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A Review of the Evidence: School-based Interventions to Address Obesity Prevention in Children 6-12 Years of Age



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EXECUTIVE SUMMARY

Childhood obesity is a key public health concern, given its dramatic rise in many countries over the past decade and accompanying negative health and economic consequences (Harris et al., 2009; Bodkin et al., 2009). Although rates are slowing or levelling out in some age groups in some countries, childhood obesity rates continue to rise in Canada (Waters et al., 2011).

Childhood obesity is known to be an independent risk factor for adult obesity (Parsons et al., 1999; Lissau, 2006; Foltz et al., 2012) and once a child is obese, it is difficult to reverse through interventions (Waters et al., 2011). This suggests an urgent need to address overweight and obesity levels in childhood (Kesten et al., 2011; Waters et al., 2011). Although the causes of obesity remain complex, prevention still offers a less expensive approach as opposed to treatment (Kesten et al., 2011). Interventions that change the wider 'obesogenic environment' related to physical activity and/or nutrition have been recommended (Butland et al., 2007; De Bourdeaudhuij et al., 2011). Obesity prevalence is also closely linked to social inequality; therefore, it is essential that in preventing obesity we are also reducing the gap in health inequalities (Monteiro et al., 2004).

Experience in several countries has shown that successful obesity prevention during childhood can be achieved through a combination of population-based initiatives (WHO, 2010). Schools are an ideal setting for interventions that support healthy behaviours (Kropfski, 2008; Brown and Summerbell, 2008; CDC, 2011) and can also potentially reach most school age children of diverse ethnic and socioeconomic groups (Van Cauwenberghe et al, 2010). The Institute of Medicine recommends that schools be a national focal point for obesity prevention (Institute of Medicine, 2012).

This review, following the *evidence-informed decision making* process developed by the National Collaborating Centre for Methods and Tools (NCCMT), expands and updates the evidence base for diet and physical activity-based interventions to prevent obesity in school children. This evidence will inform recommendations to guide Toronto Public Health (TPH) in planning, implementing and evaluating obesity prevention interventions.

The first step of the *evidence-informed decision making* process is to define the question or problem. The process of defining the question involves detailing the population, intervention, comparator and outcome(s). To determine the scope of this review, the Chronic Disease and Injury Prevention management team initially defined the research questions, one related to healthy weights and obesity prevention, and the second, physical activity participation. Although these two questions began as separate reviews, they were merged because of content overlap. The new question became "What school-based programs are effective in low-income communities/neighbourhoods to address risk factors related to obesity in children ages 6-12?"

The second step of the *evidence-informed decision making* process is to search. A systematic review of the literature was conducted through a library search of various

electronic databases for the years 2007 to May 2012. The search concentrated on the top four levels of evidence as determined by the NCCMT evidence pyramid (systems, summaries, synopses of syntheses and syntheses) as the aim was to compile the best available evidence in its most highly synthesized form. The following databases were used during the search: Guideline Advisory Committee, National Guidelines Clearinghouse, Turning Research into Practice (TRIP) Database, Health Evidence, Centre for Reviews and Dissemination, Eppi-Centre, Cochrane Collaboration and PubMed Clinical Queries. Some documents were also obtained from key stakeholder discussions. Primary inclusion criteria were used to screen articles. Articles included had to reflect the research question, be published in English within the last 5 years, and consist of interventions focusing on prevention versus treatment. Secondary relevance criteria filtered articles that met the age requirement of 6 to 12 years, took place in school settings and focussed on low-income/minority/high-priority/high-risk populations.

The third step of the *evidence-informed decision making* process is to appraise. Quality assessments of the systematic reviews were obtained through health-evidence.ca and three reviewers used the Appraisal of Guidelines for Research & Evaluation (AGREE) II instrument to assess the methodological quality of the two identified guidelines. A total of 9 systematic reviews and 2 guidelines were selected. Six were rated as being of high quality, while 5 of the remaining documents were of moderate quality. The 9 systematic reviews represent 410 articles that describe 364 separate interventions.

The fourth step of the *evidence-informed decision making* process is to synthesize the research evidence into "actionable messages". In order to make final recommendations, relevant data were extracted from the reviews and guidelines and then further categorized into review characteristics or review outcomes. These results from the systematic reviews were used along with the findings and recommendations from the National Institute for Health and Clinical Health Excellence (NICE) guideline. Since the Centers for Disease Control and Prevention (CDC) guideline did not provide sufficient detail of their findings, it was not used when recommendations were developed; but only used as supporting arguments.

The recommendations developed for this report are divided by themes – **setting and audience, multi-risk approach, multi-component approach, dietary-based interventions, physical activity-based interventions and other intervention components.**

In terms of **setting and audience**, obesity prevention interventions are recommended within the school setting for children 6-12 years of age for mixed gender groups. This review evidence demonstrates that interventions targeting children from low socio-economic backgrounds can positively impact physical activity levels and dietary intake. This may highlight the need to focus on specific neighbourhoods when planning obesity prevention interventions. The importance of targeting all children versus only high risk populations who are already overweight or who have risk factors of becoming overweight is also emphasized in this review.

This review evidence demonstrates that obesity prevention interventions should always address both diet and physical activity (**multi-risk**) in order to improve anthropometric measures, as well as physical activity levels.

Multi-component school-based obesity prevention programs combining behavioral, environmental, and educational components including health education, enhanced physical education, and promotion of healthy food options are also effective. In particular, any education component included in an intervention should be multi-risk and should not be delivered in isolation of other components. Overall, evidence demonstrates that a multi-component "whole-school approach" or the "Healthy Schools Approach" is effective in addressing obesity prevention.

Dietary-based interventions implemented alone to improve anthropometric measures are not effective however, dietary-based interventions to improve dietary intake and/or behaviour (vs. anthropometric measures alone) are effective. Environmental or policy-based interventions such as breakfast and/or fruit and vegetable distribution programs, either alone or as part of a multi-component intervention, are shown to improve dietary intake. These environmental or policy-based interventions can improve anthropometric measures but only when part of a multi-component intervention.

This review evidence demonstrates that school-based obesity prevention interventions should incorporate **physical activity**. In particular, interventions should focus on extending physical education classes, incorporating activity breaks, and reducing sedentary behaviours to improve anthropometric measures. Activity breaks are one strategy that has a positive impact not only on anthropometric measures but also on physical activity measures. Environmental or policy-based interventions such as playground game equipment or playgrounds painted with fluorescent markings are also shown to increase physical activity levels. When interventions focused on curriculum only, physical activity levels do not increase. Additionally, fitness enhancement is shown to be ineffective in improving anthropometric measures.

This review evidence also highlights **other intervention components** that are effective such as implementing programs for at least 3 months; employing a combination of school staff and intervention specialists to implement programs; incorporating psychosocial/psychoeducational components; involving peer leaders; using incentives to increase fruit and vegetable consumption; and involving family. Also, when planning, implementing, and evaluating obesity prevention interventions, the harm or unintended effects must also be considered. Programs should implement safeguards and regularly evaluate intended outcomes and unintended consequences.

The fourth, fifth and sixth steps of the *evidence-informed decision making* process are to adapt, implement and evaluate. Identified TPH staff will be involved in these three steps. The adaptation step will involve using an Applicability and Transferability Tool to apply the evidence-based recommendations to current practices within TPH. Current programming will also be analyzed to determine the level to which it is supported by the evidence and gaps. The resulting directions will then be implemented and evaluated.

RECOMMENDATIONS

The following recommendations were informed by the evidence presented in 9 systematic reviews and one guideline by the National Institute of Health and Clinical Excellence (see Appendix A for the rationale). These recommendations will guide Toronto Public Health in planning, implementing and evaluating obesity prevention interventions for children 6-12 years of age within the school setting.

The systematic reviews used to develop these recommendations reported their findings according to outcome measures (i.e. behavioural outcomes and/or anthropometric measures). Because of this, specific outcome measures are identified in some of the following recommendations.

These recommendations are based on evidence addressing the primary prevention of obesity and low socio-economic status.

Setting and Audience:

- TPH should implement obesity prevention interventions in the **school setting**.
- TPH should implement obesity prevention interventions targeting children **aged 6–12** (elementary school aged).
- TPH should deliver obesity prevention interventions to **mixed gender groups**.
- TPH should implement obesity prevention interventions in schools in **lower socio-economic neighbourhoods** to increase physical activity levels and improve dietary intake.
- TPH should implement obesity prevention interventions that **target all children** versus interventions that target high risk populations who are already overweight or have risk factors of becoming overweight.

Multi-risk Approach:

- TPH should implement a combination of physical activity and dietary-based interventions **to improve anthropometric measures as well as physical and dietary behaviours**.

Multi-component Approach:

- TPH should incorporate a multi-component approach to obesity prevention including **behavioral, environmental, and educational components** including

health education, enhanced physical education, and promotion of healthy food options. In particular, the education component should be multi-risk.

- TPH should not implement either physical activity or dietary-based **education** in isolation due to its limited impact as an obesity prevention intervention.

Dietary-based Interventions:

- TPH should not implement dietary-based interventions alone **to improve anthropometric measures**.
- TPH should implement dietary-based interventions **to improve dietary intake and/or behaviour** (vs. anthropometric measures alone).
- TPH should implement environmental or policy-based interventions such as breakfast and/or fruit and vegetable distribution programs **to improve dietary intake**.
- TPH should not implement environmental or policy-based interventions focussing on system-wide nutritional change **to improve anthropometric measures**.

Physical Activity-based Interventions:

- TPH should implement physical activity-based interventions that decrease sedentary behaviours **to improve anthropometric measures**.
- TPH should implement physical activity-based interventions that focus on extended physical education classes and activity breaks **to improve anthropometric measures**.
- TPH should not implement physical activity-based interventions involving fitness enhancement **to improve anthropometric measures**.
- TPH should implement physical activity-based interventions **to increase physical activity** measures including physical activity and /or sedentary levels. The use of activity breaks is one intervention that has been shown to be successful.
- TPH should not implement physical activity curriculum alone **to increase physical activity levels**.
- TPH should implement environmental or policy-based interventions **to increase physical activity levels** (e.g., playground game equipment and activity cards

provided, playground painted with fluorescent marking designs and games by students).

Other Intervention Components:

- TPH should include **psychosocial/psychoeducational components** in physical activity and dietary-based interventions (e.g. activities increasing knowledge/attitudes/preferences, self-esteem, well-being and/or quality of life).
- TPH should implement physical activity and/or dietary-based interventions **lasting at least 3 months.**
- TPH should incorporate a **family component** into all obesity prevention interventions.
- TPH should aim for a **high level of parental involvement** in obesity prevention interventions (e.g. behaviour change goal for parents).
- TPH should use **peer leaders** in interventions focussing on obesity prevention.
- TPH should use **incentives** in interventions focussing on increasing fruit and vegetables consumption (e.g. rewards provided when fruit and vegetable servings are eaten at school).
- TPH should continue to **partner with school staff and intervention specialists** in the school setting in order to maximize the impacts of obesity prevention interventions.

Overall, TPH should **address harm or unintended effects** when planning, implementing and evaluating obesity prevention interventions.

INTRODUCTION

Childhood obesity is a key public health concern, given its dramatic rise in many countries over the past decade and accompanying negative health consequences (Harris et al., 2009). Although, rates are slowing or levelling out in some age groups in the United States, Australia and some European countries, childhood obesity rates continue to rise in countries such as Mexico, India, China and Canada (Waters et al., 2011). Overweight and obesity is the fifth largest global risk factor for mortality (WHO, 2010).

In Canada, in 1978/79, 12% of 2 to 17 year olds were overweight, and 3% were obese (Shields, 2006). In 2004, the overweight rate for this same age group increased to 18% and 8% respectively (Shields, 2006). The obesity rate in Toronto for ages 2-17 years was 10% and 18.5% for overweight in the same age group (Shields and Tjepkema, 2006). The most recent Canadian Health Measures Survey (2007-09) indicates that more than 1 in 4 Canadian children and youth are considered to be overweight or obese. About 17% of children and youth aged 6 and older have a BMI that falls into the overweight category and 9% are obese (Statistics Canada, 2010).

The health risks of being overweight or obese have been well documented and include cardiovascular diseases (such as coronary artery disease and stroke), diabetes, hypertension, osteoarthritis, certain cancers and gallbladder disease (Ministry of Health Promotion, 2010; Bodkin et al., 2009). This growing trend is likely to result in significant increases in the rates of chronic diseases and may result in the first ever decline in life expectancy in the developed world (Olshansky et al., 2005).

Obesity not only increases health risks but also results in social and economic consequences. Obesity has been shown to diminish a child's quality of life and is associated with decreased self-esteem and depressive symptoms. Obese children are often exposed to teasing, discrimination, victimization and social exclusion (Katz, 2008). Childhood obesity is also linked with school absenteeism and poor school performance (Foltz et al., 2012). In a May 2009 report, direct and indirect health care costs in Ontario were estimated to be \$1.6 billion annually and \$4.3 billion annually in Canada (Bodkin et al., 2009).

Childhood obesity is also known to be an independent risk factor for adult obesity (Parsons et al., 1999; Lissau, 2006; Foltz et al., 2012) resulting in long-term negative consequences. Once a child is obese, it is difficult to reverse through interventions (Waters et al., 2011). This suggests an urgent need to address overweight and obesity levels in childhood (Kesten et al., 2011; Waters et al., 2011). The UK government's think-tank, Foresight, describes obesity as the result of complex interactions between 'individual biology, eating behaviours and physical activity, set within a social, cultural and environmental landscape' (Butland et al., 2007). This complexity explains why treatment and prevention strategies following simple recommendations for reducing energy intake and increasing energy expenditure are often unsuccessful. To add to this complexity, researchers have targeted these lifestyle behaviours and as a result, the

evidence linking interventions to obesity outcomes have been limited because of the diversity of initiatives implemented and measurements used for obesity outcomes (Kamath et al., 2008).

Although the causes of obesity remain complex, prevention still offers a less expensive approach as opposed to treatment (Kesten et al., 2011). Therefore, there is a need to develop interventions to reduce the prevalence of obesity in children before they reach adulthood. Historically, most initiatives have focussed on health education to increase knowledge, awareness, attitudes and motivation (De Bourdeaudhuij et al., 2011). These interventions often focused on either nutrition or physical activity separately, and have shown low to modest effects on behaviour and minimal effects on BMI (Hardeman et al., 2000). In recent years, interventions that take into account the wider 'obesogenic environment' (Butland et al., 2007) have been recommended. As a result, interventions focusing on changing the environment related to physical activity and/or nutrition have been developed in order to improve healthy behaviours (De Bourdeaudhuij et al., 2011).

Obesity prevalence is also closely linked to social inequality, with greater inequality associated with a higher risk of obesity in most developed countries (Monteiro et al., 2004). It is therefore essential that in preventing obesity we are also reducing the gap in health inequalities. The evidence regarding the appropriate public health interventions to reduce the risk of obesity across the whole population, or targeted towards those at greatest risk, still remains limited. "The impact of interventions on preventing obesity, the extent that they work equitably, their safety and how they work, remains poorly understood" (Waters et al., 2011).

Experience in several countries has shown that successful obesity prevention during childhood can be achieved through a combination of population-based initiatives, both at the national level and as part of local 'settings-based' approaches, in particular, school and community-based programs (WHO, 2010). Schools are an ideal setting for interventions that support healthy behaviours as the majority of children are schooled outside the home. Schools provide an established infrastructure, a safe and supportive physical environment, policies, curricula and staff that can offer continuous, intensive contact with children (Kropski, 2008; Brown and Summerbell, 2008; CDC, 2011). School-based interventions can also potentially reach most school age children of diverse ethnic and socioeconomic groups (Van Cauwenberghe et al, 2010). A recently released Institute of Medicine (IOM) report identifies five critical areas or environments for change. The IOM recommends that schools be a national focal point for obesity prevention by requiring quality physical education and opportunities for physical activity in schools; ensuring strong nutritional standards for all foods and beverages sold or provided through schools; and ensuring food literacy, including skill development, in schools (Institute of Medicine, 2012).

As mentioned, studies in high-income countries have shown that obesity prevalence is higher in children from lower socioeconomic (SES) groups (Monteiro et al., 2004). Some evidence suggests that obesity prevention efforts may benefit more children from higher SES groups and this is partially explained by less parental engagement from lower SES groups in school-based programs (WHO, 2010). In order to avoid exacerbating SES

inequalities, interventions targeting schools in lower SES areas may be required (WHO, 2010). Targeting both, children and their parents or caregivers may be more effective than implementing obesity interventions for children alone (Seo and Sa, 2010).

Because of the magnitude of health impacts of obesity, Toronto Public Health embarked on this review of the literature to determine evidence-based approaches that could potentially impact rates of obesity in Toronto's children aged 6-12.

METHODOLOGY

To determine the scope of this review, the Chronic Disease and Injury Prevention management team initially defined the research questions. These questions were identified as priorities for Toronto Public Health. This review details two of the questions identified related to healthy weights and obesity prevention, and secondly, physical activity participation. Although these two questions began as separate reviews, it became apparent that there was considerable content overlap and that the same results set addressed all relevant outcomes. As such, a decision was made to merge the two reviews. Below, the research questions, search, and screening process are outlined in more detail.

