education classes;
- 3) Changes in school routines to increase time spent by students being physically active;
- 4) Provision of equipment;
- 5) Training for teachers in incorporating physical activity into school curriculum and routines; and
- 6) Educational materials for teachers.

Almost all interventions implemented changes to curricula and distributed printed or audiovisual educational materials. Some trials also included parental engagement via provision of educational materials. The authors noted that none of the trials used the same combination of interventions with the same intensity, making each study unique.⁹ The three most common intervention providers were classroom teachers, members of the research team and physical education teachers.

Methodological Quality of Primary Studies

The majority of the primary studies, despite being RCTs, were at moderate risk of bias.⁹ The risk of bias was mostly attributed to lack of blinding of outcome assessors, reliance on self-reported outcome measures and inadequate random allocation to treatment and control groups.⁹ As such, it may be likely that studies reporting positive results are overestimating the true treatment effect, and should be interpreted with caution.⁹ On a positive note, the review authors acknowledged that the methodological quality of recent RCTs have improved relative to older trials. More studies applied adequate statistical analyses and objective instruments to assess physical activity. Therefore, we can be more confident in the study results.

10. Synthesis of Findings

This section includes the key findings from Dobbins et al. (2012) systematic review. A summary of the results is provided in Table 1. See Appendix F for a detailed description of the evidence.

In elementary school children, school-based interventions (n=15/24) have a modest positive effect in increasing physical activity rates, physical activity duration and cardiorespiratory fitness. Children exposed to these interventions;

- a) are approximately three times more likely to participate in MVPA during the school day;
- b) increase their duration of physical activity between five to 45 minutes more per week; and
- c) increase their aerobic capacity between 1.6 to 3.7 mL/kg per min.

Physical Activity Rates

Two out of five studies using a combination of curriculum changes, educational materials, more school-day MVPA and community-based strategies reported an increase in the proportion of children engaged in MVPA (Simon {2004}: OR=2.74, 95% confidence interval [CI], 2.01 to 3.75; Verstraete {2006}: p<0.01 [magnitude of effect was not reported]). These two studies used physical education teachers and research staff, and were longer. The three studies showing no effect used classroom teachers and were shorter. Generally, studies reporting positive results used similar combinations of intervention components as those showing no effect. The sample size of the five studies ranged from 235 to 2111 participants.

Physical Activity Duration

Thirteen out of 23 RCTs assessing duration of physical activity were targeted to elementary school children. One study targeted adolescents. These studies used a combination of curriculum changes and printed educational materials and reported a modest increase in minutes of MVPA per week. Overall, the magnitude of effect varied across studies from just under five min to 45 min more per week of MVPA (95% CI ranged from 1.4 min to 90 min more per week of MVPA). These interventions were implemented by classroom teachers and were longer. The sample size of the 23 studies ranged from 33 to 4019 participants.

Cardiorespiratory Fitness (VO₂max)

Among six RCTs assessing cardiorespiratory fitness, four that targeted grade school children using a combination of curriculum changes, printed educational materials and education sessions reported a modest increase in cardiorespiratory fitness. The magnitude of

effect for three of four studies ranged from an increase of 1.6 to 3.7 mL/kg per min (95% CI, 0.2 to 7.2 mL/kg per min), and the fourth study reported a lower heart rate by four beats/min (95% CI, -8.2 to - 0.6) as a proxy measure for VO₂max. This is considered a modest positive increase in cardiorespiratory fitness. These interventions were longer and used a similar combination of intervention components compared to interventions reporting no effect. Among the effective studies, two of four were implemented by classroom teachers. The intervention provider for the other effective studies and those that showed no effect is unknown. The sample size of the six studies ranged from 182 to 1221 participants.

The evidence is less promising in adolescents, as most interventions (n=5/6) did not show a positive effect in increasing physical activity rates or cardiorespiratory fitness, and only one study moderately increased physical activity duration.

Contextual Variables

We also abstracted from each RCT contextual variables associated with physical activity we deemed important to the Region of Peel's socio-demographic context and ethno-cultural diversity (Appendix F and Appendix G). Overall, there was large variability in the type and number of contextual (e.g., age, ethnicity, gender) variables reported across RCTs. The most common variables were age and gender, which had limited influence on the outcomes. Some RCTs reported an association between age or gender and physical activity levels, and others did not.

Table 1. Synthesis Results: 30/44 RCT School-based Interventions Reporting on Physical Activity and Cardiorespiratory Fitness outcomes in Dobbins et al. (2013) Systematic Review.

Outcomes	Intervention Components	Reporting Positive Effect	Reporting No Effect	Summary
Physical activity Rates (proportion of participants physically active; n=5 studies)	Combination of *curriculum changes, printed †educational/audio visual materials, more time engaged in MVPA during the school day (e.g., 15 min activity breaks) and ‡community-based strategies.	1 study † Proportion of children engaged in non-school MVPA (OR 2.74, 95% CI, 2.01 to 3.75) compared to controls.	3 studies	Two out of five studies reported a modest increase in the proportion of children engaged in MVPA. Effective studies were longer (three months to four school years) and used PE teachers and research staff while interventions showing no effect were shorter (one school year to 12 months) and used classroom teachers. Generally, studies reporting no effect used similar combination of intervention components as those showing positive effect.
	Combination of †educational materials and game equipment.	1 study † Proportion of children engaged in school MVPA (p<0.01; magnitude of effect and CI not reported).	NA	
Physical activity Duration (minutes engaged in physical activity; n=23 studies)	*Combination of curriculum changes and †printed educational materials.	14 studies † Physical activity duration ranging from five min to 45 min more per week of MVPA (CIs ranged from 1.4 min to 90 min more per week of MVPA).	9 studies	Fourteen out of 23 studies using similar intervention components and implemented by classroom teachers' modestly increased physical activity duration in children (one study in adolescents). These interventions were longer (18 weeks to six years) than interventions reporting no effect (12 weeks to 10 months).
Cardiorespiratory Fitness (maximal oxygen uptake [VO ₂ max]; n=6 studies)	*Curriculum changes.	1 study † VO ₂ max in children by 1.9 mL/kg per min (95% CI, -1.44 to -5.17).	NA	Four out of six studies using similar intervention components and implemented by classroom teachers modestly improved cardiorespiratory fitness in children. These interventions were longer (seven months to three years) than interventions reporting no effect (12 weeks to 2 years). Among the effective studies, two of four were implemented by classroom teachers. The intervention provider for the other four studies is unknown.
	Combination of *curriculum changes and †printed educational materials.	1 study † VO ₂ max in children by 1.6 mL/kg per min (95% CI, 0.22 to 2.92). 1 study ‡ Heart rate by 4 beats/min (95% CI, -8.2 to -0.6) as a proxy for VO ₂ max.	2 studies	
	Combination of *curriculum changes, †printed educational materials and education	1 study † VO ₂ max in intervention children by 3.7 mL/kg per min	NA	

sessions.	(95% CI, 0.3 to 7.2).		
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RCT, randomized controlled trial; NA, not applicable; MVPA, moderate to vigorous physical activity; PE, physical education; VO₂max, maximal oxygen uptake; OR, odds ratio; CI, confidence interval; ↑, increase; ↓, decrease.

* Some examples of curriculum changes include: additional PE lessons; in-class lessons focus on physical activity, healthy lifestyle and positive attitude toward PA; PE lessons focus on sport skills, fitness and non-competitive play.

† Some examples of education materials include: game equipment with “activity cards” demonstrating use of equipment during recess; newsletters for parents; materials to educate teachers on physical activity.

‡ Some examples of community-based strategies include: sporting and bicycle events; walkathons; active transportation; workshops for parents; and physical activity homework for the family.

11. Applicability and Transferability

Senior management and frontline staff from the School Health and Active Living teams and the Family Health division were invited to independently assess the applicability and transferability of the evidence provided in this review. The assessment was conducted using the Applicability and Transferability tool adapted from The National Collaborating Centre for Methods and Tools (http://www.nccmt.ca/pubs/2008_09_AT_paper_v_oct2007_ENG.pdf). The tool is designed to capture the key contextual and situational factors that influence the implementation of a public health program. The following are the key results of that discussion (Appendix H):

7.1 Political Acceptability or Leverage

- There is political will to increase physical activity levels in children, as evidenced by:
 - The Ministry of Health and Long Term Care's priority to decrease childhood obesity (i.e., Healthy Kids Strategy);
 - The Ministry of Education's mandate for *Daily Physical Activity*;
 - The Canadian Physical Activity Guidelines for Children and Youth; and
 - Peel's focus on *Supportive Environments for Healthy Living*.
- To intervene at the school level, Public Health should be cognisant of the current financial and temporal constraints faced by schools and school boards - changing/enhancing the curriculum will be challenging.

7.2 Social Acceptability

- Increasing physical activity is perceived as valuable and ethical, however there is some uncertainty as to how parents will accept and support a school-based physical activity initiative. For example, some immigrant families don't recognize the value of play, and others don't view physical activity as part of the school climate as it's not related to academics.
- Parent engagement/advocacy is critical for fostering physical activity opportunities in schools – a clear and consistent message is needed so parents understand the importance of activity on children's physical, psychological and academic well-being.
- Some schools do not seek physical activity support from Peel public health nurses as they don't view it as a priority in their schools.
- Winter months are a barrier as there is less opportunity for students to be active.

7.3 Available Essential Resources (Human and Financial)

- Each school board has access to a physical activity content expert.
- Half of Peel schools have a physical activity specialist teacher.
- There are existing venues to educate teachers on physical activity; Peel Health facilitates workshops/conferences/trainings that support teachers on the physical education curriculum and Daily Physical Activity (e.g., "keep fit and be active").
- The Ontario Physical and Health Education Association (OPHEA) provides teachers with educational materials and Daily Physical Activity (DPA) support.
- Peel PHN's provide ongoing physical activity support to schools, if requested.
- There is opportunity for parents to advocate to trustees for having more physical education specialists in schools.

- A population health approach that applies effective interventions across all school boards will be necessary to reach all Peel school-aged children – other type of interventions could be prohibitively expensive.
- Existing partnerships between CDIP and Family Health divisions and school boards may leverage collaborative multi-pronged strategies at the school level – positive partnerships will play a significant role in implementing school-based interventions.

7.4 Organizational Expertise and Capacity

- There is cross-cutting divisional expertise and capacity among CDIP and Family Health staff to implement the recommendations of this rapid review.
- A school-based physical activity strategy will complement the *Supportive Environments for Healthy Living and Nurturing the Next Generation* program priorities outlined in Peel Public Health's 10-Year Strategic plan.
- A physical activity intervention may overlap with existing programs depending on the objectives set out for the intervention. The objectives can be any of the following: improve physical activity levels, independent of reducing sedentary time or vice versa, or focus on improving both outcomes. The approach can lend itself to cross-divisional collaboration, with Family Health targeting children 6 years and younger and CDIP targeting children 6 to 18 years of age.

7.5 Magnitude of Health Issue in Local Setting

- Peel estimates: In 2011, 41% of Peel grade nine students failed to meet current standards of acceptable cardiorespiratory fitness and 76% had musculoskeletal fitness levels that were associated with 'some' to 'considerable' health risks.¹ Students in grades 7-12 spent

a large portion of their day being sedentary, including watching TV, playing video games, and surfing the internet using computer and cell phones.

- Canadian estimates: 7% of children age five to 11 and youth age 12 to 17 meet Canada's guidelines of 60 minutes of moderate to vigorous physical activity (MVPA) per day.²
- Peel data gaps: Unclear how many minutes per day of physical activity Peel students are achieving.

7.6 Magnitude of the "Reach" and Cost-effectiveness of the Intervention

- The potential reach is considerable: In total, the two boards serve 156,900 elementary school students and 75,100 secondary school students.
- Cost-effectiveness of interventions has not been reviewed.

7.7 Target Population Characteristics

- Peel's target population characteristics are comparable to most study populations, given most interventions targeted elementary school-aged boys and girls in the United States, Europe, Australia and Canada.

12. Recommendations

1. Support and promote school-based physical activity interventions in elementary school children.
2. Implement, at minimum, enhancements to the school curriculum and printed educational materials that promote physical activity during school hours. This could include:
 - Increasing physical education lessons that focus on skill development and non-competitive sport;
 - Using “activity cards” to demonstrate how to use play equipment during recess; and
 - Educating teachers about physical activity.
3. At this time, no recommendations from this paper can be made for secondary school-aged youth. We will continue to monitor the evidence for effective interventions in adolescents.

References

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Appendices

Appendix A: Socio-ecological Framework for School-based Physical Activity Promotion

Appendix B: Search Strategy

Appendix C: Literature Search Flowchart

Appendix D: Data Extraction Tables of Review Articles

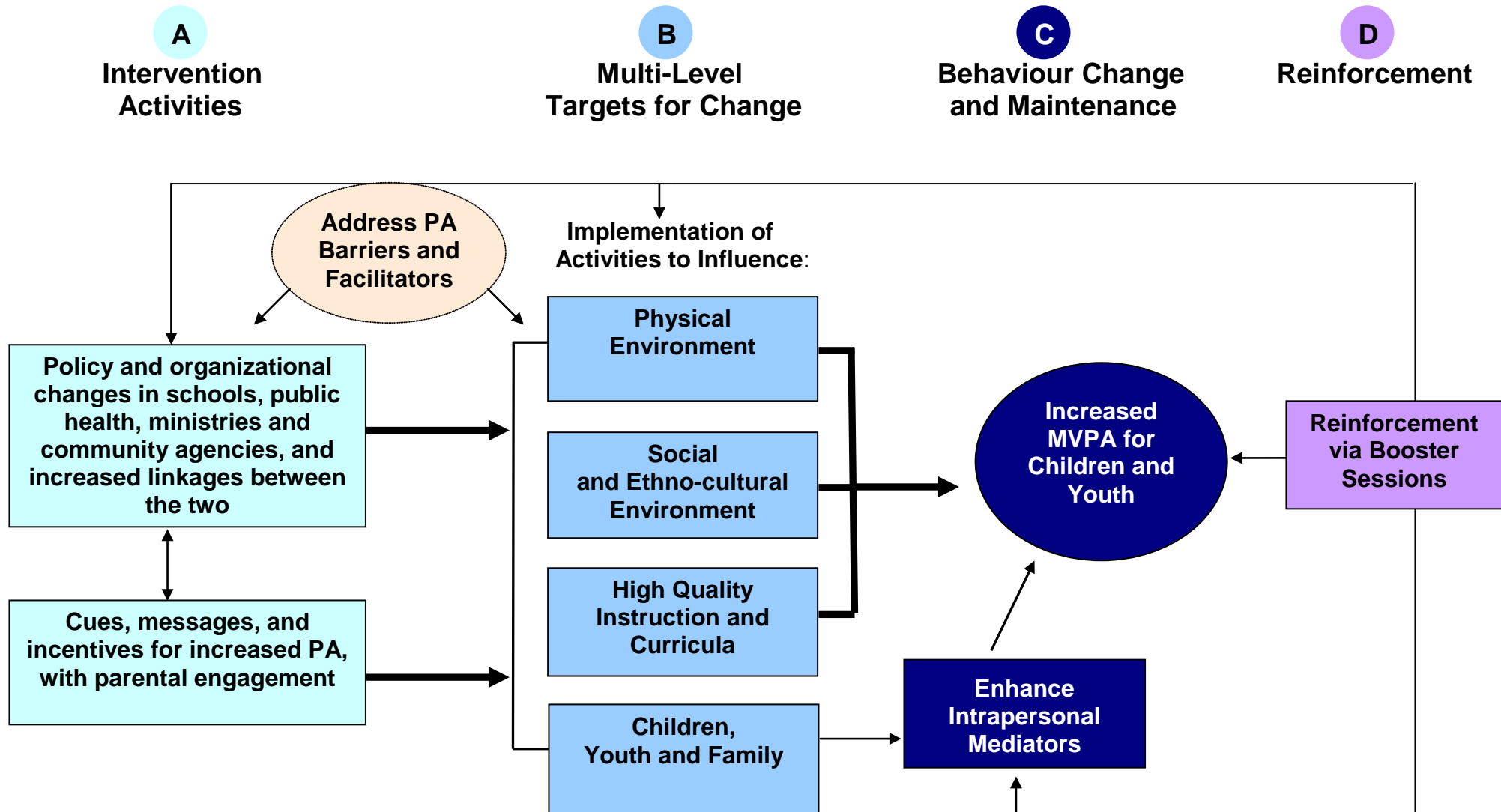
Appendix E: Data Synthesis Table of Excluded Reviews

Appendix F: Detailed Results from 30/44 RCTs in Dobbins et al. (2013) Systematic Review Reporting on Physical Activity and Cardiorespiratory Fitness Outcomes

Appendix G: Contextual Factors from 30/44 RCTs in Dobbins et al. (2013) Systematic Review Reporting on Physical Activity and Cardiorespiratory Fitness Outcomes

Appendix H: Applicability and Transferability Worksheet

Appendix A: Socio-ecological Framework for School-based Physical Activity Promotion