Research Questions

Research Question 1:

"What interventions or strategies are most effective in low-income communities/neighbourhoods to address risk factors related to obesity?"

<p>P: Low-income communities I: Best Intervention C: N/A O: Factors influencing healthy weights and obesity prevention</p>
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Research Question 2:

"What school-based programs are effective in increasing physical activity participation in higher needs schools?"

<p>P: Children in higher needs schools I: School-based physical activity programs C: N/A O: Increasing participation in physical activity</p>

Literature Search

A literature search for the proposed research questions in this rapid review was initially conducted using the *Resources to Guide & Track Your Search* tool (Available at: <http://health-evidence.ca/tools/show/12>) developed by Health Evidence. Various electronic databases were searched for guidelines and systematic-reviews from 2007 to May 2012:

- Guideline Advisory Committee (GAC)
- National Guidelines Clearinghouse (NGC)
- Turning Research into Practice (TRIP) Database (Guidelines and Systematic Reviews)
- Health Evidence
- Centre for Reviews and Dissemination (CRD)
- Eppi-Centre
- Cochrane Collaboration
- PubMed Clinical Queries

The following search terms were employed for best evidence around obesity prevention in low-income communities: "obesity"; "obesity and low-income"; "obesity and low-income and nutrition and physical activity". The following key phrase was used to search best available interventions to increase school-based physical activity participation in higher needs schools: "school and physical activity and programs and high risk".

Assessing Evidence Relevance

Each research question established its unique relevance criteria based on the topic of interest.

Research Question 1:

Once duplicates were removed, a total of 393 reviews/guidelines were screened based on titles and abstracts by two public health staff (JC, YG). The primary inclusion criteria reflected the research question, published in English within the last 5 years, and consisted of interventions focusing on prevention versus treatment. Three hundred twenty nine articles were identified as non-relevant based on the title and abstract screening, resulting in 64 articles as potentially relevant for full document assessment. Reviewers further removed 11 additional guidelines and protocols. The guidelines were removed as they provided recommendations that were too general for the previously stated PICO (Population, Intervention, Comparator, and Outcome) questions. The protocols were removed as developments of full systematic reviews are still in progress. Due to Toronto Public Health's interest in exploring more intensive interventions for children within the school setting, secondary relevance criteria was applied to further filter the search process. Prior to assessing the full documents based on the secondary relevance criteria, reviewers included the Obesity guideline developed by the National

Institute for Health and Clinical Excellence (NICE), where the most recent update found to date was published in the year 2006. This guideline was included in developing recommendations because of its high quality, relevance to the research question, and its repeated inclusion in other reviews. Using the secondary relevance criteria, a full document assessment was undertaken in which 15 documents were removed as they did not meet the age requirement from senior kindergarten (SK) to grade 8 (ages 6 to 12 years), 13 were removed as they did not take place in a school setting, and 17 were removed as they did not focus on low-income/minority/high-priority/high-risk populations. To create consistency with age categorization for the purpose of this report, reviewers labelled ages 0-5 years as "infant/pre-school"; 6-12 years as "children"; and 13-18 years as "adolescents". A total of 9 articles, 8 systematic reviews and one guideline, were acquired for quality assessment (See Figure 1).

Research Question 2:

A total of 153 documents were obtained after removing duplicates from the 4 levels of public health evidence: Systems, Summaries, Synopses of Syntheses, and Syntheses. One hundred twenty-two documents were removed based on title and abstract screening by a public health staff (PW), applying the same primary relevance criteria as the first research question, but with the context of exploring best available evidence in increasing physical activity participation through school-based programs in higher needs schools. Relevance assessments for 31 full documents were conducted; 20 documents were removed based on not meeting the low socioeconomic status/minority criterion, 1 document was removed as it did not have physical activity as an outcome, and 4 were removed as they focused on treatment as opposed to primary prevention. A total of 6 documents, 5 systematic reviews and one guideline, were selected for quality assessment (See Figure 2).

Quality Assessment of Systematic Reviews

Quality assessments of the systematic reviews were obtained through health-evidence.ca, which uses a ten-point quality assessment tool (available at: http://www.health-evidence.ca/downloads/QA%20tool_Doc%204.pdf). All review assessments obtained have been pre-rated by two reviewers from the health-evidence.ca registry with each reviewer having independently assessed the tool with disagreements resolved through discussion. The ten criteria used to assess methodological quality were: (1) a clearly focused question; (2) inclusion criteria explicitly stated; (3) comprehensive search strategy; (4) adequate number of years covered in the search; (5) description of level of evidence; (6) assessment of the methodological rigour of primary studies; (7) methodological quality of primary studies assessed by two reviewers and results given; (8) tests of homogeneity or assessment of similarity of results conducted and reported; (9) appropriate weighting of primary studies; and (10) author's interpretation of results supported by the data. Each criterion, worth one point each, was given equal weight in the overall assessment score. The overall score out of 10 classified reviews into three categories: Strong, Moderate, and

Weak. Reviews receiving an overall rating of eight or more were considered strong, those with a score of five to seven, moderate, and those with four or less, weak.

Quality Assessments of the Guidelines

Two to three reviewers (RT, JC, PW, YG) used the Appraisal of Guidelines for Research & Evaluation (AGREE) II instrument (available at: <http://www.agreetrust.org/>) to assess the methodological quality of each identified guideline. All guidelines were assessed independently by two reviewers and arising disagreements were resolved through discussion with the third reviewer. Twenty-three key items organized within 6 domains were used to assess methodological quality using a 7 point response scale (1-strongly disagree to 7-strongly agree). The 6 domains used in the assessment were: (1) Scope and Purpose; (2) Stakeholder Involvement; (3) Rigour of Development; (4) Clarity of Presentation; (5) Applicability; and (6) Editorial Independence. The overall quality assessment of each guideline was determined by adding the scores of each reviewer and compiling the reviewers' overall decision regarding whether the guideline should be used. Reviewers further categorized the quality point response scale with a score of 6 or more as strong, those with a score of 5 to 3, moderate, and those with 3 or less, weak. This was decided by the reviewers at their own discretion to create consistency in the way quality assessment was reported for the systematic reviews and guidelines.

Merging of the Review Process to Combine Questions

Due to the overlapping themes between the two research questions, a total of 12 systematic reviews and 2 guidelines acquired from each of the two independent searches were combined for data extraction. Prior to extracting data, duplicates of reviews and guidelines were screened. In total, 4 systematic reviews were removed; two based on duplication, one due to its low quality assessment rating, and one being an umbrella review that compiled information based on systematic reviews that were incorporated only as selected documents to be analysed for a report. Quality ratings for the finalized reviews and guidelines included in this report were either moderate or high in quality (see Appendix B: Quality Assessment Summary).

After merging the two research questions, the new PICO question was "What school-based programs are effective in low-income communities/neighbourhoods to address risk factors related to obesity in children ages 6-12?"

Data Extraction

Review characteristics and all outcome data were extracted from all included systematic reviews in this report and organized into a matrix table. Additional tables were then created according to the most prominent review characteristics and outcomes, to further

summarize and present the data addressing the research question. The extracted review characteristics included author and year of publication, author's country, theoretical basis of the intervention, settings, target audience, length of intervention, the mode of delivery, the provider, parent/guardian involvement, and methodological quality rating (see Appendix C: Review Characteristics). The outcome data included outcome measures, results, general implications, and additional comments/limitations. As for the guidelines, since they presented a set of recommendations as their result, the recommendations were extracted along with any relevant results in the form of data, the organization, year of publication, organization's country, and methodological quality rating. This data is presented in Appendix D.

Figure 1

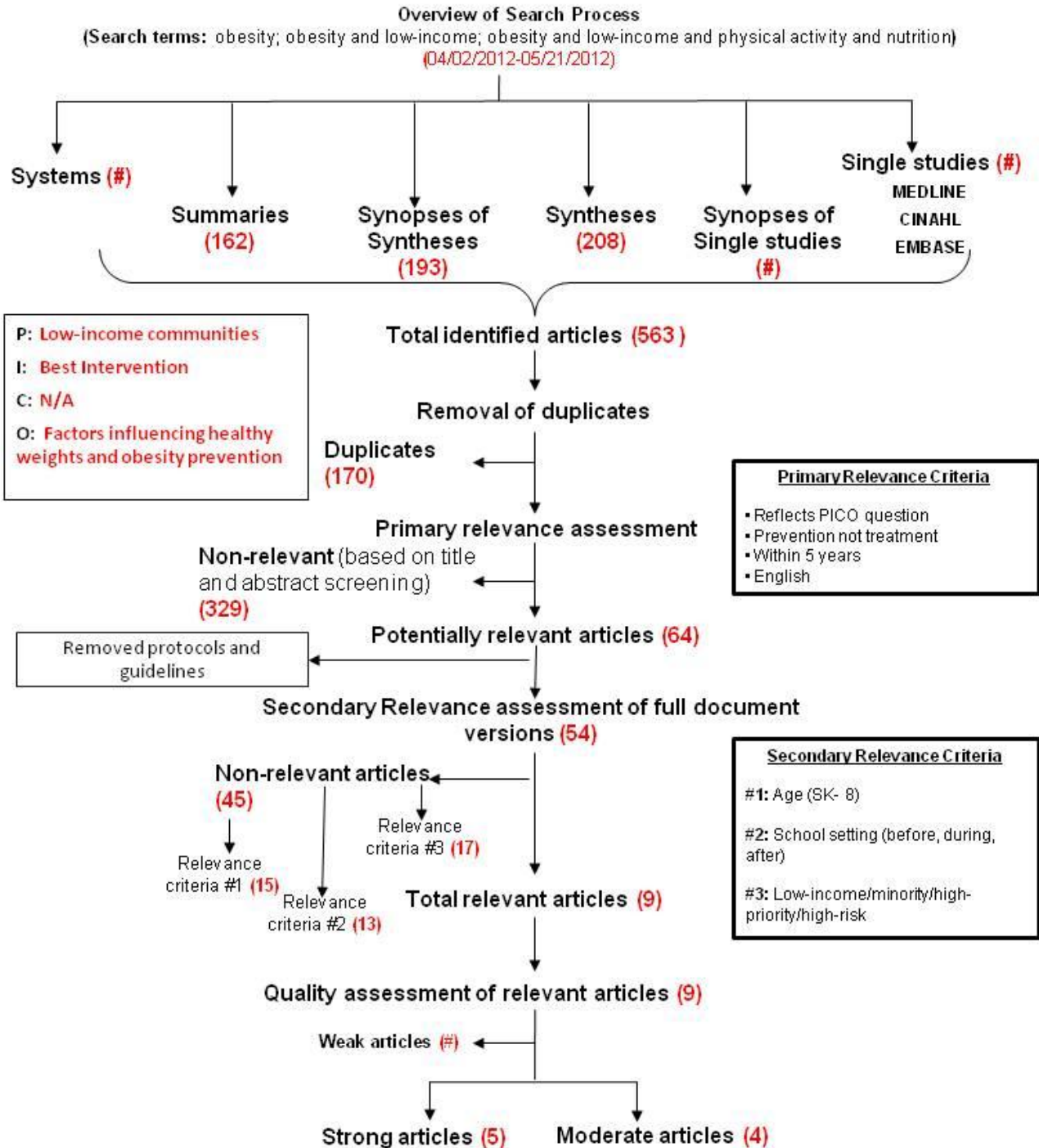
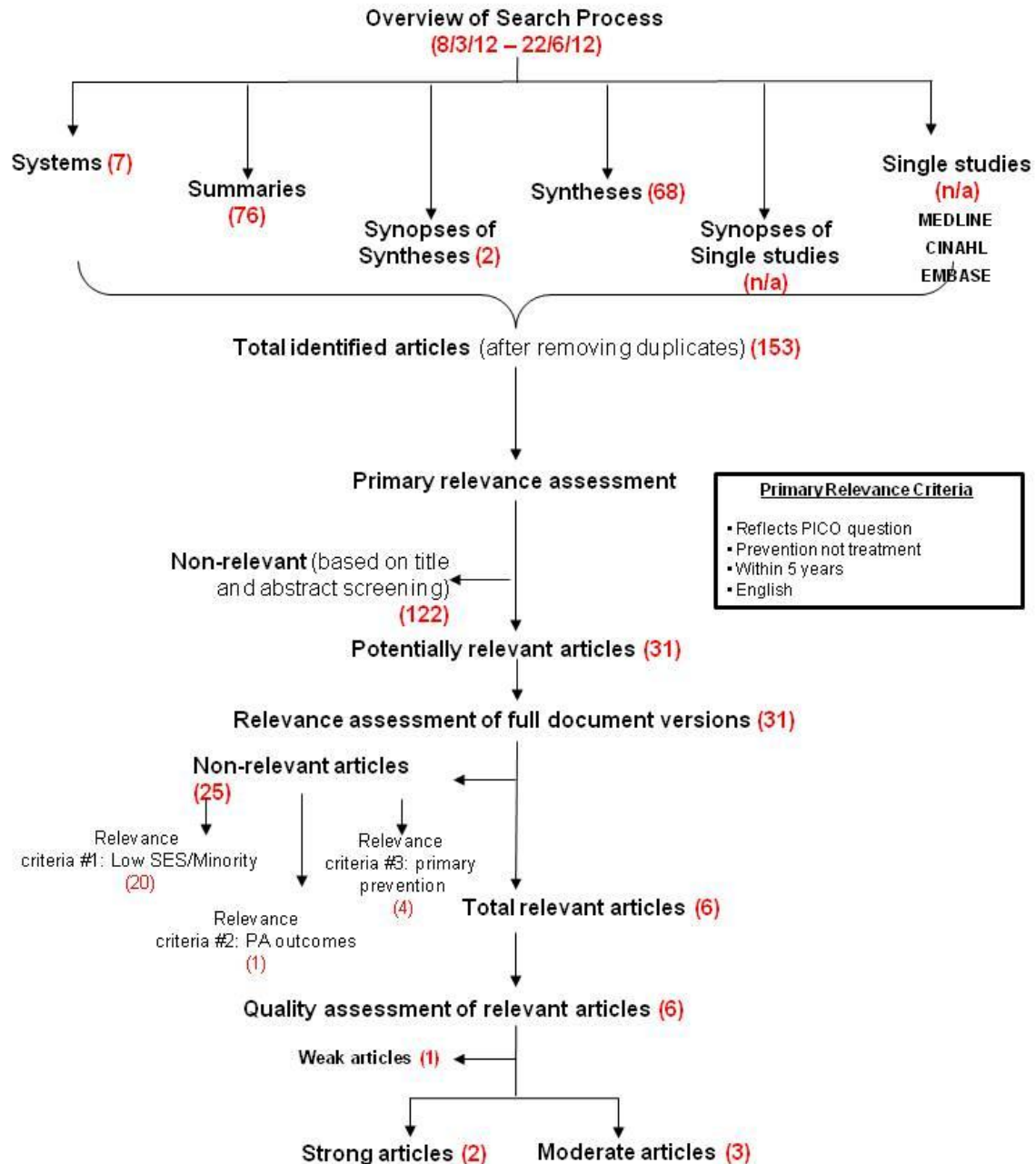


Figure 2



Have you used this tool? We would appreciate hearing from those who have used the tool, perspectives on its usefulness, how it was adapted, and any suggestions for revision: www.health-evidence.ca/account/contactus

How to cite this tool: Health-evidence.ca. (2009, November 25). *Keeping Track of Search Results: A Flowchart*. Retrieved [insert date you downloaded this document e.g., January 13, 2010], http://www.health-evidence.ca/publictools/10/Keeping_Track_of_Search_Results_-_A_Flowchart.ppt.

RESULTS

A total of 9 systematic reviews and 2 guidelines were selected after merging the two research questions for this rapid review. Six of the selected documents were rated as high quality, while 5 of the remaining documents were of moderate quality.

The two guidelines, one by the National Institute of Health and Clinical Excellence (NICE) and the other by the Centre for Disease Control and Prevention (CDC), were not included in summarizing the results below. The NICE guideline was included based on its relevance to the research questions and consistency with the results of this review, although it did not meet the time frame inclusion criteria. Therefore, the NICE guideline was used when developing the recommendations. The CDC guideline was not used when developing the recommendations, since outcome data was not provided in the guideline, making it unclear as to the origin of the recommendations presented. However, the guideline was used as supporting evidence for discussion.

Characteristics:

This review synthesizes the results of 2 well done guidelines from the UK and the US and 9 well done systematic reviews. The 9 systematic reviews represent 410 articles that describe 364 separate interventions implemented in many parts of the world.

The systematic review locations, as identified by the corresponding author, were the United States (1), United Kingdom (3), Australia (3), Spain (1) and the Netherlands (1).

Of the nine included systematic reviews, 5 did not identify the theoretical basis of the single reviews. In the other 4 reviews, the theories mentioned most frequently were: the Transtheoretical model (Waters et al. , 2011, Camacho-Minano et al, 2011, Nguyen et al, 2010,), and Social Cognitive Theory (Waters et al, 2011, Nguyen et al, 2010 and Van Cauwenberghe et al, 2010). The Transtheoretical model suggests that individuals progress through six stages (pre contemplation, contemplation, preparation, action, maintenance, and termination) to enable health behaviour change and the individual's stage of change must match the messages in order to be effective in changing behaviour (Prochaska et al., 1997). Social Cognitive Theory suggests that motivations and actions are controlled by thought, and that in order for behaviour change to occur, an individual will anticipate an outcome by considering: perceived self-efficacy (the belief in one's capabilities); situation-outcome (belief that consequences will occur without interfering personal action); and action-outcome (belief a behaviour will lead to an outcome) (Bandura et al., 1982; Luszczynska et al., 2005). Other mentioned theories included Environmental Change Theory (Waters et al, 2011), Socioecological Theory (Waters et al, 2011, Camacho-Minano et al, 2011), Social Learning Theory (Waters et al, 2011), Health Promotion Theory (Waters et al, 2011, Camacho-Minano et al, 2011), Theory of Planned Behaviour (Van Cauwenberghe et al, 2010), Self-Determination Theory (Camacho-Minano et al, 2011), Theory of Meaning of Behaviour (Camacho-

Minano et al, 2011), Social Action Theory (Camacho-Minano et al, 2011) and Youth Development and Resiliency-based Approaches (Waters et al, 2011).

An inclusion criterion for this review was that the target population included children aged 6 – 12. The ages represented in the included reviews were reported in multiple ways. Some reviews identified children >12 and adolescents as >12 (including middle schools 11 – 14) (Waters et al, 2011, van Sluijs et al, 2007, Van Cauwenberghe et al, 2010, and Salmon et al, 2007). Some reviews identified the target by school attendance (elementary/middle/high) (Cook-Cottone et al, 2009, Camacho-Minano et al, 2011). These two categorizations offer essentially the same samples. Differing age breakdowns included pre-adolescents aged 7 – 11 (Kesten et al, 2011) and a separation of children and adolescents at age 11 (De Sa and Lock et al, 2008, Nguyen et al, 2010). Because of the large level of overlap with the latter sampling techniques, the results of these reviews were included as reflective of our sample criteria 6 – 12.

Intervention length described within the reviews varied considerably. The reviews described interventions that ranged from 1 week to 6 years. Where more detailed breakdowns exist, the reviews identify that the most frequent intervention lengths are between 3 months to greater than one year.

All reviews included intervention components that were delivered in the school setting, before, during or after school hours. All reviews provided additional interventions in the home, family/community, childcare, and/or primary care. Interventions were delivered by teachers, non-school staff (ie school nurse), trained study personnel, and/or collaborations.

Three different levels of intervention are described by the reviews. All nine reviews describe policy and education based programs with parental involvement. A typical intervention involved school-based physical activity and nutrition education, psychoeducational components, in-class physical activity, school environmental support strategies and home support through parental involvement. Three of the reviews added a peer leadership component (De Sa and Lock et al, 2008, Camacho-Minano et al, 2011, Salmon et al, 2007). Two of these latter reviews included online coaching/web-based strategies (Camacho-Minano et al, 2011, Salmon et al, 2007)

The Effects of the Interventions:

The outcomes included in this review represented four broad categories: physical health status (n= 5 reviews), physical activity measures (n= 4 reviews), dietary measures (n= 3 reviews), and psychosocial/psychoeducational measures (n= 2 reviews). Physical health status included the change in anthropometric measures (e.g., Body Mass Index (BMI), waist circumference, etc.), cholesterol, and/or blood pressure. However, the majority of reviews focused on BMI (n= 5 reviews) as their primary outcome measure to evaluate the effectiveness of the interventions intended to prevent childhood obesity. *Physical Health Status* was further analyzed according to the following categories:

dietary-based Interventions, physical activity-based interventions, psychosocial/psychoeducational variables, duration, family and community involvement, intervention delivery based on setting and provider, and tailored programs.

Physical activity measures included the change in physical activity and/or sedentary levels. *Physical Activity Measures* was further sub-divided into the following categories: physical activity-based interventions, education only interventions, environmental or policy-based interventions, multi-component interventions, family and community involvement, and tailored programs.

Dietary measures included the change in food and nutrition intake (both objective and self-reported) and/or dietary behaviours. *Dietary Measures* was further analyzed according to the following categories: general dietary-based interventions, education-only interventions, environmental or policy-based interventions, multi-component program, peer leaders and incentives, and tailored programs.

Lastly, psychosocial measures included the change in: measurements of self-esteem, knowledge/attitudes/preferences well-being and/or quality of life. When reviews examined the effectiveness of environmental changes (e.g., food provision services), its impact was measured through one of the four outcome categories stated above.

PHYSICAL HEALTH STATUS

Five of the selected systematic reviews presented results based on physical health status (Cook-Cottone et al., 2009; Kesten et al., 2011; Nguyen et al., 2010; Van Cauwenberghes et al., 2010; and Waters et al., 2011). All five reviews included BMI as their outcome measure to examine the effectiveness of the interventions.

Dietary-based Interventions

All five systematic reviews reported the impacts of dietary-based interventions on BMI and the results were mixed.

Two of the reviews reported a significantly, positive outcome for interventions focusing on dietary changes (Cook-Cottone et al., 2009; Nguyen et al., 2010). Cook-Cottone et al., 2009, reported that the encouragement of nutritional change appeared to have a significant positive association with BMI ($r=0.13$, 95% CI 0.11, 0.14). However, studies that did not address nutritional change were also associated with significant, positive outcomes ($r=0.05$, 95% CI 0.03, 0.08). In addition, interventions that implemented system-wide nutritional change (e.g., in the form of modified school lunches) appeared to have a limited and negative effect ($r= -0.03$; $p<0.001$) on BMI (Cook-Cottone et al., 2009). Nguyen et al., 2010, also demonstrated a significant reduction in BMI through changes in dietary behaviours in participants receiving interactive electronic interventions.

Kesten et al., 2011, showed a positive impact on anthropometric changes although most of the included studies did not produce medium to large effect sizes (reported in Cohen's D value). Of these interventions, 43.7% produced effect sizes less than 0.2, 45.8% produced low effect sizes (Cohen's D value of 0.2), and 10.4% produced medium effect sizes (Cohen's D value of 0.5) (Kesten et al., 2011).

The remaining two systematic reviews did not result in positive or strong anthropometric changes (Van Cauwenberghe et al., 2010; Waters et al., 2011). Van Cauwenberghe et al., 2010, illustrated that from the four interventions focussed on dietary education reporting effects on anthropometric measures among children, one reported a positive effect on BMI; two found significant negative effects; and one found no effect. Overall, the evidence did not support interventions focussed on dietary education to change BMI status (Van Cauwenberghe et al., 2010). Waters et al., 2011, found a non-significant standardized mean change in BMI (-0.12, 95% CI:-0.28, 0.05) for dietary-based interventions delivered to children ages 0-18 years. This included the subgroup analysis of children ages 6-12 years.

Physical Activity-based Interventions

Four of the five systematic reviews reported the impacts of physical activity-based interventions on anthropometric changes (Cook-Cottone et al., 2009; Kesten et al., 2011, Nguyen et al., 2010; Waters et al., 2011). The overall results appear to be positive.

A significant standardized mean change in BMI, for children ages 0-18, was found for physical activity-based interventions (-0.11, 95% CI:-0.19,-0.02) and for those interventions combining physical activity and diet (-0.18; 95%CI: -0.27,-0.09) (Waters et al., 2011).

Nguyen et al., 2010, also reported significant positive changes in adiposity measures for those interventions combining physical activity and diet via interactive electronic interventions.

Kesten et al., 2011, showed a positive impact on anthropometric changes based on objective and self-reported physical activity measures. However, most of the included studies did not produce medium to large effect sizes (reported in Cohen's D value). For the objective physical activity measures, 33.3% reported effect sizes of less than 0.2, 42.8% produced low effect sizes (Cohen's D value of 0.2), and 23.8% produced medium effect sizes (Cohen's D value of 0.5). For the self-reported measures, 60% reported effect sizes of less than 0.2, 30% produced low effect sizes (Cohen's D value of 0.2), and 10% produced medium effect sizes (Cohen's D value of 0.5) (Kesten et al., 2011).

Cook-Cottone et al., 2009, explored the effects of physical activity-based interventions anthropometric measures. This review more specifically focussed on sedentary level, activity level and fitness level. Interventions targeting the reduction of sedentary behaviours (e.g., television viewing, computer time; $r=0.15$, $p<0.001$) were more

effective than those that did not ($r=0.00$, $p<0.05$). Interventions increasing physical activity (e.g., extended physical education classes, activity breaks) produced minimal, statistically significant results ($r=0.04$, $p<0.001$) while those that did not were also shown to have positive effects ($r=0.09$, $p<0.001$). No significant overall effect was found for interventions involving fitness enhancement (e.g., strength and/or inductance training; $r=0.03$, $p=0.105$) (Cook-Cottone et al., 2009).

Psychosocial/Psychoeducational Variables

Two of the five reviews analysed the impacts of psychosocial/psychoeducational variables (e.g. change in knowledge and attitudes) on anthropometric changes (Cook-Cottone et al., 2009; Kesten et al., 2011). Both reviews found these variables to be significant characteristics that are to be incorporated into an intervention program.

Cook-Cottone et al., 2009, reported a significant overall effect for programs that included psychoeducational content ($r=0.05$; $p<0.001$). Programs that did not include this component were shown to have non-significant effects ($r=0.03$; $p=0.189$) (Cook-Cottone et al., 2009).

The Kesten et al., 2011 review, showed a positive impact where 22.2% of knowledge and attitude measures produced effect sizes of less than 0.2, 33.3% produced low effect sizes (Cohen's D value of 0.2), 22.2% produced medium effect sizes (Cohen's D value of 0.5), and 22.2% produced high effect sizes (Cohen's D value of 0.8).

Duration

Two of the five reviews examined the impact of duration on BMI changes (Cook-Cottone et al., 2009; Waters et al., 2011). Both reviews conducted a meta-analysis that demonstrated a positive effect for programs that were at least 3 months long.

Waters et al., 2011, noted that when all three age groups (0-5, 6-12, 13-18 years) were combined for analysis, there were statistically significant standardized mean change in BMI for interventions that had a duration of ≤ 12 months (-0.17 ; 95% CI: $-0.25,-0.09$) and >12 months (-0.12 ; 95%CI: $-0.21,-0.03$).

Cook-Cottone et al., 2009, found small, significantly positive BMI effects for interventions that were low/moderate in duration (13-27 weeks, $r=0.04$, $p<0.001$), moderate (28-32 weeks, $r=0.07$, $p< 0.001$), and long (>32 weeks, $r= 0.05$, $p<0.001$). Interventions less than 3 months were shown to be ineffective ($r= -0.04$, $P<0.05$) (Cook-Cottone et al., 2009).

Family and Community Involvement

One of the five reviews focused on the impact of programs involving parents and community on anthropometric changes (Cook-Cottone et al., 2009). Although all levels of parental involvement resulted in a significant positive effect, those that involved a

higher level of parental involvement showed the most promise. Significantly stronger effects ($r=0.12$, $p<0.001$) resulted from interventions that integrated a high level of parental involvement (e.g., requiring parents to adopt a behaviour change goal). However, interventions involving minimal ($r=0.07$, $p<0.001$) and moderate ($r=0.04$, $p<0.001$) parental involvement were also as effective as those that did not ($r=0.04$, $p<0.001$). Also, interventions that integrated community involvement ($r=0.05$, $p<0.01$) were as effective as those that did not ($r=0.05$, $p<0.001$) (Cook-Cottone et al., 2009).

Intervention Delivery Based on Setting and Provider

Two of the five reviews reported the impact of programs on anthropometric changes depending on the setting and provider (Cook-Cottone et al., 2009; Waters et al., 2011).

Cook-Cottone et al., 2009, explored whether the intervention provider had an effect on outcome success. The programs delivered collaboratively by intervention specialists with school teachers ($r=0.12$, $p<0.001$) showed the greatest impact, while those programs provided by trained teachers ($r=0.00$, $p=0.839$) or teacher-only (regular classroom or physical education teachers) was of less impact ($r=0.03$, $p<0.05$). No significant overall effects were found for those programs delivered by intervention specialists ($r=-0.03$, $p=0.323$) alone (Cook-Cottone et al., 2009).

Whereas, Waters et al., 2011, investigated the effectiveness based on where the interventions were delivered Water et al., 2011, analysed the impact of various settings on the effectiveness of the intervention. The overall results based on the meta-analysis combining all three age groups (0-5 years, 6-12 years, and 13-18 years), produced a significant standardized mean change on BMI for educational settings (-0.14 ; 95% CI: $-0.28, 0.05$); while, education + other settings (-0.09 ; 95% CI: $-0.20, 0.02$) and non-educational settings (-0.28 ; 98% CI: $-0.72, 0.16$) were stated as non-significant. Similar results were reported for the 6-12 years age group. Holding interventions in educational settings for ages 6 -12 years resulted in a significant standardized mean change of -0.17 (95% CI: $-0.25, -0.009$; $p<0.0001$) on BMI, while both multiple settings and non-educational settings (e.g., home, community) resulted in a non-significant standardized mean change of -0.07 (95%CI: $-0.24, 0.10$) on BMI (Waters et al., 2011).

Tailored Programs

Two of the five reviews reported the impact of tailoring programs based on age, gender, ethnicity, and/or socio-economic status (SES) on anthropometric measures (Cook-Cottone et al., 2009, and Waters et al., 2011).

Both reviews examined programs tailored to age. A positive result was found for program targeting elementary school children. Cook-Cottone et al., 2009, reported a significantly positive effect for school-based interventions targeting elementary school-age children ($r=0.06$; $p<0.001$), as well as those targeting middle school-age children ($r=0.03$; $p<0.05$). Waters et al., 2011, also found a significant standardized mean

change in BMI (-0.15, 95% CI: -0.23, -0.08) for obesity prevention programs targeting children ages 6 to 12 years.

The two systematic reviews also explored the effectiveness of an intervention when delivered to a specific gender. Overall, programs of mixed-gender showed most promise. A meta-analysis conducted by Cook-Cottone et al., 2009, illustrated a significant positive effect ($r=0.05$; $p<0.001$) when interventions were delivered to mixed gender groups. In comparison, interventions delivered solely to female students did not show any impact (Cook-Cottone et al., 2009). In the 19 studies that analysed the impact of intervention by gender for children aged 6-12 years in Waters et al., 2011 review, eight studies reported no difference in outcomes by gender. However, four reported more pronounced intervention effects in male participants and seven reported more pronounced intervention effects in female participants. Nevertheless, a meta-analysis was not conducted to examine whether these effects were significant overall (Waters et al., 2011).

One of the two systematic reviews explored the effectiveness of interventions targeting specific ethnic groups (Cook-Cottone et al., 2009). Overall, there is not enough evidence to conclude that programs should be tailored to specific ethnicities however; there is promise in tailoring programs to those of lower SES. Interventions involving Asian students and predominantly Caucasian students produced positive significant effects. Interventions involving a Native American population had a small, positive effect; while interventions targeting African-American or Hispanic students resulted in a non-significant effect (Cook-Cottone et al., 2009). Waters et al., 2011, found a similar effect using the PROGRESS (Place, Race, Occupation, Gender, Religion, Education, Socio-economic status, Social Status) measure of equity. The review reported no association either between the outcomes (e.g., impact on fatness or physical activity related factors) of the intervention and the PROGRESS measure, or between groups of lower SES (Waters et al., 2011).

Cook-Cottone et al., 2009, further explored the impact of universal programs and selected interventions through a meta-analysis. Universal programs that targeted all children were significantly more effective ($r=0.07$; $p<0.001$) than selected programs aimed at high-risk populations who are already overweight or have risk factors of becoming overweight ($r=0.01$; $p=0.131$) (Cook-Cottone et al., 2009).

PHYSICAL ACTIVITY MEASURES

Four of the selected systematic reviews presented results based on physical activity measures such as physical activity and/or sedentary levels (Camacho-Minano et al., 2011; Kesten et al., 2011; Salmon et al., 2007; and van Sluijs et al., 2007).

Physical Activity-based Interventions

All four systematic reviews reported the impacts of physical-activity based interventions on physical activity and/or sedentary levels (Camacho-Minano et al., 2011; Kesten et al., 2011; Salmon et al., 2007; van Sluijs et al., 2007). Overall, the results were moderate in terms of effects with certain strategies being more effective than others.

Of the 12 studies with an acceptable methodological quality in Camacho-Minano et al., 2011 review, 5 failed to increase girls' physical activity, while 7 studies were successful. However, in some cases, their results were modest.

Kesten et al., 2011, reported statistically significant results for 50% of the objective physical activity measures and 39.7% of the self-reported physical activity measures.

From the 57 studies involving children and adolescents in the van Sluijs et al., 2007 review, 38 resulted in a positive effect with 27 being statistically significant. Of these studies achieving statistical significance, 14 focused on children.