Appendix B: Search Strategy

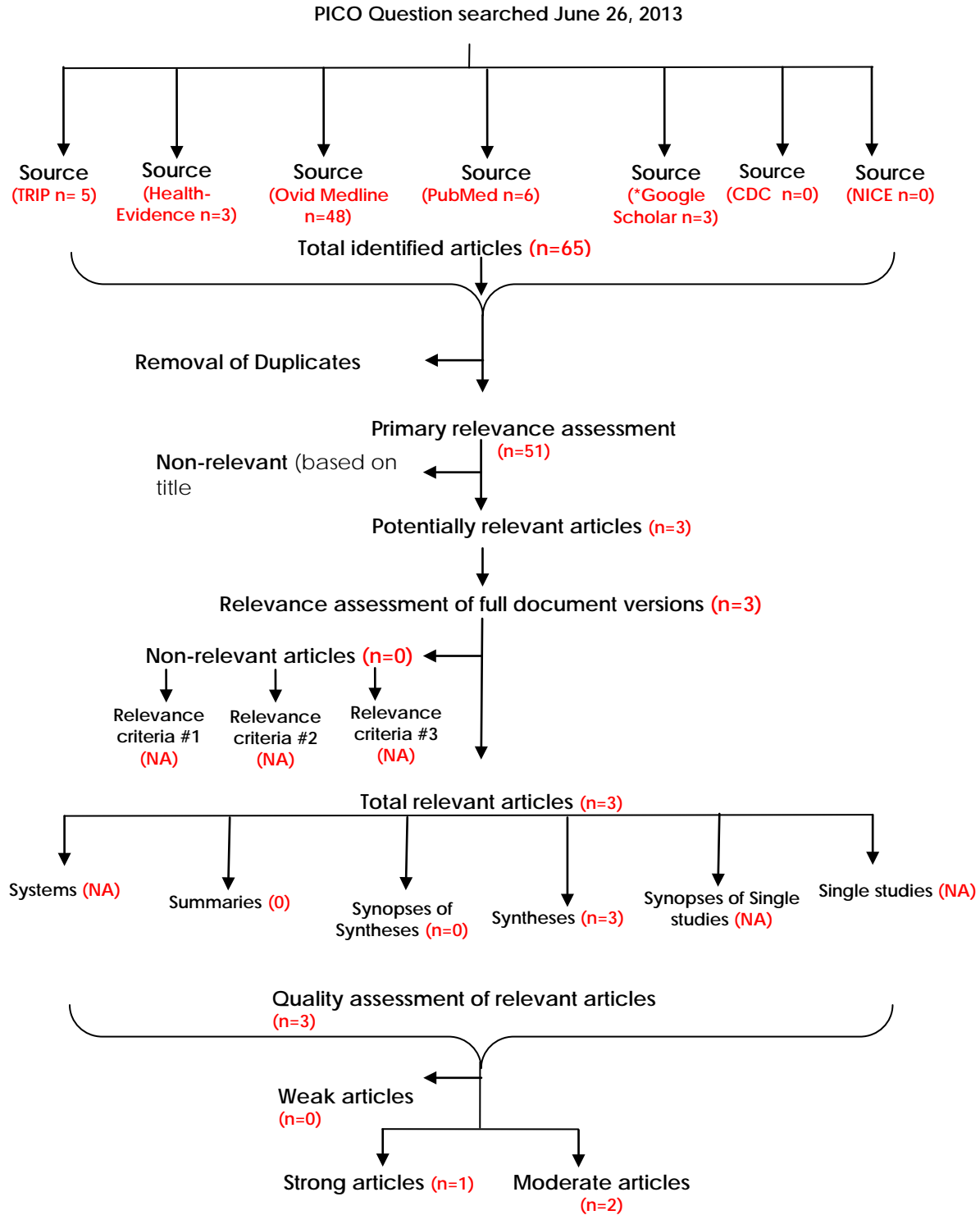
1. We searched the following four pre-processed sources for summaries and syntheses: Health-Evidence, TRIP database, The Guide to Community Preventive Services and The National Institute for Health and Clinical Excellence. We used terms customized for the database, including derivations of “school-based physical activity” AND “children”.

Database: EBM Reviews - Cochrane Database of Systematic Reviews <2005 to May 2013>, EBM Reviews - Health Technology Assessment <2nd Quarter 2013>, EBM Reviews - NHS Economic Evaluation Database <2nd Quarter 2013>, Global Health <1973 to 2013 Week 24>, Ovid MEDLINE(R) <1946 to June Week 2 2013>, Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <June 25, 2013>

Search Strategy:

- 1 exp exercise/ (121151)
- 2 exp motor activity/ (179736)
- 3 exp "Physical Education and Training"/ (13127)
- 4 exp physical fitness/ (23790)
- 5 (physical\$ adj5 (fit\$ or train\$ or activ\$ or endur\$)).ti,ab. (98171)
- 6 "energy balance".ti,ab. (13238)
- 7 exp schools/ (84864)
- 8 "school-based".ti,ab. (9934)
- 9 1 or 2 or 3 or 4 or 5 or 6 (287612)
- 10 7 or 8 (92256)
- 11 meta-analysis.mp,pt. (86343)
- 12 systematic review.tw. (56983)
- 13 cochrane database of systematic reviews.jn. (17669)
- 14 11 or 12 or 13 (126096)
- 15 exp guideline/ (41014)
- 16 (practice guideline or guideline).pt. (24263)
- 17 15 or 16 (41014)
- 18 14 or 17 (166232)
- 19 (comment or letter or editorial or note or erratum or short survey or news or newspaper article or patient education handout or case report or historical article).pt. (1706706)
- 20 18 not 19 (160052)
- 21 effectiv\$.ti,ab. (1345997)
- 22 9 and 10 and 21 (860)
- 23 20 and 22 (83)
- 24 limit 23 to yr="2007 -Current" (72)
- 25 remove duplicates from 24 (49)
- 26 9 and 10 and 20 and 21 (83)
- 27 remove duplicates from 26 (59)
- 28 limit 27 to ed=20070101-20121130 [Limit not valid in CDSR, Global Health; records were retained] (48)

Appendix C: Literature Search Flowchart



Source: Health-evidence.ca. *Keeping Track of Search Results: A Flowchart*. [Retrieved Nov. 22, 2011]

Appendix D: Data Extraction Table of Review Articles

Items Reviewed	Systematic Review by Dobbins et al. (2013)
General Information & Quality Rating for Review	
1. Author(s) and Date	Dobbins et al. (2013)
2. Country	Corresponding author from Canada <ul style="list-style-type: none"> Majority of the primary studies were conducted in the US (24), Australia (5), Belgium (3), China (2), and Greece (1). Several other countries, mostly in Europe, conducted one study each, as well as one study from Canada and one from India
3. Quality Rating	Rated using Health-Evidence tool = Strong quality <ul style="list-style-type: none"> The review met 10/10 quality criteria
4. Objectives of Review	<ul style="list-style-type: none"> To summarize the evidence of the effectiveness of school-based interventions in promoting PA and fitness in children and adolescents (6 to 18 years).
Details of Review	
5. Number of primary Studies	<ul style="list-style-type: none"> 44 (14 from original review and 30 from updated search)
6. Types of Studies	<ul style="list-style-type: none"> RCTs
7. Search Period	<ul style="list-style-type: none"> July 27 to October 2011
8. Number of databases searched	<ul style="list-style-type: none"> 8 (MEDLINE, BIOSIS, CINAHL, EMBASE, SPORTDiscus, PsycINFO, Sociological Abstracts and CENTRAL) Additional records were identified through reference lists, hand searching and contacting key experts
9. Inclusion and Exclusion Criteria	<ul style="list-style-type: none"> Inclusion: 1. Interventions had to be relevant to public health practice (focused on health promotion activities); 2. implemented, facilitated, or promoted by staff in local public health units; 3. implemented in a school setting and aimed at increasing PA; and 4. included all school-attending children, and be implemented for a minimum of 12 weeks Exclusion: 1. interventions conducted by physicians, fitness experts or clinic based; and 2. interventions as part of a treatment regimen for a specific critical illness or comorbidity
Details of Interventions	
10. Target groups	Healthy children and youth aged 6 to 18 years, whether they were overweight, obese, or not <ul style="list-style-type: none"> The samples were comprised of multiple ethnicities including African-American, Asian, Australian, European, First Nations/Aboriginal, Greek, Hispanic, Scandinavian, and white participants. Generally, the interventions were implemented in urban centers among all socioeconomic classes.
11. Description of interventions	<p>Note: None of the trials used the same combination of interventions with the same intensity, making each trial unique</p> <ul style="list-style-type: none"> Almost all studies implemented changes to curricula on increasing time spent in PA and on increasing knowledge about the benefits of an active lifestyle Almost all studies also distributed printed or audiovisual educational materials primarily to students, but sometimes to parents as well, often in association with educational sessions About quarter of the studies (n=11) involved school-based activities other than school curricula (e.g. school fun nights, walkathons, educational materials or sessions (or both) for school staff and parents, game equipment) Half of the studies (22/44) used community-based interventions in conjunction with school-based, such as training sessions and

	<p>workshops for parents and parent involvement in home-based physical activities (homework),</p> <ul style="list-style-type: none"> • Some studies reported the use of counseling, health screening, and support groups • In some instances the intervention included strategies to engage parents in the intervention, as well as community-based strategies, mass media, and policy development <p>15 trials focused primarily on grade school programs that included some parental involvement</p>
12. Intervention Providers	<ul style="list-style-type: none"> • Variety of professionals including PE teachers, classroom teachers, research staff, health professionals, peers and in a few studies parents <ul style="list-style-type: none"> ○ The three most common were classroom teachers (n = 28), members of the research team (n = 13), and PE teachers (n = 9)
12. Intervention settings	<ul style="list-style-type: none"> • Primarily School (elementary or secondary), and some instances in school and family or community
13. Theoretical frameworks	<ul style="list-style-type: none"> • The most commonly used theories were social cognitive theory and the health-belief model while self determination theory, PRECEDE, social learning theory, and the trans-theoretical model were used to a lesser extent
14. Primary Outcomes	<p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> • Rate of MVPA (per cent of sample engaged in MVPA), assessed either through self-report or through the use of accelerometers during both school or non-school (or both) time. • Duration of PA (total minutes per hour or week) assessed by self-report, although some studies collected these data via accelerometers • Television viewing (time spent watching TV), assessed by self-report or parental report as the minutes per hour or week spent watching television, outside of school. <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> • Cardiorespiratory fitness measured by direct VO₂max and estimated VO₂max • Mean systolic blood pressure (mmHg) • Mean diastolic blood pressure (mmHg) • Mean blood cholesterol (mg/dL). • BMI (kg/m²) • Pulse rate (beats/minute)
Results of Review	
15. Meta-analysis?	No (due to heterogeneity in the populations, interventions, and outcomes measured)
16. Main Results of Review	<p>Note: For the purpose of this rapid review, only outcomes related to PA levels and cardiorespiratory fitness will be presented</p> <p><i>Primary outcomes</i></p> <ul style="list-style-type: none"> • <u>Rate of MVPA (n=5):</u> 2/5 studies reported statistically significant positive effects in grade school children only (Simon 2004: OR =2.74, 95%CI 2.01-3.75; Verstraete 2006 did not report effect size) - Intervention duration ranged from three months to four years. The rest of the studies showed no effect. • <u>Duration of PA (n=23):</u> 12/17 studies in grade school children reported statistically significant positive effects - length of the intervention ranged from 12 weeks to six years, with the median being one to two school years; Among the two studies in grade school children and secondary school adolescents, one did not report statistically significant effects, while the second reported a statistically significant effect in favour of the control group; and 1/3 studies in adolescent girls reported statistically significant positive effect.