Salmon et al., 2007, explored the effectiveness of physical activity interventions through various strategies. Interventions focusing on curriculum-only were not effective in promoting physical activity in both children and adolescents. Of the five studies that targeted children using curriculum strategies only, four of the studies were ineffective. Overall, only two of the 11 studies focussing on curriculum-only among children or adolescents were effective. However, interventions that focused on activity breaks had a significant impact on children's overall physical activity. The two studies incorporated for this analysis, using either self-reported or objective measures, showed significant effect on children's physical activity levels (Salmon et al., 2007).

Education Only Interventions

Two of the four reviews reported the impacts of education only interventions had on physical activity levels among children (Salmon et al., 2007; van Sluijs et al., 2007). Overall, there was no effect on physical activity levels.

Interventions that focused on physical education lessons among children or adolescents had a small effect on physical activity during lessons, but the impact on physical activity outside school or overall were unclear (Salmon et al., 2007). Similarly, van Sluijs et al., 2007, reported no overall evidence of effect through education only interventions in increasing physical activity levels.

Environmental or Policy-Based intervention

Two of the four reviews reported the impact of environmental or policy-based interventions on physical activity levels (Salmon, 2007; van Sluijs, 2007). Although results from both reviews illustrated a positive effect, whether this approach can increase overall physical activity is still undetermined.

Salmon et al., 2007, featured three studies that examined the impact of environmental changes on physical activity. All three studies produced small increases in physical activity, but none assessed overall physical activity participation or the sustainability of the physical activity beyond the intervention period (Salmon et al., 2007).

Four studies in the van Sluijs, 2007 review, focused on changes in the school environment. Two randomized control trials (RCTs) reported a significant impact although they were considered of low quality. Overall, studies to date illustrate some evidence of an effect for environmental interventions on physical activity measures (van Sluijs et al., 2007).

Multi-component Interventions

Two of the four reviews, explored the effectiveness of multi-component interventions for increasing physical activity levels (Salmon et al., 2007; van Sluijs et al., 2007). Both reviews resulted in inconclusive evidence.

Only one study from Salmon et al., 2007, examined the impact of whole-school strategies on children's physical activity levels. The whole-school approach included changes to curriculum, physical education, and the physical, social, and organizational school environments. The study showed no impact in increasing physical activity levels among children. The review could not draw any conclusions about effectiveness of such strategies as only two studies were included in this analysis (one targeting children and one targeting adolescents) addressing the whole-school approach to increasing physical activity levels (Salmon et al., 2007).

Similarly, van Sluijs, 2007, reported inconclusive evidence of effectiveness based on the evaluation of 10 studies, with only one of the high quality trials reporting a significant positive effect.

Family and Community Involvement

Two of the four reviews, examined the impact of family and/or community involvement on increasing physical activity levels (Salmon et al., 2007, and van Sluijs et al., 2007). Mixed results were reported.

Salmon et al. 2007, illustrated that for most interventions (n=9) that incorporated school and family-based components, some elements of a child's physical activity increased. However, all three interventions that were delivered in school and involved the community in some way were not successful (Salmon et al., 2007).

Of the 14 studies that included family or community components in the van Sluijs et al., 2007 review, only one of the high-quality RCTs illustrated a significant positive impact. Overall, inconclusive evidence was reported for school-based interventions that included family or community involvement. The same review, based on 15 studies, also

reported inconclusive evidence of an effect for school-only interventions (van Sluijs et al., 2007).

Tailored Programs

One of the four reviews reported the impact of tailoring programs based on gender, ethnicity, and socio-economic status (SES) in order to increase physical activity levels (van Sluijs et al., 2007). Five studies included in this review targeted girls only, with only one study reporting a significantly positive result, while three showed only positive trends. Overall, no evidence of an effect was reported for interventions targeting girls or ethnic minority groups. However, for interventions targeting children from low SES backgrounds, a significant positive effect was found (van Sluijs et al., 2007).

DIETARY MEASURES

Three of the selected systematic reviews presented results based on dietary measures such as change in food and nutrition intake (both objective and self-reported) and/or dietary behaviours (de Sa and Lock, 2008; Kesten et al., 2011; Van Cauwenberghe et al., 2010).

General Dietary-based Interventions

Two of the three reviews reported the impact of dietary-based interventions on dietary measures (de Sa and Lock, 2008; Kesten et al., 2011). Overall, the results were positive.

de Sa and Lock, 2008, found a statistically significant increase, for 19 (of 23) studies, in fruits and/or vegetable (FV) consumption at some stage during the intervention. Sixteen of the 19 studies also maintained change in FV consumption at follow-up. Although the remaining four studies did not observe an increase in FV consumption, one study reported a significant increase in knowledge of the health benefits of FV, two studies reported a decrease in high-fat food consumption, and one study prevented further decline in FV intake (de Sa and Lock, 2008).

Kesten et al., 2011, showed that 27.3% of self-reported nutrition measures to contain statistically significant results.

Education-only Interventions

One of the three reviews reported the impact of education-only interventions in children on dietary behaviours (Van Cauwenberghe et al., 2010). There was limited evidence that only educational-based interventions in children can improve dietary behaviour. From the analysis based on 14 studies, six studies found positive effects, two found mixed results and the remaining showed no effect (Van Cauwenberghe et al., 2010).

Environmental or Policy-Based interventions

All three reviews examined environmental or policy-based interventions and their impact on dietary intake and/or behaviour (De Sa and Lock, 2008; Kesten et al., 2011; and Van Cauwenberghe et al., 2010). The results were mixed.

Kesten et al., 2011, contained six studies within the school setting that resulted in significant positive changes to dietary behaviour, a physical measure, or both through modification of school food provision. In the de Sa and Lock, 2008 review, 70% of school interventions increased FV intake in both younger and older children, where intervention effects ranged from increases of +0.14 servings per day to +0.99 servings per day. However, neither school environment-only interventions, nor environmental change plus curriculum sessions had a significant impact on FV intake (de Sa and Lock, 2008). Similarly, limited evidence was found from Van Cauwenberghe et al., 2010, where five studies of FV subscription or distribution programs and one breakfast distribution program assessed the effect on FV intakes and breakfast habits. Positive impact on increasing FV intakes and on breakfast habits was found in the six studies, but only one study sustained the effect long term (3 years later). There was inconclusive evidence that environmental interventions can improve breakfast habits (Van Cauwenberghe et al., 2010).

Multi-Component Program

Two of the three reviews reported the impact of multi-component interventions on dietary measures (Van Cauwenberghe, 2010; de Sa and Lock, 2008). Both reviews provided strong evidence that multi-component interventions can improve FV intakes and dietary behaviours.

Van Cauwenberghe, 2010, assessed the impact of multi-component studies on FV intake. Nine studies used for analysis consisted primarily of a FV subscription or distribution program combined with nutrition education curriculum. All found an improvement in dietary intake and behaviour (Van Cauwenberghe, 2010).

The majority of the studies included in the de Sa and Lock, 2008 review, showed increased FV intake in both younger and older children and 75% of the included studies used a multi-component approach. Although it was difficult to identify the most effective components, most programs did include some educational component (either making it an essential part of the program or through simultaneous 'healthy eating' initiatives) (de Sa and Lock, 2008).

Peer Leaders and Incentives

One of the three reviews explored the impact of peers and incentives (de Sa and Lock, 2008). Incentives were effective in three of the studies while the positive effect was not maintained at follow-up in another two studies. Also, a small significant increase, which

was not sustained at two year follow-up, was observed in environment-based interventions when executed through trained peer leaders (De Sa and Lock, 2008). Overall, engaging peer leaders and rewarding children through incentives was found to have a positive effect although this effect was not sustained in the long-term.

Tailored Programs

One of the three reviews reported the impact of tailoring programs based on ethnicity and socio-economic status (SES) on dietary intake and/or behaviour (Van Cauwenberghe et al., 2010). Interventions focussing on ethnicity and/or SES showed positive results.

Interventions targeting children of low socio-economic backgrounds seemed to be effective to improve dietary intake. From the eight studies incorporated for this analysis, two studies reported mixed results, while the other six studies reported improvements in dietary behaviour (Van Cauwenberghe et al., 2010).

A positive impact was also reported for interventions targeting children from ethnic minority groups in changing dietary behaviours. Two studies evaluated this effect and both studies resulted in a significant positive effect on dietary intake (Van Cauwenberghe et al., 2010).

PSYCHOSOCIAL/PSYCHOEDUCATIONAL MEASURES

Two of the selected systematic reviews presented results based on psychosocial/psychoeducational measures such as knowledge/attitudes/preferences, measurements of self-esteem, well-being and/or quality of life (Kesten et al., 2011; Waters et al., 2011). Kesten et al., 2011, reported statistically significant results for 44.4% of the knowledge and attitude measures. Of the included studies within the Waters et al. 2011 review, modest behavioural impacts have been achieved in most of the interventions for children ages 6-12. However, in most cases psychosocial/psychoeducational measures were not reported independently and were associated with other measures mentioned earlier in this report.

Harm or Unintended Effects:

Waters et al., 2011, explored the harm or unintended effects around obesity prevention interventions for children ages 6-12. Only eight of the 39 studies assessed the harm or unintended consequences (e.g., prevalence of underweight, unhealthy eating practices, teasing, stigmatisation, body image perceptions, satisfaction, and self-worth) of the interventions. The included studies either reported few or no harmful outcomes (Waters et al., 2011).

DISCUSSION

This review expands and updates the evidence base for diet and physical activity-based interventions to prevent obesity in school children. The evidence informs recommendations that will guide Toronto Public Health in planning, implementing and evaluating obesity prevention interventions for children 6-12 years of age within the school setting.

The Use of Outcome Measures

Much discussion has ensued regarding what the most appropriate outcome measures are to evaluate the effectiveness of obesity prevention interventions. Physical health status measures (e.g., body mass index (BMI), waist circumference, blood pressure, cholesterol, etc.), physical activity measures (e.g., physical activity and/or sedentary levels, etc.), dietary measures (e.g., food and nutrition intake, dietary behaviours, etc.), and psychosocial/pyschoeducational measures (e.g., knowledge/attitudes/preferences, measurements of self-esteem, well-being, etc.) are commonly used.

BMI is often selected as a physical health status measure. However, BMI is only one of the many possible indicators for assessing health. While weight is an appropriate component of a comprehensive health risk assessment, it is *inappropriate* as a primary measure of health of an individual or a population (Toronto Public Health, May 2011). For example, some studies have found improved health-related outcomes (e.g., decreased blood pressure, increased physical activity, improved fitness, and/or improved diet), yet fail to find positive changes in BMI (Cook-Cottone et al., 2009). Emphasising weight solely takes the focus away from developing strategies that recognize and address the broader social, environmental, and economic factors that influence people's health (Toronto Public Health, May 2011).

The use of different outcome measures can influence the interpretation of intervention effectiveness. Because the systematic reviews in this review reported their findings based on outcome measures, it was necessary to take this into account when developing the recommendations.

Physical Activity and Diet as Risk Factors

Unhealthy diets and physical inactivity are key risk factors that contribute to obesity (Butland et al., 2007; Waters et al., 2011). The selected systematic reviews used in this review included either a physical activity and/or diet component as part of their intervention.

This review evidence demonstrates that school-based obesity prevention interventions should incorporate physical activity. In particular, interventions should focus on extending physical education classes, incorporating activity breaks, and reducing

sedentary behaviours to reduce anthropometric measures (Cook-Cottone et al., 2009; Kesten et al., 2011; Waters et al., 2011). This is further supported by findings in this review regarding physical activity-based interventions that focus on increasing physical activity levels and/or decreasing sedentary levels (Camacho-Minano et al., 2011; Kesten et al., 2011; Salmon et al., 2007; van Sluijs et al., 2007). Establishing activity breaks was one strategy that showed positive impact not only on anthropometric measures but also on physical activity measures (Cook-Cottone et al., 2009; Salmon et al., 2007). Activity breaks are also recommended as an opportunity for students to engage in physical activity outside of physical education classes (CDC, 2011). It is important for school staff to be aware of the importance of these activity breaks and not withhold them as a form of punishment. The CDC guideline (2011) emphasizes the need to establish this positive environment that encourages and supports opportunities to be physically active. Staff should also promote activities that children find enjoyable, can engage in outside of school hours and continue to participate in as they grow older (NICE, 2006).

Results from a recent Cochrane review reported that school-based physical activity interventions have a positive impact on physical activity, fitness, sedentary behaviour, and blood cholesterol (Dobbins et al., 2009). However, in this review, when interventions focused on curriculum only, physical activity levels were not increased (Salmon et al., 2007). This review also showed fitness enhancement to be ineffective in reducing anthropometric measures (Cook-Cottone et al., 2009). On the other hand, when interventions focused on decreasing sedentary behaviours (e.g., screen time which includes television viewing and computer use), it was shown to be effective (Cook-Cottone et al., 2009). In fact, strategies focussed on reducing television viewing have also been shown to be cost effective (Gortmaker et al., 2011). In addition to interventions focusing on sedentary behaviours, other strategies suggested in the CDC report include requiring daily recess, offering intramural physical activity programs during after-school hours, offering interscholastic sports, and implementing walk- and bicycle-to-school programs (CDC, 2011).

Similar to physical activity, the impact of diet-related interventions can vary depending on the outcome being measured. For example, environmental or policy-based interventions such as breakfast and/or fruit and vegetable distribution programs should be implemented to improve **dietary intake** (Kesten et al., 2011; da Sa and Lock, 2008; Van Cauwenberghe et al., 2010). On the other hand, environmental or policy-based interventions focussing on system-wide nutritional change should not be implemented to impact **BMI** (Cook-Cottone et al., 2009). The NICE guidelines further support this approach by encouraging school policies that help children maintain a healthy weight, eat a healthy diet and be physically active. This includes policies related to recreational space, food and beverage availability within the school, curriculum, and active transportation to and from school (NICE, 2006).

Although some diet or physical activity-based interventions have shown success, this review evidence demonstrates that obesity prevention interventions should always address both diet and physical activity. Doing this not only maximizes the impact of the

intervention (Nguyen et al., 2010; Waters et al., 2011), but is also cost-effective (Gortmaker, 2011). In addition, evidence supports multi-component interventions.

Multi-component Interventions Addressing Diet and Physical Activity

Multi-component school-based obesity prevention programs often combine behavioral, environmental, and educational components including health education classes, enhanced physical education, and promotion of healthy food options.

This review evidence demonstrates that interventions that only focus on education are not as effective as those that focus on more than one component (Salmon et al., 2007; Van Cauwenberghe, et al., 2010; de Sa and Lock, 2008). Kropski, 2008 et al., noted that educational interventions may be more effective when combined with other policies. In the school setting, multi-component interventions appear to be more effective than single component efforts (Kriemler et al., 2011; De Bourdeaudhuij et al., 2011; Seo and Sa, 2010; Kamath et al., 2008). In this review, it is clear that there is strong evidence that multi-component interventions can improve fruit and vegetable intakes and other dietary behaviours (Van Cauwenberghe, et al., 2010; de Sa and Lock, 2008) however; current evidence does not provide a definitive answer related to physical activity based on the available selected systematic reviews (Salmon et al., 2007; van Sluijs et al., 2007). There is evidence though in other systematic reviews related to physical activity, but which did not address low-income populations specifically, that multi-component interventions also increase physical activity (Kamath 2008), and reduce BMI (Brown 2009, De Bourdeaudhuij 2011, Katz 2008, Seo and Sa, 2010). The NICE Guideline, indicates mixed evidence for multi-component school-based interventions as some interventions showed a reduction in BMI when they addressed physical activity, dietary intake and sedentary behaviours. In addition, the Guideline indicates that multi-component interventions involving changes to the school environment are effective in improving physical activity and dietary behaviours at least while the interventions are being implemented (NICE, 2006).

Overall, evidence demonstrates that a multi-component "whole-school approach" or "Healthy Schools Approach" that includes "high-quality instruction and programs, a healthy physical environment, a supportive social environment and community partnerships" (TPH, 2011) is effective in addressing obesity prevention through initiatives focussing on diet and physical activity (NICE, 2006). When beginning the program planning cycle, these two risk factors should be equally integrated into behavioural, environmental and educational components.

This review evidence further highlights other specific program components such as implementing programs for at least 3 months, employing a combination of school staff and intervention specialists to implement programs (Cook-Cottone et al., 2009; Waters et al., 2011), and incorporating psychosocial/psychoeducational components (Cook-Cottone et al., 2009; Kesten et al., 2011; Waters et al., 2011). Involving peer leaders and incentives has also been shown to be effective (de Sa and Lock, 2008).

Evidence supports that family involvement is a key component when developing obesity prevention interventions. Additionally, both NICE and the CDC guidelines recommend that family and community members be encouraged to participate in activities by communicating with them in a variety of ways and involving them at special events and other venues. This review evidence demonstrates mixed results in increasing physical activity levels when incorporating a family component (Salmon et al., 2007; van Sluijs et al., 2007). Interestingly, Cook-Cottone et al., 2009, found that when high parental involvement occurred, there was a reduction in BMI. A high level of involvement includes working with parents to set behaviour goals for themselves, moderate involvement includes program meetings or activities and minimal involvement consists of the distribution of psychoeducational materials. If the outcome measure of the intervention is BMI, then perhaps investing additional resources to engage parents at a higher level would be a worthy endeavour.

Tailored Programs

When planning obesity prevention interventions, it is important to consider tailoring activities based on gender, preferences, ethno cultural backgrounds, and socio-economic status. Based on this review evidence, it is recommended to deliver interventions to mixed gender groups (Cook-Cottone et al., 2009; van Sluijs et al., 2007). However, Kropski et al., 2008, suggested that boys and girls may not respond in the same way to a given intervention. The review concluded, with limited evidence, that girls may respond better to programming based on social learning (educational interventions), while for boys, structural and environmental changes facilitate increased physical activity and improved dietary intake. The NICE guideline further supports this by recommending that differences in boys' and girls' preferences be considered when planning an intervention (NICE, 2006). Taking into account preferences across gender groupings is also an important consideration. An example included in this review involves allowing students to paint a playground with fluorescent marking designs and games to increase physical activity levels (Salmon et al., 2007; van Sluijs et al., 2007).

The evidence related to the importance of tailoring interventions based on ethno cultural background is mixed (Cook-Cottone et al., 2009; Van Cauwenberghe et al., 2010; Waters et al., 2011). When examining changes to BMI, culture or ethnicity does not seem to play a role, however, it does have a positive significant effect on dietary intake. Although changes to BMI have not been demonstrated, it is difficult to dismiss the importance of this type of tailoring. The CDC supports this by recommending a curriculum that is culturally and developmentally appropriate and a school environment that reflects the culture within the community by demonstrating cultural awareness in healthy eating and physical activity practices (CDC, 2011).

This review evidence demonstrates that interventions targeting children from low socio-economic backgrounds can positively impact physical activity levels, and dietary intake (Van Cauwenberghe et al., 2010; van Sluijs et al., 2007). This may highlight the need to consider focussing on specific neighbourhoods when planning obesity prevention

interventions. Targeting all children versus only high risk populations who are already overweight or who have risk factors of becoming overweight was also assessed in this review (Cook-Cottone, et al., 2009) with results emphasizing the need to target all children within low socio-economic neighbourhoods when planning interventions.

Harm or Unintended Effects

When planning, implementing, and evaluating obesity prevention interventions, the harm or unintended effects must be considered. It is of concern that only a few studies in the selected systematic reviews used in this report examined such effects. This concern is further emphasized by CDC, where the guideline recommends creating a school environment that encourages a healthy body image, shape, and size among all students and staff members. It further recommends providing health, mental health, and social services to students in order to address healthy eating and physical activity (CDC, 2011). Programs should implement safeguards and regularly evaluate intended outcomes and unintended consequences (CDC, 2007; 2011). For example, BMI measurement programs in schools, conducted for surveillance and screening purposes, need to ensure a safe and supportive environment to avoid stigmatizing students which may lead to harmful behaviours.

Appendix A: Development of TPH Recommendations Based on Supporting Evidence from Systematic Reviews and NICE Guideline

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>Setting</p> <p>Worked: Meta-analysis combining all three age groups (0-5 years, 6-12 years, and 13-18 years), produced a statistically significant effect size for educational settings only (-0.14; 95% CI: -0.28, 0.05) (Waters et al., 2011) (Physical Health Status)</p> <p>6-12 years age group, educational only setting for ages 6 -12 years resulted in a statistically significant effect of -0.17 (95% CI: -0.25, -0.009; p<0.0001) (Waters et al., 2011) (Physical Health Status)</p> <p>Didn't work: Education + other settings (-0.09; 95% CI: -0.20, 0.02) and non-educational settings (-0.28; 98% CI: -0.72,0.16) were stated as non-significant (Waters et al., 2011) (Physical Health Status)</p> <p>6-12 years age group, both multiple settings and non-educational settings (e.g., home, community) resulted in a non-significant mean effect size of -0.07 (95%CI: -0.24, 0.10) (Waters et al., 2011) (Physical Health Status)</p>	<p>TPH should implement obesity prevention interventions in the school setting.</p>	<p>Recommendation 1: All schools should ensure that improving the diet and activity levels of children and young people is a priority for action to help prevent excess weight gain. A whole-school approach should be used to develop life-long healthy eating and physical activity practices.</p>
<p>Dietary-based Interventions (Physical Health Status)</p> <p>Worked: Nguyen et al., 2010, demonstrated significant reduction in BMI outcome measures through changes in dietary behaviours in participants receiving interactive electronic interventions</p> <p>Kesten et al., 2011, showed a positive impact on anthropometric changes although most of the included studies did not produce medium to large effect sizes (reported in Cohen's D value). Of these interventions, 43.7%</p>	<p>TPH should <u>not</u> implement dietary-based interventions alone to improve anthropometric measures.</p>	

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>produced effect sizes less than 0.2, 45.8% produced low effect sizes (Cohen's D value of 0.2), and 10.4% produced medium effect sizes (Cohen's D value of 0.5) (Kesten et al., 2011).</p> <p>Didn't work: Waters et al., 2011, found a non-significant standardized mean change in BMI (-0.12, 95% CI:-0.28, 0.05) for dietary-based interventions delivered to children ages 0-18 years. This included the subgroup analysis of children ages 6-12 years.</p> <p>Cook-Cottone et al., 2009, reported that the encouragement of nutritional change appeared to have a significant positive association with BMI (r=0.13, 95% CI 0.11, 0.14). However, studies that did not address nutritional change were also as effective. (r=0.05, 95% CI 0.03, 0.08).</p>		
<p>Dietary-based Intervention (Dietary Measures)</p> <p>Worked: De Sa and Lock, 2008, found a statistically significant increase, for 19 (of 23) studies, in fruits and/or vegetable (FV) consumption at some stage during the intervention. Sixteen of the 19 studies also maintained change in FV consumption at follow-up. Although the remaining four studies did not observe an increase in FV consumption, one study reported a significant increase in knowledge of the health benefits of FV, two studies reported a decrease in high-fat food consumption, and one study prevented further decline in FV intake.</p> <p>Kesten et al., 2011, showed that 27.3% of self-reported nutrition measures to contain statistically significant results.</p>	<p>TPH should implement dietary-based interventions to improve dietary intake and/or behaviour (vs. anthropometric measures alone).</p>	
<p>Physical Activity (Physical Health Status)</p> <p>Worked: A significant standardized mean change in BMI, for children ages 0-18, was found for physical activity-based interventions (-0.11, 95% CI:-0.19,-0.02) (Waters et al, 2011)</p>	<p>TPH should implement physical activity-based interventions that decrease sedentary behaviours to improve anthropometric measures.</p>	<p><i>School-based physical activity interventions (physical activity promotion and reduced television viewing) may help children maintain a healthy weight.</i></p>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>Interventions targeting the reduction of sedentary behaviours (e.g., television viewing, computer time; $r=0.15$, $p<0.001$) were more effective than those that did not ($r=0.00$, $p<0.05$). (Cook-Cottone et al, 2009)</p> <p>Interventions increasing physical activity (e.g., extended physical education classes, activity breaks) produced minimal, statistically significant results ($r=0.04$, $p<0.001$) while those that did not were also shown to have positive effects ($r=0.09$, $p<0.001$) (Cook-Cottone et al., 2009).</p> <p>Kesten et al., 2011, showed a positive impact on anthropometric changes based on objective and self-reported physical activity measures. However, most of the included studies did not produce medium to large effect sizes (reported in Cohen's D value). For the objective physical activity measures, 33.3% reported effect sizes of less than 0.2, 42.8% produced low effect sizes (Cohen's D value of 0.2), and 23.8% produced medium effect sizes (Cohen's D value of 0.5). For the self-reported measures, 60% reported effect sizes of less than 0.2, 30% produced low effect sizes (Cohen's D value of 0.2), and 10% produced medium effect sizes (Cohen's D value of 0.5).</p> <p>Didn't Work</p> <p>No significant overall effect was found for interventions involving fitness enhancement (e.g., strength and/or inductance training; $r=0.03$, $p=0.105$) (Cook-Cottone et al., 2009).</p>	<p>TPH should implement physical activity-based interventions that focus on extended physical education classes and activity breaks to reduce anthropometric measures.</p> <p>TPH should <u>not</u> implement physical activity-based interventions involving fitness enhancement to improve anthropometric measures.</p>	
<p>Physical Activity (Physical Activity Measures)</p> <p>Worked:</p> <p>Of the 12 studies with an acceptable methodological quality in Camacho-Minano et al., 2011 review, 5 failed to increase girls' physical activity, while 7 studies were successful</p> <p>Kesten et al., 2011, reported statistically significant results for 50% of the objective physical activity measures and 39.7% of the self-reported physical</p>	<p>TPH should implement physical activity-based interventions to increase physical activity measures including physical activity and /or sedentary levels. The use of activity breaks is one intervention that has been shown to be successful.</p>	<p><i>There is a body of evidence to suggest that young people's views on barriers and facilitators suggest that interventions should</i></p> <ul style="list-style-type: none"> <i>(i) modify physical education lessons to suit their preferences,</i> <i>(ii) involve family and peers, and make physical activity a social</i>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>activity measures</p> <p>From the 57 studies involving children and adolescents in the van Sluijs et al., 2007 review, 38 resulted in a positive effect with 27 being statistically significant. Of these studies achieving statistical significance, 14 focused on children.</p> <p>Interventions that focused on activity breaks had a significant impact on children's overall physical activity (The two studies incorporated for this analysis, using either self-reported or objective measures, showed significant effect on children's physical activity levels (Salmon et al., 2007).</p> <p>Didn't Work:</p> <p>Interventions focusing on curriculum-only strategies were not effective in promoting physical activity in both children and adolescents (five studies that targeted children using curriculum strategies only, four of the studies were ineffective). Overall, only two of the 11 studies focussing on curriculum-only among children or adolescents were effective. (Salmon et al., 2007)</p>	<p>TPH should <u>not</u> implement physical activity curriculum alone to increase physical activity.</p>	<p><i>activity, (iii) increase young people's confidence, knowledge and motivation relating to physical activity, and (iv) make physical activities more accessible, affordable and appealing to young people</i></p> <p><i>School-based physical activity interventions (physical activity promotion and reduced television viewing) may help children maintain a healthy weight.</i></p>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>Education-only Intervention (Physical-Activity and Dietary)</p> <p>Worked: There was limited evidence that only educational-based interventions in children can improve dietary behaviour. From the analysis based on 14 studies, six studies found positive effects, two found mixed results and the remaining showed no effect (Van Cauwenberghe et al., 2010).</p> <p>Interventions that focused on physical education lessons among children or adolescents had a small effect on physical activity during lessons, but the impact on physical activity outside school or overall were unclear (Salmon et al., 2007)</p> <p>Didn't Work: Van Cauweberghe et al., 2010, illustrated that from the four interventions focussed on dietary education reporting effects on anthropometric measures among children, one reported a positive effect on BMI; two found significant negative effects; and one found no effect. Overall, the evidence did not support interventions focussed on dietary education to change BMI status.</p> <p>van Sluijs et al., 2007, reported no overall evidence of effect through education only interventions in increasing physical activity.</p>	<p>TPH should <u>not</u> implement either physical activity or dietary-based education in isolation due to its limited impact as an obesity intervention.</p>	<p><i>There is a body of evidence to suggest that young people's views of barriers and facilitators to healthy eating indicated that effective interventions would (i) make healthy food choices accessible, convenient and cheap in schools, (ii) involve family and peers, and (iii) address personal barriers to healthy eating, such as preferences for fast food in terms of taste, and perceived lack of will-power</i></p>
<p>Physical-activity and Dietary-based (Multi-risk):</p> <p>Worked: Nguyen et al., 2010, also reported significantly positive changes in adiposity measures for physical activity behaviours, along with changes in dietary behaviours, in participants receiving interactive electronic interventions.</p> <p>A significant standardized mean change in BMI, for children ages 0-18, was found for physical activity-based interventions (-0.11, 95% CI:-0.19,-0.02)</p>	<p>TPH should implement a combination of physical activity and dietary-based interventions to improve anthropometric measures as well as physical and dietary behaviours.</p>	