	<ul style="list-style-type: none"> ○ The magnitude of effect varied across studies from 5 to 45 min more per week of MVPA, and the 95% CIs ranged from 1.4 min to 90 min more per week of MVPA <p><i>Secondary Outcomes</i></p> <ul style="list-style-type: none"> ● <u>Cardiorespiratory fitness (VO₂max, n=6):</u> 4/5 studies in grade school children reported statistically significant positive effects, and the remaining did not show an effect <ul style="list-style-type: none"> ○ The magnitude of effect ranged from 1.6 to 3.7 mL/kg per min, AND 95% CIs ranged from 0.2 to 7.2 mL/kg per min
17. Comments/Limitations	<p>Major limitations reported by authors:</p> <ul style="list-style-type: none"> ● Lack of blinding particularly of outcome assessors, lack of consistency in how outcomes are measured, reliance on self-reported outcomes for most behavioral outcomes, a lack of description of the process used to randomly allocate participants to intervention and control groups, and some studies experienced high attrition rates as well as incomplete outcome data <p>Additional limitations (noted through critical appraisal):</p> <ul style="list-style-type: none"> ● No limitations were identified

PE, physical education; PA, Physical activity; VO₂max, maximal oxygen uptake.

Appendix E: Data Extraction Table of Excluded Reviews

Author and Year/ Journal	Publication Type	Title	Reason for Exclusion
Ickes MJ et al. (2012)/ <i>Journal of Physical Activity & Health.</i>	Systematic Review	“Systematic Review of Recess Interventions to Increase Physical Activity”.	<ul style="list-style-type: none"> ● Rated as ‘moderate’ methodological quality (5/10) using Health-Evidence tool. The key methodological issues were as follows: <ul style="list-style-type: none"> ○ Limited search strategy. ○ Did not assess methodological quality of the primary studies. ○ Results were not transparent. ○ Appropriate methods were not used to compare results across studies.
Kreimler et al. (2011)/ <i>British Journal of Sports Medicine.</i>	Review of Reviews and Systematic Review	“Effect of school-based interventions on physical activity and fitness in children and adolescents: A review of reviews and systematic update”.	<p>Rated as ‘moderate’ methodological quality (6/10) using Health-Evidence tool. The key methodological issues were as follows:</p> <ul style="list-style-type: none"> ○ Limited search strategy. ○ Did not assess methodological quality of the primary studies. ○ Results were not transparent. ○ Appropriate methods were not used to compare results across studies, and only p values (e.g., p<0.05) were reported.

Appendix F: Detailed Results from 30/44 RCTs in Dobbins et al. (2013) Systematic Review Reporting on Physical Activity and Cardiorespiratory Fitness Outcomes.

Author	Target Pop.	Intervention Components	Outcomes			*Contextual Variables
			PA Rates	PA Duration	CRF	
Results Overview						
Number of RCTs (total unique n=30; three trials reported on PA duration and CRF)			5	23	6	12
# RCTs showing significant positive effect			2/5	14/23	4/6	8
# RCTs showing no effect			3/5	9/23	2/6	4
RCTs Showing Statistically Significant Positive Effect						
Simon 2004	Children	Educational component focusing on PA and sedentary behaviors, new opportunities for PA during and after school hours. Emphasis on fun, well-being, non-competitiveness. Sporting events, bicycle, and on-foot transport were organized.	↑ PA outside of school (OR =2.74; 95 CI, 2.01- 3.75)	NA	NA	No interaction effect shown for gender; Sig. diff. in SES between Int. and cont. groups at baseline (p<0.05)- no interaction effect shown; Mostly White, urban school.
Verstraete 2006	Children	Provided game equipment and 'activity cards', demonstrating use of the equipment for use outdoors during recesses and lunch break.	↑ in MVPA (p<0.01)	NA	NA	Sig gender differences for girls; Girls time on mod. PA sig ↑ in int., ↓ in cont.; MVPA ↑ for girls in Int., ↓ in cont.; boys MVPA ↓ in both groups; Mostly White, Urban school.
Araujo-Soares 2009	Children	2 x 90-min PA sessions with related homework. Students kept a diary for 3 weeks. Worksheets and a 3-min film were used, and each student received a leaflet with main topics.	NA	↑ MVPA by 45 min (95% CI, 9-82; p=0.016)	NA	NA
Barbeau 2007	Children	After-school program of 30 min of homework time with a healthy snack, and 80 min of PA (25 min skill development, 35 min MVPA, and 20 min of toning and stretching). MVPA included games such as basketball, tag, softball, etc.	NA	↑ PA by 22.2 min (95% CI, 9.6-34.2; p=0.0006)	↑ VO ₂ max by 1.6 mL/kg per min (95%CI, 0.22-2.92; p=0.02)	NA - All girls; Mostly African American.
Donnelly 2009	Children	90min/week of MVPA academic lessons delivered intermittently throughout the school day.	NA	↑ MVPA (p=0.001)	NA	Teachers more physically active had students who were also more physically active (p<0.001); Mostly white, Urban school.
Ewart 1998	Adolescent	50-min 'Project Heart' aerobic exercise classes	NA	↑ PA (p< 0.0003)	NA	NA – All girls, mostly African

		including didactic instruction.				American, Urban school.
Haerens 2006	Children	Int.1: Increase levels of MVPA to at least 60 min a day, increase fruit consumption, increase water consumption, and reduce fat. A computer assessed children's PA activities and provided tailored feedback. Int. 2: Int.1 plus parental involvement (meeting, a newsletter 3 x year, and a CD with an adult computer-tailored intervention for home).	NA	↑ PA (p<0.05)	NA	Students not participating at follow-up were significantly older and consumed more soft drinks than follow-up participants.
Kriemler 2010	Children	Multicomponent PA program that included: 1) 3 existing 45-min PE lessons per week; 2) 2 additional 45-min PE lessons per week; 3) daily short activity breaks; and 4) PA homework.	NA	↑ PA (p=0.03)	NA	NA – Urban and rural schools
Luepker 1996	Children	Int.1: Received a school-based program consisting of school food service modifications, PE interventions, and curricula Int. 2: received the same school-based program plus a family-based program (family curricula and family fun nights).	NA	↑ PA (p<0.001)	NA	No sig. gender diff. at 3 year follow-up; running distance ↑ with age in Int. by 100 yards and in control schools by 84 yards but diff. was not sig.; African American students were more likely to drop out at three year follow-up.
McManus 2008	Children	Int.1:Completed a 2-week education program, taught using an active game approach, that included information about heart health, the use of heart rate feedback to attain an activity target, goal-setting and role-play. Int.2: No-education program completed a 2-week control program of standard PE classes without PA or heart health education.	NA	↑ PA (p<0.05)	No significant effect on VO ₂ max	NA
Salmon 2008	Children	Students were assigned to 1 of 4 conditions: a behavioral modification group (N = 69); a fundamental motor skills group (N = 73); a combined behavioral modification and fundamental motor skills group (N = 90).	NA	FMS group only: ↑ PA by 9.5 min (95% CI, 1.4-17.6; p<0.05)	NA	Sig. group gender interaction for enjoyment of PA (p=0.001): sig. positive diff. between baseline and post PA. in Int. boys than Con.; Boys spend sig. ↑ time in MVPA than girls; Girls reported sig. ↑ enjoyment than boys; Int. group reported higher enjoyment over time compared to control; All government schools in low SES areas.
Stone 2003	Children	Program was implemented during third through	NA	↑ PA (p<0.05)	NA	NA

		fifth grades, with 4 components including: food service, skills based classroom curricula, family, and PE.				
Trevino 2004	Children	50 sessions of health programming: 3 health behavior messages on diabetes control (↓ dietary saturated fat, ↑ dietary fiber, ↑ PA). Children set goals and keep records of their accomplishments and rewarded with coupons from a school store.	NA	NA	↑ VO ₂ max by 1.9 mL/kg per min (95%CI, not reported; p<0.05)	NA – Mostly Mexican American with low SES
Walther 2009	Children	One unit of physical exercise (45 min) with at least 15 min of endurance training per school day, plus lessons on healthy lifestyle 1 per month.	NA	NA	↑ VO ₂ max by 3.7 mL/kg per min (95%CI, not reported; p=0.032)	NA – Mostly white
Wang 2008	Children	After-school program with 2-hour intervention sessions (40 min academic enrichment activities and a healthy snack provided; 80 min of PA designed to improve sport skills, aerobic fitness, strength, and flexibility with a minimum of 40 min were devoted to vigorous PA), offered 5 days a week, instructed by certified school teachers and paraprofessionals.	NA	NA	↑ VO ₂ max by ↓ in heart rate by -4.4 (95% CI, -8.2 to -09.6; p=0.025)	NA – Urban school
Webber 2008	Children	6 health education lessons to enhance behavioral skills known to influence PA (self monitoring, setting goals for behavior change). Offered in 2 forms: 1 for a traditional classroom setting and 1 for PE class. 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.	NA	Program Champion-directed only: ↑ MET-weighted min of MVPA by 1.6 (95% CI, 0-3.3; p=0.05)	NA	In year one, African American and white girls had sig. greater MVPA both in the Int.and Con.groups than Hispanic girls; MVPA was sig. higher for white girls than African American and Hispanic girls in 2005-06; No effect with staff-directed Int. compared to Con.; Champion directed Int.↑ PA than control during last 2 years.