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>that were a combination of physical activity and dietary-based (-0.18; 95%CI: -0.27,-0.09) (Waters et al., 2011)</p>		
<p>Environmental or Policy-Based Interventions (Physical Activity):</p> <p>Worked: Salmon et al., 2007, featured three studies that examined the impact of environmental changes on physical activity. All three studies produced small increases in physical activity, but none assessed overall physical activity participation or the sustainability of the physical activity beyond the intervention period.</p> <p>Four studies in the van Sluijs, 2007 review, focused on changes in the school environment. Two randomized control trials (RCTs) reported a significant impact although they were considered of low quality. Overall, studies to date illustrate some evidence of an effect for environmental interventions on physical activity measures.</p>	<p>TPH should implement environmental or policy-based interventions to increase physical activity levels (e.g., playground game equipment and activity cards provided, playground painted with fluorescent marking designs and games by students).</p>	
<p>Environmental or Policy-Based Interventions (Dietary):</p> <p>Worked: Kesten et al., 2011, contained six studies within the school setting that resulted in significant positive changes to dietary behaviour, a physical measure, or both through modification of school food provision.</p> <p>In the de Sa and Lock, 2008 review, 70% of school interventions increased FV intake in both younger and older children, where intervention effects ranged from increases of +0.14 servings per day to +0.99 servings per day.</p> <p>Limited evidence was found from Van Cauwenberghe et al., 2010, where five studies of FV subscription or distribution programs and one breakfast distribution program assessed the effect on FV intakes and breakfast habits. Positive impact on increasing FV intakes and on breakfast habits was found in the six studies, but only one study sustained the effect long term (3 years later).</p>	<p>TPH should implement environmental or policy-based interventions such as breakfast and/or FV distribution programs to improve dietary intake.</p> <p>TPH should <u>not</u> implement environmental or policy-based interventions focussing on system-wide nutritional change to improve anthropometric measures.</p>	<p>Recommendation 2: <i>Head teachers and chairs of governors, in collaboration with parents and pupils, should assess the whole school environment and ensure that the ethos of all school policies helps children and young people to maintain a healthy weight, eat a healthy diet and be physically active, in line with existing standards and guidance. This includes policies relating to building layout and recreational spaces, catering (including vending machines) and the food and drink children bring into</i></p>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>Didn't work: Neither school environment-only interventions, nor environmental change plus curriculum sessions had a significant impact on FV intake (de Sa and Lock, 2008).</p> <p>Interventions that implemented system-wide nutritional change (e.g., in the form of modified school lunches) appeared to have a limited and negative effect ($r = -0.03$; $p < 0.001$) on BMI (Cook-Cottone et al., 2009).</p>		<p><i>school††, the taught curriculum (including PE), school travel plans and provision for cycling, and policies relating to the National Healthy Schools Programme and extended schools.</i></p> <p>Recommendation 7: <i>Children and young people should eat meals (including packed lunches) in school in a pleasant, sociable environment. Younger children should be supervised at mealtimes and, if possible, staff should eat with children.</i></p>
<p>Psychosocial/Psychoeducational</p> <p>Worked: Cook-Cottone et al., 2009, reported a significant overall effect for programs that included psychoeducational (presentation of information) content ($r = 0.05$; $p < 0.001$). Programs that did not include this component were shown to have non-significant effects on anthropometric changes ($r = 0.03$; $p = 0.189$) (Cook-Cottone et al., 2009). (Dietary and Physical Education)</p> <p>The Kesten et al., 2011 review, showed a positive impact where 22.2% of knowledge and attitude measures produced effect sizes of less than 0.2, 33.3% produced low effect sizes (Cohen's D value of 0.2), 22.2% produced medium effect sizes (Cohen's D value of 0.5), and 22.2% produced high effect sizes (Cohen's D value of 0.8).</p> <p>Of the included studies within the Waters et al. 2011 review, modest behavioural impacts have been achieved in most of the interventions for children ages 6-12. However, in most cases psychosocial measures were not reported independently and were associated with other measures</p>	<p>TPH should include psychosocial/psychoeducational components in physical activity and dietary-based interventions (e.g. activities increasing knowledge/attitudes/preferences, self-esteem, well-being and/or quality of life).</p>	<p>Recommendation 6: <i>Staff delivering physical education, sport and physical activity should promote activities that children and young people find enjoyable and can take part in outside school, through into adulthood. Children's confidence and understanding of why they need to continue physical activity throughout life (physical literacy) should be developed as early as possible.</i></p>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
mentioned earlier in this report. (Dietary and Physical Education)		
<p>Duration</p> <p>Worked: Both reviews conducted a meta-analysis that demonstrated a positive effect for programs that were at least 3 months long (Cook-Cottone et al., 2009; Waters et al., 2011) Waters et al., 2011, noted that when all three age groups (0-5, 6-12, 13-18 years) were combined for analysis, there were statistically significant standardized mean change on BMI for interventions that had a duration of \leq 12 months (-0.17; 95% CI: -0.25,-0.09) and $>$12 months (-0.12; 95%CI:-0.21,-0.03).</p> <p>Cook-Cottone et al., 2009, found small, significantly positive BMI effects for interventions that were low/moderate (13-27 weeks, $r=0.04$, $p<0.001$), moderate (28-32 weeks, $r=0.07$, $p< 0.001$), and long ($>$32 weeks, $r= 0.05$, $p<0.001$) in duration.</p> <p>Didn't Work: Interventions less than 3 months were shown to be ineffective ($r=-0.04$, $P<0.05$) (Cook-Cottone et al., 2009)</p>	<p>TPH should implement physical activity and/ or dietary-based interventions lasting at least 3 months.</p>	<p>Recommendation 5: <i>Interventions should be sustained, multicomponent and address the whole school, including after-school clubs and other activities. Short-term interventions and one-off events are insufficient on their own and should be part of a long-term integrated programme.</i></p> <p><i>There is a body of evidence to suggest that short- and long-term school-based interventions to improve children's dietary intake may be effective, at least while the intervention is in place. This includes interventions aiming to increase fruit and (and to a lesser extent) vegetable intake, improve school lunches and/or promote water consumption</i></p> <p><i>There is evidence from multi-component interventions to suggest that both short- and long-term physical activity focused interventions may be effective, at least while the intervention is in place</i></p>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>Family and Community Involvement</p> <p>Worked: Although all levels of parental involvement resulted in a significant positive effect, those that involved a higher level of parental involvement showed most promise. Significantly stronger effects ($r=0.12$, $p<0.001$) resulted from interventions that integrated a high level of parental involvement (e.g., requiring parents to adopt a behaviour change goal) (Cook-Cottone et al., 2009) (Physical Health Status) However, interventions involving minimal ($r=0.07$, $p<0.001$) and moderate ($r=0.04$, $p<0.001$) parental involvement were also as effective as those that did not ($r=0.04$, $p<0.001$) (Cook-Cottone et al., 2009) (Physical Health Status) Salmon et al. 2007, illustrated that for most interventions ($n=9$) that incorporated school and family-based components, some elements of a child's physical activity increased. (Salmon et al., 2007) (Physical Activity)</p> <p>Didn't Work: Also, interventions that integrated community involvement ($r=0.05$, $p<0.01$) were as effective as those that did not ($r=0.05$, $p<0.001$) (Cook-Cottone et al., 2009) (Physical Health Status) However, all three interventions that were delivered in school and involved the community in some way were not successful (Salmon et al., 2007) (Physical Activity) Of the 14 studies that included family or community components in the van Sluijs et al., 2007 review, only one of the high-quality RCTs illustrated a significant positive impact. Overall, inconclusive evidence was reported for school-based interventions that included family or community involvement. The same review, based on 15 studies, also reported inconclusive evidence of an effect for school-only interventions (van Sluijs et al., 2007) (Physical Activity)</p>	<p>TPH should incorporate a family component into all obesity prevention interventions.</p> <p>TPH should aim for a high level of parental involvement in obesity prevention interventions (e.g. behaviour change goal for parents) to reduce BMI.</p>	<p>Recommendation 9: Where possible, parents should be involved in school-based interventions through, for example, special events, newsletters and information about lunch menus and after-school activities.</p> <p><i>There is a body of evidence to suggest that young people's views of barriers and facilitators to healthy eating indicated that effective interventions would (i) make healthy food choices accessible, convenient and cheap in schools, (ii) involve family and peers, and (iii) address personal barriers to healthy eating, such as preferences for fast food in terms of taste, and perceived lack of will-power</i></p> <p><i>There is a body of evidence to suggest that young people's views on barriers and facilitators suggest that interventions should (i) modify physical education lessons to suit their preferences, (ii) involve family and peers, and make physical activity a social activity, (iii) increase young people's confidence, knowledge and motivation relating to physical</i></p>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
		<i>activity, and (iv) make physical activities more accessible, affordable and appealing to young people</i>
<p>Peer Leaders and Incentives</p> <p>Worked: A small significant increase, which was not sustained at two year follow-up, was observed in environment-based interventions when executed through trained peer leaders (De Sa and Lock, 2008) (Dietary-based)</p> <p>Incentives were effective in three of the studies while the positive effect was not maintained at follow-up in another two studies. (De Sa and Lock, 2008) (Dietary-based)</p>	<p>TPH should use peer leaders in interventions focussing on obesity prevention.</p> <p>TPH should use incentives in interventions focussing on increasing fruit and vegetables consumption (e.g. rewards provided when FV servings are eaten at school).</p>	
<p>Provider</p> <p>Worked: Cook-Cottone et al., 2009, explored whether the intervention provider had an effect on outcome success. The programs delivered collaboratively by intervention specialists with school teachers ($r=0.12$, $p<0.001$) showed the greatest impact, while those programs provided by trained teachers ($r=0.00$, $p=0.839$) or teacher-only (regular classroom or physical education teachers) was of less impact ($r=0.03$, $p<0.05$)</p> <p>Didn't work: No significant overall effects were found for those programs delivered by intervention specialists ($r=-0.03$, $p=0.323$) alone (Cook-Cottone et al., 2009).</p>	<p>TPH should continue to partner with school staff and intervention specialists in the school setting in order to maximize the impacts of obesity prevention interventions.</p>	<p>Recommendation 3: Head teachers and chairs of governors should ensure that teaching, support and catering staff receive training on the importance of healthy-school policies and how to support their implementation.</p> <p>Recommendation 4: Schools should establish links with relevant organisations and professionals, including health professionals and those involved in local strategies and partnerships to promote sports for children and young people.</p>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>Age</p> <p>Worked: A positive result was found for program targeting elementary school children. Cook-Cottone et al., 2009, reported a significantly positive effect for school-based interventions targeting elementary school-age children ($r=0.06$; $p<0.001$), as well as those targeting middle school-age children ($r=0.03$; $p<0.05$). (Physical Health Status)</p> <p>Waters et al., 2011, also found a significant standardized mean change on BMI (-0.15, 95% CI: -0.23, -0.08) for obesity prevention programs targeting children ages 6 to 12 years. (Physical Health Status)</p>	<p>TPH should implement obesity prevention interventions targeting children ages 6 – 12 (elementary school aged).</p>	

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>Gender</p> <p>Worked: A meta-analysis conducted by Cook-Cottone et al., 2009, illustrated a significant positive effect ($r=0.05$; $p<0.001$) when interventions were delivered to mixed gender groups. (Physical Health Status)</p> <p>Five studies included in this review targeted girls only, with only one study reporting a significantly positive result, while three showed only positive trends. Overall, a positive trend was reported for interventions targeting girls (van Sluijs et al., 2007) (Physical Activity Measures).</p> <p>Didn't Work: In the 19 studies that analysed the impact of intervention by gender for children aged 6-12 years in the Waters et al., 2011 review, eight studies reported no difference in outcomes by gender. However, four reported more pronounced intervention effects in male participants and seven reported more pronounced intervention effects in female participants. Nevertheless, a meta-analysis was not conducted to examine whether these effects were significant overall. (Physical Health Status)</p> <p>In comparison, interventions delivered solely to female students did not show any impact (Cook-Cottone et al., 2009). (Physical Health Status)</p>	<p>TPH should deliver obesity prevention interventions to mixed gender groups.</p>	<p>Recommendation 8: Staff planning interventions should consider the views of children and young people, any differences in preferences between boys and girls, and potential barriers (such as cost or the expectation that healthier foods do not taste as good)</p>
<p>SES</p> <p>Worked: The review reported no association either between the outcomes (e.g., impact on fatness or physical activity related factors) of the intervention and the PROGRESS measure, or between groups of lower SES (Waters et al., 2011). (Physical Health Status)</p> <p>However, for interventions targeting children from low SES backgrounds, a significant positive effect was found (van Sluijs et al., 2007).(Physical Activity Levels)</p>	<p>TPH should implement obesity prevention interventions in schools in lower socio-economic neighbourhoods to increase physical activity levels and improve dietary intake.</p>	<p><i>The effectiveness of interventions among lower-income and other vulnerable groups remains unclear</i></p>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p>Interventions targeting children of low socio-economic backgrounds seemed to be effective to improve dietary intake. From the eight studies incorporated for this analysis, two studies reported mixed results, while the other six studies reported improvements in dietary behaviour (Van Cauwenberghe et al., 2010). (Dietary Intake and/or Behaviour)</p>		
<p>General</p> <p>Worked: Cook-Cottone et al., 2009, further explored the impact of universal programs and selected interventions through a meta-analysis. Universal programs that targeted all children were significantly more effective ($r=0.07$; $p<0.001$) than selected programs aimed at high-risk populations who are already overweight or have risk factors of becoming overweight ($r=0.01$; $p=0.131$) (Cook-Cottone et al., 2009). (Physical Health Status)</p>	<p>TPH should implement obesity prevention interventions that target <u>all</u> children versus interventions that target high risk populations who are already overweight or have risk factors of becoming overweight.</p>	<p><i>The effectiveness of tailored physical activity interventions targeted at Black Minority Ethnic Groups, compared with a non-targeted intervention programme, remains unclear</i></p> <p><i>The effectiveness of interventions remains unclear when targeting children from Black Minority Ethnic Groups</i></p>
<p>Multi-component</p> <p><i>Both reviews provided strong evidence that multi-component interventions can improve FV intakes and dietary behaviours.</i></p> <p><i>Nine studies used for analysis consisted primarily of a FV subscription or distribution program combined with nutrition education curriculum. All found an improvement in dietary intake and behaviour (Van Cauwenberghe, 2010) (Dietary intake)</i></p> <p><i>The majority of the studies included in the de Sa and Lock, 2008 review, showed increased FV intake in both younger and older children and 75% of the included studies used a multi-component approach. Although it was difficult to identify the most effective components, most programs did</i></p>	<p>TPH should incorporate a multi-component approach to obesity prevention including behavioral, environmental, and educational components including health education, enhanced physical education, and promotion of healthy food options. In particular, the education component should be multi-risk.</p>	<p><i>The evidence on the effectiveness of multi-component school-based interventions to prevent obesity (addressing the promotion of physical activity, modification of dietary intake and reduction of sedentary behaviours) is equivocal. Some identified interventions demonstrated a reduction in mean BMI and the prevalence of obesity while the intervention was in place, but this finding was not universal.</i></p>

Supporting Evidence from Systematic Reviews	Public Health Recommendation	NICE Guideline
<p><i>include some educational component (either making it an essential part of the program or through simultaneous 'healthy eating' initiatives) (de Sa and Lock, 2008).</i></p> <p><i>van Sluijs, 2007, reported inconclusive evidence of effectiveness based on the evaluation of 10 studies, with only one of the high quality trials reporting a significant positive effect.</i></p> <p><i>The whole-school approach included changes to curriculum, physical education, and the physical, social, and organizational school environments. The study showed no impact in increasing physical activity levels among children. The review could not draw any conclusions about effectiveness of such strategies as only two studies were included in this analysis (one targeting children and one targeting adolescents) addressing the whole-school approach to increasing physical activity levels (Salmon et al., 2007).</i></p> <p><i>Only 2 studies and well-done – mixed impact from two studies. One well done trial showed no impact.</i></p> <p><i>Limited and don't know quality – state of literature is limited for physical activity.</i></p>		<p><i>There is a body of evidence that school-based multi-component interventions addressing various aspects of diet and/or activity in the school, including the school environment are effective in improving physical activity and dietary behaviour, at least while the intervention is in place. However, UK-based evidence to support multi-component interventions (the 'whole-school approach') is limited</i></p>
<p>Harm or unintended effects</p> <p>8 of the 39 studies in the Waters et al, 2011 review assessed the adverse of unintended consequences of obesity prevention interventions. A variety of measure were assessed including prevalence of underweight, unhealthy eating practices, teasing, stigmatization, body image perceptions, satisfaction and self-worth. Due to the lack of evidence related to this issue, further research is required.</p>	<p>TPH should consider addressing harm or unintended effects when planning, implementing and evaluating obesity prevention interventions.</p>	

APPENDIX B: Quality Assessment Summary

Study Details		Quality Assessment Criteria* ('x' indicates criteria met)											
Author	Year	1	2	3	4	5	6	7	8	9	10	Total/10	Rating
Camacho-Minano et al.	2011	x	x		x	x	X		x	x	x	8	High
Cook-Cottone et al.	2009	x	x		x	x			x	x	x	7	Moderate
de Sa and Lock	2008	x	x	x	x	x			x			6	Moderate
Kesten et al.	2011	x	x		x	x	x		x		x	7	Moderate
Nguyen et al.	2011	x	x	x	x	x	x	x	x		x	9	High
van Sluijs et al.	2007	x	x		x	x		x	x	x	x	8	High
Salmon et al.	2007	x	x		x	x			x	x	x	7	Moderate
Van Cauwenberghe et al.	2010	x	x	x	x	x	x	x	x	x	x	10	High
Waters et al.	2011	x	x	x	x	x	x	x	x		x	9	High

*Criteria for quality assessment: (1) clearly focused question; (2) appropriate inclusion criteria to select primary studies; (3) comprehensive search strategy described; (4) search strategy covered adequate number of years; (5) description of level of evidence; (6) assessment of methodological quality; (7) results transparent (two independent reviewers quality assessed); (8) appropriate to combine/compare studies; (9) appropriate methods for combining results; (10) author's interpretations supported by the data.

Appendix C: Review Characteristics

Review Characteristics (Systematic Reviews)								
Author, Date, Place	# of Primary Studies, Type of Studies	Theoretical Basis	Settings	Target Audience	Inter-vention Length	Mode of Delivery	Provider	Parent/Guardian Involvement
Cook-Cottone et al., 2009, United State	40 studies included but further expanded to 66 comparisons since some studies had multiple "arms" of interventions	None Mentioned	Took place within school setting. Interventions took place either during school hours or after school	In elementary, middle or in high school	-11 short (0 – 13 weeks) -16 low/moderate (13 – 27 weeks) -23 moderate (28-32 weeks) -16 long (>32 weeks)	Interventions were either policy, program, educational based, or a combination of these three	-17 by teacher (regular classroom or physical education teacher) -23 by trained teacher -7 by interventionist (nonschool staff e.g., nutritionist, registered nurse) -19 by collaboration	-11/66 comparisons involved minimal parental involvement -17/66 comparisons included moderate -2/66 comparisons with high parental involvement -9/66 comparisons included community involvement
van Sluijs et al., 2007, United Kingdom	Fifty-seven primary studies included in which 32 included children with 27 taking place in a school-based	None Mentioned	For children: -School only setting (13 studies) -School plus (family or community) (14 studies) -family based (4 studies) -community	Children (<12 years) and adolescents (≥ 12 years). High schools and American middle schools (6 th to 8 th grade, ages 11-4) were also	Interventions varied from 5 weeks to 6 years within the children category	Interventions consisted of various programs (e.g., physical education programmes, physical activity sessions, and change in environment (e.g., painting playground	The review does not make any interpretation about who delivers the intervention. However, from examining the description of	10 of the 27 th studies conducted in a school-setting consisted of some form of parental involvement. Parents were involved in the intervention by receiving weekly newsletter and packages from

	setting. The other 24 studies focus on the adolescent population.		based(2 studies)	incorporated in the adolescent category		according to children's design)) and school policies to promote overall physical activity among children. When it included family or community components, interventions included homework assignments to do with parents or incorporate of physical activity into existing community events.	the interventions implemented in school-settings, most interventions were delivered by school staff (physical education teachers and/or classroom teachers). School staffs were trained prior to executing the intervention.	school, involvement with encourage their children in healthy behaviours and being involved in school events.
Kesten et al., 2011, United Kingdom	30 primary studies were included in this review where 20 of the studies were conducted in a school setting.	None Mentioned	Twenty out of 30 studies took place in a school setting (both during and after-school). There were other primary studies included in this review that were family-based (3 studies), community-based (4 studies), and three studies that were a combination of all three settings.	Pre-adolescent girls; 7-11 years age range	11 included studies were short-term (3 to 12 months) while 19 were long term (≥ 12 months). Within school setting, 15 studies were considered long while 5 were short.	Interventions focused on modifying physical activity behaviours alone, nutrition alone or a combination of nutrition and physical activity within the various settings. Majority of the studies combined physical activity and nutrition components in their intervention.	Teachers, nutritionist but most the primary studies have not been described based on who deliveries the intervention in this review	6 school-based interventions reported a family component which engaged family through written information specifically for parents, meetings for parents with educational material and advice, instructing parents not to bring unhealthy treats into schools for celebrations and teaching physical activity games with a family element.