*Contextual variables = Data were abstracted from primary studies for the following variables: sex, age, socioeconomic status (SES), ethnicity, school size, recent immigration, religious practices, participation preferences, cost-effectiveness, equipment, local champion, and urban or rural setting. Text refers to variables that were factored into the statistical analysis at baseline and/or post intervention. For example, some studies stratified their results to assess for an interaction effect between the intervention and age or gender etc.

RCT, randomized controlled trial; PA, physical activity; CRF, cardiorespiratory fitness; Sig., statistically significant; Diff., difference; ↑, increase; ↓, decrease; NA, not applicable; OR, odds ratio; CI, confidence interval; PE, physical education, Pop, population; MET, metabolic equivalent.

Appendix G. Contextual Factors from 30/44 RCTs in Dobbins et al. (2013) Systematic Review Reporting on Physical Activity and Cardiorespiratory Fitness Outcomes.

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
Systematic Review Results: n=31 reporting on Physical Activity and Fitness Outcomes													
Dobbins et al. (2013) Note: comparisons are between studies	Studies used a combination of the following components: curriculum changes, printed educational materials, more time engaged in MVPA during school day, audio visual and community-based strategies. Interventions ranged from 18 weeks to 4 years. Interventions were generally provided by teachers.	NR	Sign effect for children (≤ 12 yrs); not effect for adolescents (> 12 yrs) except for one study.	NR	African American, Asian, Hispanic, and White	NR	NR	NR	NR	NR	NR	NR	Mostly Urban
Primary Studies Showing Significant Positive Effect (n=17)													
Haerens et al. (2006)	MVPA to at least 60 min; sports materials provided and encouraged to create more non competitive opportunities during breaks, noon or after-school hours; computer feedback on PA; parental involvement be sending educational materials home.	NR	Pupils not participating at follow-up were significantly older and consumed more soft drinks then follow-up participants	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Luepker et al. (1996)	The CATCH intervention included school-based (school food service, physical education, classroom curricula) and family-based (home curricula, family fun nights) components. The school food service changes and physical education enhancement were ongoing throughout the 3 school years whereas the 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), physical activity (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 the school meal programs. Food service personnel	No sig diff in follow-up participation at 3 years by sex	9-minute distance run by students increased with age in intervention schools by 100 yards and in control schools by	NR	African American students were more likely to drop out a three year follow-up	NR	NR	NR	NR	NR	NR	NR	NR

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
	attended a 1-day training session at the beginning of each school year. They were provided with more information, assistance in planning, and other support during monthly follow-up visits to the schools and booster sessions. The physical education specialists and teachers attended 1 to 1.5 days of training every school year. The classroom curricula included: the Adventures of Hearty Heart and Friends (grade 3 to 15, 30- to 40-min classes during 5 weeks); Go for Health (grade 4 to 24, 30- to 40-min classes during 12 weeks); and Go for Health-5 (grade 5 to 16, 30- to 40-min classes during 8 weeks) and F.A.C.T.S. for Five (grade 5 - 4-session tobacco use prevention curriculum). The 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 the classroom curricula were sent home with the 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, games). The intervention schools were further randomized into 2 equal subgroups Intervention 1: One group received a school-based program consisting of school food service modifications, physical education interventions, and the CATCH curricula Intervention 2: One group received the same school-based program plus a family-based program.		84 yards – the difference between conditions was not sig										
Salmon et al. (2008)	Students were assigned to 1 of 4 conditions: a behavioral modification group (BM; N = 69); a fundamental motor skills group (FMS; N = 73); a combined BM and FMS group (N = 90). Components of the intervention program 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 program. BM condition: included 19 sessions of 40 to 50 min' duration over 3 school terms by the intervention specialist teacher, with different aims for each set of lessons (e.g. increasing awareness of time-use, health benefits of physical activity, self monitoring time spent in sedentary behaviors and physical activity, raising awareness of the home and community environments in relation to choices and opportunities, decision-making skills, developing their own physical activities and games, intelligent viewing', a 'Switch-off Challenge', and intermittent reinforcement schedule with a small reward). FMS condition: 19 sessions of 40 to 50 min over 3 school terms taught by the same intervention specialist teacher who delivered the BM intervention. The FMS intervention focused on 6 skills, including 3 object control skills and	Gender moderated the interv effects; boys spend sig more time engaged in MVPA than girls and acceleromet er counts		All governme nt school in low SES areas boys spent sig more time in MVPA	NR	NR	NR	NR	Overall, Girls reported sig higher enjoyment than boys; FMS reported higher enjoyment over time compared to control; There was sig group gender interaction for	NR	NR	NR	NR

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
	3 locomotor skills. Skills were taught with an emphasis on fun through games and maximum involvement for all the children. Most lessons focused on at least 2 skills, and each skill was a focus lesson in at least 6 or more sessions.								enjoyment of PA (p=0.001): sig positive diff in PA between baseline and post interv among boys in the FMS compared to control				
Simon et al. (2008)	The ICAPS program was implemented over 4 academic years to promote PA inside and outside. The intervention includes an educational component focusing on PA and sedentary behaviors, 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, non-competitiveness. Sporting events, bicycle, and on-foot transport are organized, with teachers, parental organizations, and sport associations encouraged to participate in meetings and regular contact. Intervention staff are informed of study objectives and work in collaboration with the different partners. The ICAPS coordinators regularly visit intervention school members to inquire about difficulties and help resolve material or personnel needs.	There was no interaction for gender	NR	Sig diff in SES (low, mid and high) in control and interv groups; however no interaction effect at baseline	Predominately White	NR	NR	NR	NR	NR	NR	NR	Urban
Verstraete et al. (2006)	Intervention: classes received a set of game equipment and 'activity cards' including examples of games and activities that can be performed with the equipment. Children were allowed to play outdoors with the equipment during recesses and lunch break. Before providing the game equipment, the different play toys and 'activity cards' were presented to the children of each class group by a research staff member. Teachers were asked to stimulate the children to play with the game equipment and agreed on rules with the children about the use and the loss or damage of the game equipment to assure its endurance. The teachers were advised to divide the game equipment into different sets and to exchange those sets regularly to prevent children losing interest in the equipment. Children were only allowed to play with the equipment of their own class. The set of game equipment for each class group included 2 jump ropes, 2 double Dutch ropes, 2 scoop sets, 2 flying discs, 2 catch balls, 1 poco bal, 1 plastic bal, 2 plastic hoops, 2 super	Sig gender differences found for low, mod, and mod to vig PA for girls; In girls time spent on mod PA sig increased in intervention group, while decreased in control; also	NR	NR	White	NR	NR	NR	NR	NR	Yes	NR	Urban

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
	grips, 3 juggling scarves, 6 juggling rings, 6 juggling bean balls, 1 diabolo, 1 angel-stick, 4 spinning plates, 2 sets of badminton racquets and 2 sets of oversized beach paddles.	MVPA increased for girls in Interv group, while decreased in control; boys MVPA decreased in both groups											
Webber et al. (2008)	TAAG health education included 6 lessons in each of the 7th and 8th grades designed to enhance behavioral skills known to influence physical activity participation. Activity challenges associated with the lessons reinforced the contents, encouraged self monitoring, and set goals for behavior change. To meet the varying formats in which health education was taught at the school, TAAG health education was offered in 2 forms: 1 for a traditional classroom setting and 1 for physical education (PE) class. TAAG PE class promoted moderate to vigorous physical activity (MVPA) for at least 50% of class time and encouraged teachers to promote physical activity outside of class. Activities targeted to create (1) environmental and organizational changes supportive of physical activity and (2) cues, messages, and incentives to be more physically active. Specifically, the intervention was designed to establish more opportunities, improve social support and norms, and increase self-efficacy, outcome expectations, and behavioral 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 physical activity programs for girls. These programs were delivered both on and off school property, in most cases either before or after school.	All female	NR	Low SES schools were given priority during stratified randomization	46% white, 17 African American, 22% Hispanic, rest other; No sig interactions between treatments and race/eth; there were sig diff in the # of MET-weighted min of MVPA among three largest ethnic groups; in 6 th grade sample in 2003, African American and white						No sig diff with staff-directed intervention compared to control; However, Champion directed intervention showed more PA than control (during last 2 years)	NR	

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
					girls had greater # of MVPA both in the inter and control groups than Hispanic girls; MVPA was higher for white girls than African American and Hispanic girls in 2005-06								
Wang et al. (2008) Cost-effectiveness study – body fat and Fitness as the outcomes but authors only used BMI for CEA	'FitKid' after-school program was offered 5 days a week (not offered during holidays and vacation periods). Certified school teachers and paraprofessionals implemented the program, 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-min period during which the youths were provided with a healthy snack and academic enrichment activities. The 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. The academic enrichment activities were incorporated into the program to ensure that participation in the FitKid intervention during the afterschool hours would not damage the academic progress of the children. The 80 min of physical activity included a variety of activities designed to improve sport skills, aerobic fitness, strength, and flexibility; 40 min were devoted to vigorous physical activity.	NR	NR	NR	Predominately African American	NR	NR	NR	NR	Yes; total intervention cost \$174,070, \$558/student or \$956/student who attended ≥40% of sessions; these students reduced %body fat by 0.76% at an additional cost of	NR	NR	Urban

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
										\$317/stude			
Donnelly et al. (2009)	Physical Activity Across the Curriculum (PAAC), provided training for classroom teachers (6 hour in-service session) to deliver existing academic lessons taught through physical activity, using examples from TAKE 10!, a program of the International Life Sciences Institute Research Foundation/Center for Health Promotion. 90min/week of moderate to vigorous physically active academic lessons were delivered intermittently throughout the school day.	NR	NR	Almost half (43%) of students qualified for free or reduced lunch	Predominately white	NR	NR	NR	NR	NR	NR	Teacher participation in classroom PA was directly related to PA levels. Teachers who were more PA had students who were also more physically active (p<0.001)	Urban
Colin-Ramirez et al. (2010)	Classroom lessons and exercise breaks; weekly 30-min lessons emphasized importance of PA, delivered by trained health teams; Exercise breaks in the classroom lasting 2 x 10min; Family members in support and reinforcement of classroom lessons and child received a book of activities to take home with exercises to do with parents.	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Trevino et al. (2004) Note: at baseline intervention schools had lower fitness scores than control schools	50 sessions of health programming for 7 months. Focus on 3 health behavior messages associated with diabetes mellitus control (fat intake, increase fiber intake, increase physical activity). Set goals aimed at accomplishing the targeted behaviors and to keep records of accomplishments. Children asked to encourage peers and adult caretakers to practice 3 health behaviors. Children and parents who practiced the 3 health behaviors were rewarded with coupons (worth a \$\$ amount) from a store set up in the school.	NR	NR	94% were from economically disadvantaged households; mother's level of	80% were Mexican American	NR	NR	NR	NR	NR	NR	NR	Urban

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
				education was similar in both groups; 82% of mothers had a high school education or less									
Araujo-Soares et al.(2009)	2 classroom-based physical activity sessions of 90 min each, along with homework, delivered by a trained psychologist, assisted by a sports education teacher. The psychologist received workshop training from the research team. A member of the research team served as supervisor to help prepare the sessions. In the week proceeding both physical activity sessions, adolescents were asked to keep a self-monitoring diary as homework, to keep track of daily physical activities in detail. After the intervention they were encouraged to maintain the diary for 2 more weeks. During sessions, worksheets and a 3-min film were used. At the end of the sessions, each student received a pamphlet reinforcing main topics of the session.	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Barbeau et al. (2007)	10-month after-school physical activity (PA) program 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 min of homework time while subjects received a free, healthy snack, and 80 min 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. Subjects chose 1 snack with the option of another if they wished. The PA included 25 min of skill development, 35 min of moderate to vigorous physical activity (MVPA), with 20 min of toning and stretching. Subjects wore Polar Accurex Plus HR monitors (Port Washington, NY) every day and were instructed to maintain their heart rate above 150 beats/min during the MVPA. MVPA activities included games such as basketball, tag, softball, relay races, etc., modified for activity of all subjects through the 35-min period. Subjects received small weekly prizes for behavior and attitude, and for having no more than 1 unexcused absence. A student of the month in each school received a slightly larger prize with the prizes intended to rewa	All girls	NR	NR	All students were African American	NR	NR	NR	NR	NR	NR	NR	NR

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
	rd good behavior, 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 program. Teachers mostly worked the intervention in their own school and in some cases were assigned to work in 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 the 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 the training received one-on-one training on the theoretical aspects and observed several sessions before their own implementation.												
McManus et al. (2008)	An educational program group completed a 2-week education program using targeted materials, providing learner guidance and feedback, and promoting retention of the desired behavior. Content included heart rate monitor skills and education about heart health, goal-setting, and role play. Heart rate monitor skills and goal setting included: information about activity targets (light, moderate, vigorous); daily activity accumulation to achieve 30 to 60 min of moderate-to-vigorous intensity activity (MVPA); and how to use a heart rate monitor for feedback about progression to this goal. This content was taught via an active games approach and a take home booklet. Following the educational program, children in the 2 intervention groups completed 2 weeks with heart rate feedback and 2 weeks without heart rate feedback (counterbalanced) Intervention 2: no-education program group completed a 2-week control program(physical education classes without physical activity or heart health education). Following the educational program, children in the 2 intervention groups completed 2 weeks with heart rate feedback and 2 weeks without heart rate feedback counter balanced). The No-education Program Group were not given any information about the heart rate signal or its meaning, but were informed of the correct position of the chest belt.	NR	NR	Schools were subsidized by Hon Kong government	NR	NR	NR	NR	NR	NR	NR	NR	NR
Stone et al. (2003)	The intervention program was implemented during third through fifth grades, with 4 components including: food service, skills-based classroom curricula, family, and physical education (PE). The intervention combined Social Learning Theory and principles of	NR	NR	NR	American Indian	NR	NR	NR	NR	NR	NR	NR	NR

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
	American Indian culture and practices with indigenous learning modes (e.g. story telling) incorporated. Classroom component: 2 x 45-min lessons delivered by teachers weekly for 12 weeks during grades 3 and 4, decreased to 8 weeks in grade 5. Food service component: 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: a minimum of 3 x 30-min sessions per week of moderate to vigorous physical activity based on SPARK. Family component: assistance creating a supportive environment with an interactive forum to discuss Pathways and additionally, 1) family action packs, and 2) family events at schools.												
Walther et al. (2009) Fitness outcome	Classes assigned to 1 unit of physical exercise (45 min) with at least 15 min of endurance training per school day. In addition, lessons on healthy lifestyle were included in the regular schedule once monthly for all pupils. 2 additional sixth-grade classes from a school focusing on competitive sports and physical education were selected to serve as a reference group.	NR	NR	NR	Predominately white	NR	NR	NR	NR	NR	NR	NR	NR
Ewart et al. (1998)	50-min 'Project Heart' aerobic exercise classes including didactic instruction	All girls	NR	NR	2/3 were African American. 1/3 white	Large	NR	NR	81% expressed desire to participate in a supervised exercise maintenance for at least one additional semester	NR	NR	NR	Urban
Kriemler et al. (2010)	All children participated in 3 mandatory, 45-min PE lessons per week; the intervention group participated in 2 additional 45-min PE lessons per week. The mandatory PE lessons were given by the usual classroom teachers according to the specified curriculum; the additional lessons were taught mostly outdoors by PE teachers. Three to five 2 to 5-min activity breaks (motor skill tasks - jumping or balancing on 1 leg, power games, coordinative tasks) were provided each day during academic lessons. The children also received daily physical activity homework (10 min' worth), prepared by the PE teachers, including: aerobic, strength, or motor skill tasks (e.g. brushing their teeth while standing on 1 leg, hopping up and down the stairs, rope jumping, or comparable activities).	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Urban and rural

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
Showed No Effect (n=13)													
Wilson et al. (2011) Note: Wilson showed sig positive effect, whereas in Dobbins' review it was reported as not showing sig positive effect.	ACT, a 17-week program implemented on Mondays, Tuesdays, and Thursdays for 2 hours after school. On Wednesdays students practiced what they had learned in the after-school program in their home environment. A trained team leader, with expertise in implementing physical activities (PA) in youth, provided the structure for the ACT intervention program implementation. The program had 3 main components: homework/snack (30 min), moderate to vigorous physical activities (MVPA) (60 min) that students selected each week, and a behavioral skills and motivational component (30 min) during which intervention staff worked with participants on developing strategies for increasing their MVPA in their home environment. The ACT intervention specifically targeted development of behavioral skills (communication, reciprocity of social support, group goal setting, and behavioral competence) for increasing PA outside of program days. In addition, the ACT after-school program social environment (autonomy, choice, participation, belongingness, fun, enjoyment, 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 behavior.	NR	NR	All adolescents were from low-income households	All adolescents were considered a minority; 73% were African American	NR	NR	NR	Intervention group showed sign intervention effect for higher levels of program enjoyment and greater choice of activities than control (p <0.05)	NR	NR	NR	NR
Haerens et al. (2009)	Computer tailored physical activity (PA) program consisting of 3 parts: (a) an introduction page, (b) a diagnostic tool, and (c) advice - a PA questionnaire, and a questionnaire on psychosocial determinants was completed. Then feedback was selected out of a database with messages for each possible combination of answers (e.g. normative feedback that related students' PA levels to the PA guidelines).	No sig gender by condition interaction	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Robinson 1999	The intervention: limited access to television (TV) use and budgeting TV time. Based on Bandura's Social Cognitive Theory it involved 18 lessons of 30 to 50 min as part of standard curriculum, taught by regular classroom teachers trained by research staff. Most lessons occurred in the first 2 months of the year and early lessons included self-monitoring and self-reporting for TV and video game use followed by a 10-day TV turnoff challenge after which students were encouraged to follow a 7-h per week budget. Newsletters designed to help parents motivate students and regulate time spent on TV and video games for the entire family were distributed. Each household received 1 (or more if requested) TV time master to regulate TV and video use.	No sig intervention by sex interactions for any outcomes	No sig intervention by age interactions for any outcomes	Total of both schools in study matched sociodem and scholastically; however interv. school parents	Groups did not differ in ethnicity	NR	NR	NR	NR	NR	NR	NR	NR