						Interventions within school-settings were provided through school programs (physical and/or nutritional), modification of curriculum, educational lesson plans, home component (homework, track sheet, etc.), and parental/ family programs (parental involvement-education meetings, parent workshops, phone calls to family, etc.)		
De Sa and Lock, 2008, United Kingdom	The primary study included 30 studies, including 23 studies focusing on children ages 5-11 years	None Mentioned	School setting (e.g. classroom and school breaks)	Categorized as Young (5-11 years of age) for 23 studies and Older (11-18 years of age) for 7 studies	Intervention lengths were not reported in the review; only follow-up periods were reported.	Interventions included FV provision (free or subsidized), classroom based (e.g. curriculum), School, wide (e.g. includes FV exposure) and policy, teacher involvement (e.g. training), peer leader involvement, school food service	Review doesn't specifically look at who delivered the intervention. Study description in the review does mention that some studies were executed by trained staff	Eleven (of 23) studies in younger children had parental involvement. Parents were involved in variety of ways (e.g., helping with homework and accessing tools to judge their own FV intake)

						involvement, parent involvement, school nutrition policy, and community involvement.		
Waters et al., 2011, Australia, United Kingdom and Hong Kong	Total of 55 studies were included where eight targeted children aged 0-5 years, 39 targeted children aged 6 to 12 years, and eight studies targeted children aged 13-18 years.	The predominant theories used in studies conducted in children ages 6- 12 years used were behavioural, although a variety of other theories such as environmental change, socioecological, social learning theory, health promotion, the Transtheoretical Model and youth development and resiliency based approaches were also used	community, school and out of school hours care, home, childcare or preschool/nursery/kindergarten	0-5 years, 6-12 years and 13-18 years	Interventions were categorized into either ≤12 months or >12 months	Interventions that included a classroom-based component were delivered by regular teachers and environmental intervention at the school level by the research team. Materials that were used in the interventions included lesson plans, materials used within the classroom or sent home with children, curricula and planning guides provided to teachers, resources provided for families, as well as items provided as incentives for participation and achievement.	About half of the interventions were delivered by trained study personnel. The remaining interventions were delivered primarily by school-based staff, mostly including teachers after receiving training and materials from the study team.	Reviewers did not make an overall statement regarding parental/guardian involvement. However, parental involvement was mentioned in the description of single studies that were included in this review.

Camacho-Minano et al., 2011, United State of America	A total of 29 articles were reviewed, describing the evaluation of 21 interventions	Fourteen of the interventions defined a behavioural theory as the framework for the intervention. However, there is a large variability in the explanations about how the theory constructs were used in the intervention. Ten interventions were grounded only on one theory, while four studies reported using more than one theory for the intervention framework. The Social Cognitive	School (17), community (3) and primary care clinic (1)	Girls aged 5 – 18	The duration of the programs varied greatly from 1 week to 3 years with one-third lasting 12 weeks and another third lasting 4 months to 1 year.	Delivery methods included classroom teaching, facilitated group work, online coaching, web-based study site, follow-up prompts and/or family workshops.	Delivered by teachers, troop leaders, paediatric nurse practitioner, and primary care clinic staff.	11 studies included some kind of parental involvement.
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		<p>Theory, which was the most commonly theory reported, was utilized in eight studies. Other theories used were Transtheoretical Model of Behaviour, Self-determination Theory, Theory of Meaning of Behaviour, Health Promotion Model (HPM), Social Action Theory and Socioecological model.</p>						
<p>Nguyen et al., 2010, Australia</p>	<p>21 interventions included in 24 articles. Out of the 24 articles, fifteen focussed on obesity prevention (three in</p>	<p>The theoretical basis underlying most interventions related to social cognitive theory or the transtheoretical</p>	<p>School, community, and/or clinic-based settings</p>	<p>Children and adolescents up to age 18</p>	<p>The duration of the interventions varied from 2 weeks to 2 years with 14 interventions lasting 16</p>	<p>Classroom and homework assignments.</p>	<p>Mix of research assistants, teachers and summer camp counsellors.</p>	<p>Seven interventions included some form of parental involvement with five interventions featuring an interactive Internet- or CD-ROM-based component for parents.</p>

	children and twelve in adolescents), and nine focussed on treatment interventions (one in children and eight in adolescents).	al model.			weeks or less, two delivered over 6 months, two over 1 year, one lasting 2 years and two being of unknown duration.			
Van Cauwenberghe et al., 2010, The Netherlands	42 studies (reported in 53 articles) were included in the review, 29 in children and 13 in adolescents.	Ten studies in children and eight studies in adolescents evaluated an intervention, which was explicitly informed by one or more behavioural theories, a theoretical framework or an explicit theory-based planning model. The majority of the projects using a theory in children reported the use of the social cognitive theory or the intervention	The intervention components were mainly delivered in the school setting, but some projects in children involved additional family based components or additional community-based components.	Children 6-12 years and adolescents (13-18 years).	The duration of the interventions varied greatly between projects from a minimum of 2 weeks to a maximum of 5 years in children and from a minimum of 1 week to a maximum of 2 years in adolescents.	Half were delivered through classroom activities such as curriculum and educational materials. Others were delivered through food distribution programmes or school lunch modifications. Others were a combination of both modes.	All but three projects in children and one study in adolescents reported teachers or research staff as the primary intervention providers, while school staff and experts were involved occasionally in the delivery of the intervention.	Some projects in children involved additional family based components. Few projects in adolescents had additional family-based components.

		mapping protocol. In adolescents, the theory of planned behaviour was most frequently used.						
Salmon et al., 2007, Australia	92 published studies, representing 42 separate interventions involving Children, 25 interventions involving adolescents, and 9 interventions crossed the specified age range from this review (from 8 to 21 years).	Theoretical basis was not discussed/analysed in the review	57 interventions were delivered in school-settings, 6 via primary care, 3 in community-based setting, and 1 via the internet.	Children aged 4-12 years and adolescents aged 13-19 years	Intervention length was not analysed in this review	<p>Delivery of the interventions varied depending on the Intervention strategies.</p> <p>Curriculum Only: Topics involved through modules/lessons around reducing television viewing, preventing unhealthy weight gain, reducing energy intake, etc. (there were both in class and web-based curriculum)</p> <p>Curriculum and Physical Education: Had classes on health topics incorporating theoretical principles and</p>	Although did not specify in details in this review, most of the interventions were delivered by gym teachers and class teachers. Some were lead by intervention specialist.	9 interventions incorporated family based strategies among children. Interventions involved parents through assigning homework, parental meetings at the school, family-based component of physical activity packs/curriculum, and monthly newsletters to parents.

					<p>physical education classes (included PA). Physical education program covered physical activity and nutrition program</p> <p>Physical Education Only/Physical Education and Environment: Included aerobic activities, nutrition education, and modification of school lunches. Physical education occurred during gym class</p> <p>One intervention also included professional development for teachers, school project teams, a buddy program, a project website, and funding for equipment</p> <p>Environment Only:</p>	
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					<p>Included interventions such as painting a school playground and providing game equipments and activity cards</p> <p>Curriculum, Physical Education, and Environment: Interventions included teacher training, modified school meals, and development of school action plans(targeting curriculum, physical activity, school canteens, and playground activities)</p> <p>Activity Breaks: Play break during class time where class teachers teach games and activities</p> <p>School and Family:</p>		
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					<p>Interventions involved physical education lessons, classroom sessions, exercise breaks during class, changes to the school food service, homework activities completed with parents, parental meetings at the school, and monthly newsletters to parents.</p> <p>School and Family/Community: Interventions involved incorporating curriculum, mass media campaigns, community events, construction of sidewalks and bicycle paths, peer-led health education and policy development</p>		
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Appendix D: Outcome Summary

Outcome Summary (Systematic Reviews)				
Author, Year, Place	Outcome Measures	Results	General Implications	Comments/Limitations
Cook-Cottone et al., 2009, United State	Primary outcome measure was change in Body Mass Index (BMI). Review explored various moderators (e.g. age, sex, ethnicity, program characteristics, duration and intensity, nutritional change, physical activity and sedentary behaviour, parental and community involvement and intervention delivery) effect on change in BMI.	<p>Age: Age of student learners was also determined to influence combined effect sizes and showed significant between-group effects ($p < .01$). Interventions targeting elementary school-age children ($k = 41$, $r = .06$; $p < .001$) were significantly more effective than interventions targeting middle school-age children ($k = 20$, $r = .02$; $p < .05$). There was no significant effect found for programs targeting high-school students ($k = 5$, $r = .04$).</p> <p>Sex: Interventions delivered to mixed-sex groups produced significant effects while interventions delivered solely to female students were not significant. No significant effect was found for the four ($k = 4$) interventions that worked with girls exclusively, but programs targeting students of both sexes were found to have a significant and positive effect ($k = 62$, $r = .05$; $p < .001$).</p> <p>Ethnicity: When race was examined, overall and between-group effects were found ($p < .001$). Interventions</p>	Within school-settings, intervention goals should include the following: improved nutrition and health knowledge through psychoeducation, encouragement of nutritional change, reduction of sedentary behaviours, and a high level of parental involvement, in which parents set behavioural change goals. Notably, universal interventions, those of longer duration, interventions held within the elementary school years, and those based on collaborative delivery methods appear to be distinctly beneficial.	<ul style="list-style-type: none"> Although authors made general comments about the dependency of meta-analyses on the quality of the studies analyzed, methodological quality of the individual studies were not assessed The issue of using BMI as an outcome. Although BMI percentiles or z scores are recommended to take into account that BMI increases naturally with age, BMI z scores do not address other height/weight ratio moderators (e.g., sexual maturity). Most programmes did not assess sexual/pubertal maturation to maintain study privacy in the school setting. Study did not examine socioeconomic status, which may have been

		<p>targeting Asian students ($k=5$, $r=.30$; $p<.001$) and predominantly White students indicated significant and positive effects ($k=47$, $r=.01$; $p<.05$). The one ($k=1$) study with a Native American population had a small, positive effect ($r=.01$). Finally, interventions targeting African-American ($k=7$, $r=.03$) or Hispanic ($k=6$, $r=.01$) students did not produce significant effects.</p> <p>Program Characteristics:</p> <p><i>Universal and Selected Program:</i></p> <ul style="list-style-type: none"> • Universal programs ($k=37$, $r=.07$; $p<.001$) were significantly more effective than were selected interventions ($k=29$, $r=.01$; p =not significant) • Universal programs that target all children were associated with positive BMI outcomes while selected interventions that are aimed at high-risk populations resulted in poorer outcomes <p><i>Duration and Intensity:</i></p> <ul style="list-style-type: none"> • Low and high intensity interventions were associated with equally significant effects • Short duration (0-12 weeks, $r=-0.04$, $P<0.05$) interventions were associated with very small, significant negative effects compared to low/moderate (13-27 		<p>a mediating variable</p> <ul style="list-style-type: none"> • Parental weight may have been another variable to consider • Study did not take into account follow-up periods, which may have been important in identifying which interventions components are correlated with long-term changes • Statistical analysis of moderators to determine possible interactions
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		<p>weeks, $r=0.04$, $p<0.001$), moderate (28-32 weeks, $r=0.07$, $p<0.001$), and long (>32 weeks, $r=0.05$, $p<0.001$) duration; which were associated with small, significant, positive BMI effects</p> <p><i>Nutritional Change:</i></p> <ul style="list-style-type: none"> • Encouragement of nutritional change appears to be associated with significant, positive outcomes • Studies that did not address nutritional change at all were also associated with significant, positive outcomes • Interventions that implemented system-wide nutritional change (e.g., in the form of modified school lunches) appeared to have limited and negative effects ($r=-0.03$, $p<0.001$) <p><i>Physical Activity and Sedentary Behaviour:</i></p> <ul style="list-style-type: none"> • No significant overall effect was found for interventions that included fitness enhancement (e.g., strength and/or inductance training; $r=.03$, $p=.105$) • Programs that included increases in physical activity (e.g., extended physical education classes, activity breaks) produced minimal, statistically significant results ($r=.04$, $p<.001$) while interventions without any physical activity 		
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		<p>components were found to have the comparably strongest, positive effects ($r = .09, p < .001$)</p> <ul style="list-style-type: none"> • Programs that targeted the reduction of sedentary behaviours (e.g., television viewing, computer time; $r = .15, p < .001$) were more effective than those that did not ($r = .00, p < .05$) <p><i>Psychosocial variables:</i></p> <ul style="list-style-type: none"> • A significant overall effect was found for programs that included psychoeducational content ($k = 57, r = .05; p < .001$) • No significant effect was found for programs without this intervention component ($k = 9, r = .03$) • Between-group effects in the area of psychoeducation were not significant <p><i>Parental and Community Involvement:</i></p> <ul style="list-style-type: none"> • Interventions that integrated community involvement ($r = .05, p < .01$) were as effective as those that did not ($r = .05, p < .001$) • Interventions that integrated minimal ($r = .07, p < .001$) and moderate ($r = .04, p < .001$) parental involvement were also as effective as those that did not ($r = .04, p < .001$) • Interventions that integrated a high level of parental involvement (e.g., requiring parents to adopt a 		
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		<p>behaviour change goal) resulted in significantly stronger effects ($r = .14, p < .001$)</p> <p><i>Intervention Delivery:</i></p> <ul style="list-style-type: none"> • Strongest effect was found for those programs delivered collaboratively by intervention specialists with school teachers ($r = 0.12, p < 0.001$) while trained teachers ($r = 0.00, p = 0.839$) or interventionist ($r = -0.03, p = 0.323$) alone showed no significant overall effect • Interventions led by regular classroom or physical education teachers showed a small, significant positive effect ($r = 0.03, p < 0.05$). 		
van Sluijs et al., 2007, United Kingdom	Investigated the increase in physical activity, particularly the increase in moderate to vigorous physical activity among children through questionnaires, step counts (pedometers), and report card	<p><i>Physical activity and Children:</i></p> <ul style="list-style-type: none"> • Overall 38 studies (including children and adolescents) reported a positive intervention effect (67%), achieving statistical significance in 27 (47%) studies • Included 14 studies in children (42%) <p><i>Education Only Intervention and Children:</i></p> <ul style="list-style-type: none"> • Nineteen studies were analysed which included one large high quality RCT, two large high quality CTs, four small high quality RCTs, and seven low quality RCTs. 	Overall, some evidence of effect was shown for environmental interventions and those targeted at children from low socioeconomic backgrounds to increase physical activity in children. Alterations to the physical education programme, such as additional classes, physical education teacher training, or the availability of additional equipments were mostly observed within multicomponent interventions involving environmental or	<ul style="list-style-type: none"> • Levels of exposure to the interventions and adherence may have limited effectiveness (includes number of participants attending a session) • Most studies did not describe attendance, implementation, or quality assurance of interventions impacting overall findings • Interpretation of methodological quality was affected by the

		<ul style="list-style-type: none"> • No overall evidence of an effect of education only interventions was identified since only four of the above studies reported a statistically significant intervention effect <p><i>Environmental or Policy-based Intervention and Children:</i></p> <ul style="list-style-type: none"> • Four studies, including two low quality RCTs, focused on the change in school environment. • Both RCTs reported significant intervention effect, resulting in limited evidence of an effect of environmental interventions <p><i>Multicomponent Intervention and Children:</i></p> <ul style="list-style-type: none"> • Effectiveness of multicomponent interventions were evaluated using ten studies which included three large high quality RCTs • Only one of the high quality trails reported a significant positive effective • Inconclusive evidence of effectiveness towards multicomponent <p><i>School only Intervention and Children:</i></p> <ul style="list-style-type: none"> • Examined thirteen studies in school setting only, including one high quality and four low quality RCTs • Three of the five RCTs resulted in 	<p>policy changes . Future studies should aim to strengthen the evidence with rigorous design, appropriate sample size, follow-up beyond post intervention to assess maintenance, use of objective measures of overall activity, and assessment of factors along the causal pathway.</p>	<p>lack of information on the randomisation procedure and blinding at outcome assessment</p> <ul style="list-style-type: none"> • Short duration of follow-up, inadequate adjustment for potential confounders, and a lack of adjustment for clustering when randomisation was carried out at group level all contributes to methodological limitation • Eighteen (55%) of the studies in children used self-reported or parent reported measures
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		<p>a significantly positive effect</p> <ul style="list-style-type: none"> • Inconclusive evidence of an effect for school only interventions <p><i>School plus Community or Family-based Intervention and Children:</i></p> <ul style="list-style-type: none"> • Fourteen studies, which included two large high RCTs, investigated school based interventions that included family or community components • One of the high quality RCTs illustrated a significant positive intervention effect • Overall, inconclusive evidence of an effect for school based interventions plus family or community involvement <p><i>Gender Specific Interventions and Children:</i></p> <ul style="list-style-type: none"> • Five studies targeted girls only, which included one large high quality RCT, two small high quality RCT, and two low quality RCT • Only one study report significantly positive result while three showed positive trends • No overall evidence of an effect for interventions targeting girls <p><i>Ethnic Minority Groups and Children:</i></p> <ul style="list-style-type: none"> • Ten studies included with four of them of small high quality RCTs • Inconsistent evidence on the association between ethnicity and 		
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		<p>physical activity in children</p> <ul style="list-style-type: none"> • No overall evidence of an effect for interventions targeting ethnic minority groups <p><i>Low Socioeconomic Backgrounds and Children:</i></p> <ul style="list-style-type: none"> • Three controlled trials, where two were of high quality, assessed the effect of interventions targeting children from low socioeconomic backgrounds • Limited evidence of an effect despite all reporting a significant positive effect 		
Kesten et al., 2011, United Kingdom	Anthropometric measures (BMI, weight, height, etc.), physical activity measures, self-reported dietary measures, and knowledge and attitude related measures	<ul style="list-style-type: none"> • The effect sizes ranged from 0.01 to 1.45; where 66 were less than 0.2, 56 were categorized as low (0.2), 16 as medium (0.5) and two as high (0.8) (Note: Effect size was reported in Cohen's D value) • Most of the studies included failed to produce medium to large effect sizes • Effect sizes of less than 0.2 were produced in 57.7% of physical measures, 43.7% of nutrition measures, 33.3% of objective physical activity measures, 60% of self-reported physical activity measures and 22.2% of knowledge and attitude measures • Low effect sizes were produced by 36.5% of physical measure, 42.8% of objective physical 	Due to the heterogeneity of the studies, a simple recommendation for best practice is difficult to present. Overall, effectiveness of interventions can be suggested based increasing the reduction of time spent on sedentary behaviours, modifying school food provision when possible, and ensuring that interventions are culturally appropriate. Interventions should take into account and recognize age and gender differences and should include a range of social settings. Furthermore, emphasis should be given to developing long-term	<ul style="list-style-type: none"> • All but one of the school RCT randomized the schools into either intervention or control groups and only half of the school RCT reported taking into account of the school clustering effect in the analyses. This could lead to possible measurement bias. • Intervention details from this review were not well laid out to identify intervention vs. control groups • Conclusions drawn specifically for girls are