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)	
				reported greater household educational levels										
Bayne-Smith et al. (2004)	The PATH curriculum was taught as a personal wellness course that integrated vigorous exercise, health and nutrition education, and behavior modification. PATH student manuals were developed to provide students with information about the 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 behaviors. PATH teacher manuals were provided to physical education (PE) teachers containing instructions for teaching the program curriculum and assessing outcomes. PE teachers using the PATH curriculum received in-service training from the investigation team before and during the intervention. The PATH program consisted of 30-min classes conducted 5 days per week for 12 weeks. Individual classes began with a 5- to 10-min lecture and discussion featuring a topic on cardiovascular health and fitness and suggestions for modifying health behaviors. In addition, students frequently were given homework assignments designed to enhance or clarify lecture material through use of the PATH manuals. The lecture and discussion were followed by 20 to 25 min of vigorous physical activity in the form of either 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 program 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 (the 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.	All girls	Girls in the intervention group were significantly older than control (16.2 vs 15.9 years).	Intervention group had lower SES than control (p<0.05)	Multi-ethnic (white, African American, Hispanic, and Asian), however, using correlation analysis, this difference was not an important factor at baseline	NR	NR	NR	NR	NR	NR	NR	Urban	
Jones et al. (2008)	The IMPACT intervention included 3 major components: 1) a health curriculum for grades 6 and 7 (classroom lessons and behavioral journalism); 2) a PE program; and 3) a school food service component	All girls	NR	NR	Mostly white (72%)	NR	NR	NR	NR	NR	NR	NR	NR	NR

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
Note: Jones showed sig positive effect, whereas in Dobbin's review it was reported as not showing sig positive effect.	that emphasized calcium-rich food choices). Peer-based behavioral journalism involved the use of media (e.g. school-based newsletter with role model stories). The intervention used a 6th grade health curriculum, including 16 sessions that were implemented during PE classes, 3 times per week. The lessons in this curriculum promoted increased consumption of calcium-rich foods and increased weight-bearing physical activities. The curriculum also contained behaviourally based and active lessons adapted to the PE environment. Science-based lessons were administered during 7th grade science classes. The PE component of the program (i.e. "IMPACTivities") was implemented in the 6th and 7th grades during PE and athletics classes. The classes contained an initial 10-min warm-up (i.e. high-impact activities - rope-jumping, circuit training, and box-step activities).												
Lubans et al. (2009) Note: Lubans showed sig positive effect, whereas in Dobbin's review it was reported as not showing sig positive effect.	The intervention group (Program X intervention, based on the LEAF pilot study) included the same school sport program(as the control), however, with the following additions/alterations: 1) enhanced school sport program, delivered once a week for 10 weeks, focusing on lifetime physical activities that can be continued into adulthood (e.g. aerobics, weight training); 2) information sessions and interactive summary lecture focusing on physical activity and healthy eating; 3) pedometers for physical activity monitoring over the 6-month intervention; 4) physical activity and nutrition handbooks and monthly information newsletters for parents (designed to educate parents on strategies to support the health behaviors taught to their children in Program X); and 5) social support for physical activity and dietary behavior change using e-mail. Teachers introduced 1 of 10 physical activity and nutrition messages (selected because they represent the behaviors commonly associated with lower levels of disease risk and maintaining a healthy weight) at the beginning of each school sport session and delivered an activity reinforcing the message. These messages included: 1) Keep track of your physical activity (using goals/diary); 2) every step counts; 3) reduce your time spent watching television, using the computer, and playing electronic games immediately after school; 4) be active with friends and family; 5) identify excuses for not being active; 6) keep track of fruit and vegetable intake (using goals/diary); 7) aim for 2 pieces of fruit and 5 servings of vegetables each day; 8) drink more water and swap sugary drinks for diet drinks; 9) reduce your portion sizes and eat at the dinner table; and 10) reduce your junk food snacks. A member of the research team delivered an interactive lecture summarizing the 10 messages following the 10-week school sport component of the study.	NR	NR	Low to moderate SES	NR	NR	NR	NR	NR	NR	NR	NR	Urban

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
Peralta et al. (2009)	The intervention program was primarily based on Social Cognitive Theory, with 16 program weeks, with each week comprising 1 x 60-min curriculum session and 2 x 20-min lunchtime physical activity sessions. Each 60-min curriculum session included practical and/or theoretical components focused on promoting physical activity through increasing physical self-esteem and self-efficacy, reducing time spent in small screen recreation on weekends, decreasing sweetened beverage consumption, and increasing fruit consumption and the acquisition and practice of self-regulatory behaviors such as goal setting, time management, and identifying and overcoming barriers. Behavior modification techniques (e.g. group goals converting time spent in physical activity to kilometres to reach a specified destination, and the use of incentives) were used. The practical component included modified games and activities. The researcher primarily facilitated the intervention with staff and parents' involvement. A Program Champion (PE teacher) liaised with School Executive and other staff to promote the program within the school and assist with logistical requirements. Eleventh grade students peer facilitated lunchtime sessions, based on their potential to be positive role models and had one 20-min training session. Parents were emailed 6 newsletters throughout, informing them of the program content, motivating them, and suggesting strategies to engage the family in healthy behaviors, creating a stronger connection between parents and the school.	All boys	NR	NR	NR	NR	NR	NR	Parents (n=11) strongly agreed that program should continue; more than half suggested that their son spoke positively about the program	NR	NR	Prog champ	NR
Petchers et al. (1988)	Chicago Heart Health Curriculum Program called "Body Power" is a 1-year-long curriculum with modules on 5 topics: 1) cardiovascular system, anatomy, and physiology; 2) smoking; 3) nutrition; 4) exercise; and 5) risk factors review. Curriculum materials and activities emphasize the inter-relationship between students' feelings, behavior, and relationships and the risk factors of cardiovascular disease. The curriculum was implemented by classroom teachers with each module taught during at least 3 x 45-min sessions per week for 4 to 6 weeks. The Northeast Ohio Affiliate of the American Heart Association provided training for teachers. In total, 14 training covered relevant content and humanistic education teaching techniques. Training was supplemented by a comprehensive teachers' manual with specific objectives for each module, suggested time frames and alternative activities for teachers to select those most compatible with their own teaching styles.	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	Rural, suburban and residential suburb
Neumark-Sztainer et al. (2009)	The intervention included 3 components: 1) 14 x 2-hour after-school theatre sessions; 2) 8 weekly after-school booster sessions; and 3) family outreach to enhance home support for behavioral changes	NR	NR	90% of students qualified	Mostly African-American	NR	NR	NR	Majority of students (86%) and	NR	NR	NR	Urban

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
	through positive reinforcement of health behaviors, parent-child participation in physical activities, and availability of healthy foods. Each theatre session included: 1) a 'check-in' in which children were given an opportunity to share any behavioral changes they had made over the past week (e.g. eating more fruits and vegetables) and talk about how take-home packages were received by families; 2) easy-to-prepare healthy snacks; 3) a movement component of fun and easy activities requiring minimal resources (e.g. dancing or walking); and 4) theatrical ACTIVities. For the initial sessions, the ACTIVities component included exercises to introduce the children to theatre techniques and to build trust and cooperation. In later sessions, the ACTIVities focused on enhancing knowledge and skills related to physical activity 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 the final sessions, children were introduced to the script and began to rehearse for the final play performance. The 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 their classmates; learning exercises to do at home with their families; and rehearsals for the 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 had a parent postcard with information and interactive activities on a topic addressed in the after-school program). There were also 2 family events: 1) the students' performance of the play; and 2) a 'Ready. Set. ACTION! DVD Release Party' (i.e. a family viewing of the DVD recording of the play production, a short performance by the children, and a communal family dinner).			for free or reduced price lunch					parents (92%) would recommend the program				
Neumark-Sztainer et al. (2010)	The intervention group continued to participate in the all-girls PE class during the first semester of the school year. They 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 program included: 1) the New Moves PE class - nutrition and social support/self-empowerment sessions	All girls	NR	NR	75% were racial/ethnic minorities (e.g.,	NR	NR	NR	98% were satisfied and 100% would recommend it to a friend. 91% of	NR	NR	NR	Urban

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=0)
	(physical activity (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/ self-empowerment (Be Fab) classes 1 day/week); 2) individual counselling sessions using motivation interviewing techniques (to set personal goals for behavioral change based on eight New Moves objectives); 3) lunch get-togethers ("lunch bunches") once a week during the maintenance period where participants were served healthy food and engaged in informal discussions on New Moves topics; and 4) 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 the intervention and half-day training during the intervention. They also received regular, ongoing support from New Moves staff throughout the program. New Moves intervention staff ran all program components aside from the PE class. These staff received training and ongoing support in motivational interviewing Techniques.				African American, Hispanic)				parents were satisfied and 100% would recommend for other girls				
Williamson et al. (2007)	Healthy Eating and Exercise (HEE) program, designed with the goal of preventing inappropriate weight gain by modifying the school environment to improve healthy eating habits, increase physical activity, and decrease sedentary behavior at school and to encourage these same behavioral changes outside the school environment. The goal of the physical activity program was to increase physical activity during the school day and at home. Teachers were provided with 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 centers (PACs), and brief lesson plans provided academic games that used the supplies contained in the PACs.	NR	NR	NR	Predominately White	NR	NR	NR	NR	NR	Yes	NR	NR
Dishman et al. (2004)	Lifestyle Education for Activity Program (LEAP), a comprehensive school-based intervention that emphasized changes in instruction and the school environment. Designed to increase physical activity in high-school girls by creating a school environment that supported the unique physical activity needs and interests of adolescent girls. Aimed to increase girls' self-efficacy for physical activity, via physical education (PE), school environment, health education, school health services, faculty or staff health promotion, and parent and community involvement. The intervention staff assisted teachers to develop curricula designed to help adolescent girls enhance physical activity self-efficacy through successful experiences with physical activity both	All girls	NR	NR	White and African American	NR	NR	NR	NR	NR	NR		Urba., suburban and rural

Study Authors/ Year	Intervention Components	Sex Diff. (n=7)	Age Diff. (n=4)	SES (n=3)	Ethnic Diver. (n=3)	School Size (n=0)	Recent Immig. (n=0)	Relig. Practic. (n=0)	Partic. Prefer. (n=3)	Cost-effect. (n=1)	Equip. (n=0)	Local Champ. (n=2)	Urban or Rural (n=-0)
	inside and outside of school and develop physical and behavioral skills necessary to adopt a physically active lifestyle during the teenage years and to maintain it through adulthood. Teachers at each school developed behavioral skill instructional units that emphasized the acquisition and practice of self-regulatory behaviors (e.g. goal setting, time management, identifying and overcoming barriers, and self-reinforcement); the units were implemented in health education, biology, family and consumer science, or PE, depending on how each school provided health education. The PE component developed motor skills in a variety of physical activities that were popular with high-school girls including aerobics, weight training, dance, and self-defence using approaches that favored small groups and cooperative and successful learning experiences. In addition to facilitating non competitive mastery of skills, the instruction also used modeling of success, encouragement, and moderately intense exercise directed toward enhancing self-efficacy.												
Weeks et al. (2008)	10 min of directed jumping activity at the beginning of every physical education (PE) class (twice per week). Activities designed to apply loads to the skeleton at high strain magnitude, frequency, and rate, and 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 push ups and exercises with resistive latex bands (AusBand; Ausmedic Australia).	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

*Contextual variables = Data were abstracted from primary studies for the following variables: sex, age, socioeconomic status (SES), ethnicity, school size, recent immigration, religious practices, participation preferences, cost-effectiveness, equipment, local champion, and urban or rural setting. Text refers to variables that were factored into the statistical analysis at baseline and/or post intervention. For example, some studies stratified their results to assess for an interaction effect between intervention and age or gender etc. NR, not reported; PA, physical activity; CRF, cardiorespiratory fitness; Sig., statistically significant; Diff., difference; PE, physical education.

Appendix H. Applicability and Transferability Worksheet.

Factors	Questions	Notes
Applicability (feasibility)		
Political acceptability or leverage	<ul style="list-style-type: none"> • Will the intervention be allowed or supported in current political climate? • What will the public relations impact be for local government? • Will this program enhance the stature of the organization? <ul style="list-style-type: none"> ◦ <i>For example, are there reasons to do the program that relate to increasing the profile and/or create a positive image of public health?</i> • Will the public and target groups accept and support the intervention in its current format? 	<ul style="list-style-type: none"> • There is political will to increase physical activity levels in children, as evidenced by: • The Ministry of Health and Long Term Care's priority to decrease childhood obesity (i.e., Healthy Kids Strategy); • The Ministry of Education's mandate for Daily Physical Activity; • The Ontario Public Health Standards; • The Canadian physical activity guidelines; and • Peel's focus on Supportive Environments for Healthy Living. • To intervene at the school level, Public Health should be cognisant of the current financial and temporal constraints faced by schools and school boards - changing/enhancing the curriculum will be challenging.
Social acceptability	<ul style="list-style-type: none"> • Will the target population find the intervention socially acceptable? Is it ethical? <ul style="list-style-type: none"> ◦ <i>Consider how the program would be perceived by the population.</i> ◦ <i>Consider the language and tone of the key messages.</i> ◦ <i>Consider any assumptions you might have made about the population. Are they supported by the literature?</i> ◦ <i>Consider the impact of your program and key messages on non-target groups.</i> 	<ul style="list-style-type: none"> • Increasing physical activity is perceived as valuable and ethical, however there is some uncertainty as to how parents will accept and support a school-based physical activity initiative. For example, some immigrant families don't recognize the value of play, and others don't view PA as part of the school climate as it's not related to academics. • Parent engagement/advocacy is critical for fostering physical activity opportunities in schools - a clear and consistent message is needed so parents understand the importance of activity on children's physical, psychological and academic well-being. • Some schools do not seek physical activity support from Peel public health nurses as they don't view it as a priority in their schools. • Winter months are a barrier as there is less opportunity for students to be active.
Available essential resources (personnel and financial)	<ul style="list-style-type: none"> • Who/what is available/essential for the local implementation? • Are they adequately trained? If not, is training available and affordable? • What is needed to tailor the intervention locally? • What are the full costs? <ul style="list-style-type: none"> ◦ <i>Consider: in-kind staffing, supplies, systems, space requirements for staff, training, and technology/administrative</i> 	<ul style="list-style-type: none"> • Each school board has access to a physical activity content expert. • Half of Peel schools have a physical activity specialist teacher. • There are existing venues to educate teachers on physical activity; Peel Health facilitates workshops/conferences/trainings that support teachers on the physical education curriculum and Daily Physical Activity (e.g., "keep fit and be active"). • The Ontario Physical and Health Education Association (OPHEA) provides teachers with educational materials and Daily Physical Activity (DPA) support. • Peel PHN's provide ongoing physical activity support to schools, if requested.

	<p><i>supports.</i></p> <ul style="list-style-type: none"> • Are the incremental health benefits worth the costs of the intervention? <ul style="list-style-type: none"> ◦ <i>Consider any available cost-benefit analyses that could help gauge the health benefits of the intervention.</i> ◦ <i>Consider the cost of the program relative to the number of people that benefit/receive the intervention.</i> 	<ul style="list-style-type: none"> • There is opportunity for parents to advocate to trustees for having more physical education specialists in schools. • A population health approach that applies effective interventions across all school boards will be necessary to reach all Peel school-aged children. • Existing partnerships between CDIP and Family Health divisions and school boards may leverage collaborative multi-pronged strategies at the school level - positive partnerships will play a significant role in implementing school-based interventions.
Organizational expertise and capacity	<ul style="list-style-type: none"> • Is the intervention to be offered in line with Peel Public Health's 10-Year Strategic Plan (i.e., 2009-2019, 'Staying Ahead of the Curve')? • Does the intervention conform to existing legislation or regulations (either local or provincial)? • Does the intervention overlap with existing programs or is it symbiotic (i.e., both internally and externally)? • Does the intervention lend itself to cross-departmental/divisional collaboration? • Any organizational barriers/structural issues or approval processes to be addressed? • Is the organization motivated (learning organization)? <ul style="list-style-type: none"> ◦ <i>Consider organizational capacity/readiness and internal supports for staff learning.</i> 	<ul style="list-style-type: none"> • There is cross-cutting divisional expertise and capacity among CDIP and Family Health staff. • A school-based physical activity strategy will complement the Supportive Environments for Healthy Living and Nurturing the Next Generation program priorities outlined in Peel Public Health's 10-Year Strategic plan. • A physical activity intervention may overlap with existing programs depending on the objectives set out for the intervention. The objectives can be any of the following: improve physical activity levels, independent of reducing sedentary time or vice versa, or focus on improving both outcomes. The approach can lend itself to cross-divisional collaboration, with Family Health targeting children 6 years and younger and CDIP targeting children 6 to 18 years of age.
Transferability (generalizability)		
Magnitude of health issue in local setting	<ul style="list-style-type: none"> • What is the baseline prevalence of the health issue locally? • What is the difference in prevalence of the health issue (risk status) between study and local settings? <ul style="list-style-type: none"> ◦ <i>Consider the Comprehensive Health Status Report, and related epidemiological reports.</i> 	<ul style="list-style-type: none"> • Peel estimates for physical activity: In 2011, 41% of Peel grade nine students failed to meet current standards of acceptable cardiorespiratory fitness and 76% had musculoskeletal fitness levels that were associated with 'some' to 'considerable' health risks.¹ • Peel estimates for sedentary time: Students in grades 7-12 spent a large portion of their day being sedentary, including watching TV, playing video games, and surfing the internet using computers and cell phones. • Canadian estimates for physical activity: 7% of children age five to 11 and youth age 12 to 17 meet Canada's guidelines of 60 minutes of moderate to vigorous physical activity (MVPA) per day².

		<ul style="list-style-type: none"> Peel data gaps: Unclear how many minutes per day of physical activity Peel students are achieving.
Magnitude of the “reach” and cost effectiveness of the intervention above	<ul style="list-style-type: none"> Will the intervention appropriately reach the priority population(s)? <ul style="list-style-type: none"> What will be the coverage of the priority population(s)? 	<ul style="list-style-type: none"> The potential reach is considerable: In total, the two boards serve 156,900 elementary school students and 75,100 secondary school students. Cost-effectiveness of interventions has not been reviewed.
Target population characteristics	<ul style="list-style-type: none"> Are they comparable to the study population? Will any difference in characteristics (e.g., ethnicity, socio-demographic variables, number of persons affected) impact intervention effectiveness locally? <ul style="list-style-type: none"> <i>Consider if there are any important differences between the studies and the population in Peel (i.e., consider demographic, behavioural and other contextual factors).</i> 	<ul style="list-style-type: none"> Peel’s target population characteristics are comparable to most study populations, given most interventions targeted elementary school-aged boys and girls in the United States, Europe, Australia and Canada.
<p>Proposed Direction (after considering the above factors):</p> <ol style="list-style-type: none"> Support and promote school-based physical activity interventions in elementary school children. Implement, at a minimum, both printed educational materials and changes to the school curriculum that promote physical activity during school hours. At this time, no recommendations from this paper can be made for secondary school-aged youth. 		

Worksheet adapted from: Buffet C., Ciliska D., and Thomas H. National Collaborating Centre for Methods and Tools. November 2007. *Can I Use this Evidence in my Program Decision? - Assessing Applicability and Transferability of Evidence.*