		<p>activity measure, 30% of self-reported physical activity measure, 45.8% of nutrition measures and 33.3% of knowledge and attitude measures</p> <ul style="list-style-type: none"> • Medium effect sizes were produced in 5.8% of physical measures, 10.4% of nutrition measure, 23.8% of objective physical activity measure, 10% of self-reported physical activity measures and 22.2% of knowledge and attitude measures • High effect sizes were only produced in 22.2% of knowledge and attitude measures • Statistically significant results were produced in 39.2% of physical measures, 50% of objective physical activity measures, 39.7% of self-reported physical activity measures, 27.3% of self-reported nutrition measures and 44.4% of knowledge and attitudes measures • Six studies taking place in a school setting resulted in a significant changes to behaviour, a physical measure or both through modification of school food provision 	<p>interventions and also fund the follow up of interventions to produce more effective and sustainable changes.</p>	<p>limited to those studies which present results separately for girls</p> <ul style="list-style-type: none"> • Since the review focus upon pre-adolescents aged 7-11 years, the group may include girls who are post-menorrhoeal which may impact upon weight status • Favourable view of intervention effects due to publication bias
de Sa and Lock, 2008, United Kingdom	<p>Apart from the food and nutrition intake measurements, other measures included: knowledge/attitudes/prefer</p>	<p><i>Evidence of Effectiveness:</i></p> <ul style="list-style-type: none"> • 70% of school schemes increased FV intake in both younger and older children (intervention effect ranged from 	<p>Children's access to FV can be increased through changing school meals, snack provision, gardening, cooking or tasting programs.</p>	<ul style="list-style-type: none"> • Quality of primary studies was not assessed in this review, making interpretation of results

	<p>ences, psychosocial variables, determinants of FV intake, cholesterol, anthropometry/BMI, physical activity and reduced TV viewing hours.</p>	<p>+0.14 servings per day to +0.99 servings per day)</p> <ul style="list-style-type: none"> • No studies found overall decreases in FV intake following interventions • 75% of the intervention involved a multi-component approach but was difficult to identify the most effective components <ul style="list-style-type: none"> ○ However, most programs did include some educational component (either making it essential or through simultaneous 'health eating' initiatives) • Increase in FV intake through peer or fictional role models, or rewarding children for increasing intake was observed in three studies in both age groups <ul style="list-style-type: none"> ○ Incentives was effective in some studies (3 studies) while positive effect was not maintained at follow-up in others (2 studies) • Neither school environment interventions on their own, nor environmental change plus curriculum sessions had a significant impact on FV intake <ul style="list-style-type: none"> ○ Small significant increase (which was not sustained at 2 year follow-up) was observed through trained peer leaders • Of the 7 studies targeting obesity reduction with FV as a secondary 	<p>School FV schemes can have added benefits of reducing health and social inequalities where free scheme program reduces difference in FV intake between socioeconomic groups. The programs should run over several years and allow further evaluation of long-term effectiveness.</p>	<p>difficult to apply to general context</p> <ul style="list-style-type: none"> • Author's overall interpretation was not supported by data • Heterogeneity of both FV intake measurement and reporting across studies • Studies not using same international standard definition of what to include in FV measurement • Recall, social desirability and observer bias impacting reliable data collection in children
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		<p>aim, one study produced a positive impact on BMI and FV intake while three other studies produced significant positive result in other aspects of diet (e.g. fat intake)</p> <p><i>Fruits and/or Vegetable Consumption in Younger Children:</i></p> <ul style="list-style-type: none"> • Nineteen (of 23) studies in younger children reported a statistically significant increase in FV at some stage during the intervention. Sixteen of these 19 studies maintained change in FV consumption at follow-up • Remaining four studies that did not observe an increase in FV consumption: <ul style="list-style-type: none"> ○ One reported significant increase in knowledge of the health benefits of FV ○ Two studies primarily targeting obesity prevention (FV consumption being a secondary outcome), reported a decrease in high-fat food consumption ○ One study prevented further decline in FV intake <p><i>Results by Intervention Type:</i></p> <ul style="list-style-type: none"> • Ten studies in both younger and older children had provision of free or subsidized FV 		
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		<ul style="list-style-type: none"> • A English and Norwegian programme showed statistically significant increase in consumption during the scheme 		
Waters et al., 2011, United Kingdom	<p><i>Primary outcomes:</i></p> <ul style="list-style-type: none"> • weight and height • % fat content • BMI • ponderal index • skin-fold thickness • prevalence of overweight and obesity <p><i>Secondary outcomes:</i></p> <ul style="list-style-type: none"> • activity levels • dietary intake (using validated measures such as diaries etc) • change in knowledge • environment change (such as food provision service) • stakeholders views of the intervention and other evaluation findings • measures of self-esteem, health status and well being, quality of life • harm associated with the process or 	<p>Overall results from meta-analysis (combining all three age groups):</p> <ul style="list-style-type: none"> • a statistically significant mean effect size of -0.11 (95% CI: -0.19, -0.02) was computed for intervention being physical activity-based • non-significant effect size of -0.12 (95% CI: -0.28, 0.05) was computed for intervention being dietary-based • a statistically significant effect size of -0.18 (95% CI: -0.27, -0.09) was computed for intervention being a combination of physical activity & dietary-based • a statistically significant effect size of -0.14 (95% CI: -0.21, -0.08) was computed within educational setting only while education + other setting (-0.09, 95% CI: -0.20, 0.02) and non-education setting (-0.28, 95% CI: -0.72, 0.16) were found to have non-significant mean effect size • a statistically significant effect size of -0.17 (95% CI: -0.25,-0.09) and -0.12 (95%CI:-0.21,-0.03) were computed for interventions that were a duration of ≤ 12 months and 12months, respectively <p>Effectiveness (for ages 6 to 12 years)</p> <ul style="list-style-type: none"> • a statistically significant mean effect size of -0.15 (95%CI: -0.23 to -0.08) was found conducting 	<ul style="list-style-type: none"> • This review provided some support for the hypothesis that obesity prevention interventions in children can be effective and does not cause adverse effect or increase health inequalities • Public health should promote/support/implementation strategies to prevent obesity among 6-12 year olds in education setting that consists of interventions focusing on healthy eating and physical activity of various duration (short or long duration) • Recommend that all studies monitor the potential occurrence of unhealthy practices • The review provided positive outcomes for the more disadvantages, and thus those of higher morbidity • Reviewers advocate for assessment of outcomes 	<ul style="list-style-type: none"> • Unexplained heterogeneity of effects observed, potential attrition bias in many studies, and the likelihood of small study bias may have inflated estimate of effect • Review includes non-randomised studies which raises concerns about selection bias • Concerns for contamination and validity of outcome measures

	<p>outcomes of the intervention</p> <ul style="list-style-type: none"> • cost effectiveness/costs of the intervention 	<p>meta-analysis on the studies included; inferences should be made with caution due to heterogeneity among studies and small sample size</p> <ul style="list-style-type: none"> • education setting resulted in a similar effect size as the whole group- statistically significant effect (-0.17, 95% CI: -0.25 to -0.09; P < 0.001) • studies conducted either in multiple settings (n = 4 of 27 studies), or outside education settings (e.g. home, community) (n = 3 of 27 studies) resulted in a non-significant mean effect size of -0.07 (-0.24 to 0.10) <p>Adiposity (ages 6 to 12 years):</p> <ul style="list-style-type: none"> • Eighteen of the 39 studies reported a significant intervention effect on any measure of adiposity; <ul style="list-style-type: none"> ○ 10 long-term intervention period (> 12 months) ○ one 12 months intervention period ○ five had intervention period of approximately 6 months ○ two short-term intervention • only three of the studies that were not effective on any indicators of adiposity had a intervention period of greater than 12 months 	<p>by measures of equity, such as those indicated by PROGRESS (Place, Race, Occupation, Gender, Religion, Education, Socio-economic status, Social status), if general population is targeted</p> <ul style="list-style-type: none"> • Recommended that policy makers planning programmes should include the following activities: <ul style="list-style-type: none"> ○ Curriculum on healthy eating, physical activity and body image integrated into regular curriculum ○ More sessions for physical activity and the development of fundamental movement skills throughout the school week ○ Improved nutritional quality of foods made available to students ○ Creating an environment and culture that 	
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		<p>Behaviour (ages 6 to 12 years):</p> <ul style="list-style-type: none"> • modest behavioural impacts have been achieved in most of the interventions in this age group <p>Diet-related (ages 6 to 12 years):</p> <ul style="list-style-type: none"> • 20 studies resulted in a significantly positive diet related alteration; indicators involved: <ul style="list-style-type: none"> ○ Increase nutrition knowledge (4 studies) ○ Improved eating practices (1 study) ○ Improved food preparation practice (2 studies) ○ Higher levels of fruit and vegetable consumption (5 studies) ○ Reduction in energy dense snack foods (1 study) ○ Reduced intake of sweetened/carbonate drinks (5 studies) ○ Reduced intake of sweetened food (2 studies) ○ Reduced total intake of fat and total energy, total energy, or energy from fat (5 studies) ○ Other indicators of better diet (4 studies) <p>Physical activity-related (ages 6 to 12 years):</p> <ul style="list-style-type: none"> • Significantly positive impact were resulted from 21 studies; indicators involved: 	<p>support children eating nutritious foods and being active throughout each day</p> <ul style="list-style-type: none"> ○ Providing support for teachers and other staff to implement health promotion strategies and activities (e.g. professional development, capacity building activities) ○ Engaging with parents to support activities in the home setting to encourage children to be more active, eat more nutritious foods and spend less time in screen-based <ul style="list-style-type: none"> • Due to studies already existing in large volume, reviewers felt that it was unnecessary to continue to test short-term interventions that are predominantly individually focus, behavioural intervention in children 	
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		<ul style="list-style-type: none"> ○ Higher levels of self-efficacy towards physical activity (4 studies) ○ Better cardiovascular fitness (3 studies) ○ Higher levels of physical activity (9 studies) ○ Decreased sedentary behaviours (mostly screen time and television viewing) (8 studies) ○ More time spent in organised physical activity (1 study) <p>Cardiovascular disease risk factor (ages 6 to 12 years):</p> <ul style="list-style-type: none"> ● Eight studies reported the impact the intervention on cardiovascular disease as risk factors other than adiposity ● Four studies resulted in significant beneficial effects on blood pressure, heart rate, blood lipids, and cardiovascular fitness <p>Assessment of outcomes by gender (ages 6 to 12 years):</p> <ul style="list-style-type: none"> ● Of the 19 studies that analysed the effects of the intervention by gender, eight reported no difference in outcomes by gender, four reported more pronounced intervention effects in male participants and seven reported more pronounced intervention effects in female 	<p>aged six to 12 years and implemented in schools</p> <ul style="list-style-type: none"> ● More studies need to focus on testing interventions guided by theories such as the socioecological model and paired with better reporting systems that measures the impacts on the environment and setting, and the sustainability of the impacts reported ● Through this review, it is evident that there is a research gap towards effective interventions for children aged 0-5 years (particularly 0-3 years), and for adolescents ● Future studies should include outcome measurement not only on adiposity but also BMI(or zBMI) and prevalence of overweight ● Studies should include mean, standard deviation and number of participants assessed at each time point in each group to undertake meta-analyses ● Process data (including appropriateness, 	
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		<p>participants</p> <p>Maintenance/Sustainability of effects (ages 6 to 12 years):</p> <ul style="list-style-type: none"> • Four studies assessed the sustainability of the effects on behaviours • One study reported having maintenance till 6 months while another for the 6th and 12 months. One study, when examining the maintenance within a week after 9 months completion of the intervention, the intervention component were followed by 95% of the teachers at least once within a week period. The last study examining the maintained factor reported that it was not sustained at two years after the intervention had ended. <p>Equity (ages 6 to 12 years):</p> <ul style="list-style-type: none"> • For the studies that assessed outcomes by a PROGRESS (Place, Race, Occupation, Gender, Religion, Education, Socio-economic status, Social status) measure of equity, reported either no association between the outcomes of the intervention and the PROGRESS measure, or positive impacts for groups of lower SES <p>Harm-adverse/unintended effects</p>	<p>implementation, feasibility, acceptability, sustainability and context) as well as economic data (cost related to interventions) need to be reported</p> <p>In order to be translated into effective public health approaches, the review recommends future studies to be larger, randomized (where possible or blinded analysis of outcomes to minimise bias), longer term (powered to detect the small changes), and coupled with assessments of potential harm, equity impacts, implementation factors and sustainability</p>	
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		<p>(ages 6 to 12 years):</p> <ul style="list-style-type: none"> • Eight studies assessed adverse or unintended consequences of the interventions, which includes prevalence of underweight, unhealthy eating practices, teasing, stigmatisation, body image perceptions, satisfaction and self-worth • Very few or no adverse outcomes were reported in all studies included 		
Camacho-Minano et al., 2011, United State of America	Nine studies focused exclusively on improving the girls' PA level, while others targeted obesity prevention, increased bone mineral density and prevention of CV disease. Eleven programs exclusively targeted PA behavior, while the remaining were more comprehensive and also included strategies related to food consumption.	Of the 12 studies with an acceptable methodological quality, 5 failed to increase girls' PA and although 7 were successful, in some cases, their results were modest. This was true even in large RCTs, which reinforces that promoting PA among young girls is a complex task and is in need of further research	Ten studies reported a favourable intervention effect upon PA outcomes, seven of which were rated as having a high methodological quality. Multi-component school-based interventions that also offer a physical education that address the unique needs of girls seemed to be the most effective. Although family support is revealed as ineffective, peer strategies showed promising evidence. The review finishes highlighting possible intervention strategies and reporting areas where further investigation is required <ul style="list-style-type: none"> • Interventions carried out in the school setting should be gender sensitive (youth finding?) 	The average methodological quality score of all included studies is 58%, which means that studies that accomplished seven or more of the 11 established criteria were considered to have a high methodological quality within this research area. Of the included studies, 12 were identified as high quality, while the remaining 9 studies were rated as low quality. The review has identified several limitations in the methodological quality of studies. Specifically, information was lacking on the randomization procedure, blinding at outcome assessment and

			<ul style="list-style-type: none"> • Making PE enjoyable for more girls is a high priority in these interventions, by increasing choice and offering a wide range of non-competitive and innovative activities used as main strategies • Facilitating adequate MVPA during a PE lesson is also seen as crucial in the reviewed studies • Only four of the reviewed studies that included some kind of family support strategies were effective. Our results are supported by the little evidence for effectiveness of family involvement strategies in youth intervention programs found by a recent review • The primary influence of peers, as youth move from childhood to adolescence, makes it necessary to focus on this social influence in activity promotion efforts 	<p>lack of follow-up. This last limitation does not allow us to demonstrate the long-term effectiveness of these interventions, mainly when the most important component of them is precisely PA. Furthermore, although valid and reliable self-reported measurement instruments were used, there was a lack of objective PA outcome measures that counteracted the potential bias of self-reporting in favour of behaviour change.</p>
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			<p>targeted at girls, either through specific intervention strategies, such as peer tutoring or peer modeling, or with specific peer-based interventions</p> <ul style="list-style-type: none"> • Our results pointed out that theoretical models, which focus on the personal level, should be mixed with more 'choice-persuasive' environmental perspectives ranging from micro- to meso- to macro- scales • Culturally appropriate PA interventions should be acknowledged and be built on cultural beliefs and practices of these girls, integrate culturally appropriate activities and use formative research techniques to incorporate cultural relevant facilitators and minimize barriers to PA 	
Nguyen et al., 2010, Australia	Fifteen studies reported adiposity outcomes at both baseline and follow-up with	Most studies demonstrated some form of significant outcome (e.g. reported changes in dietary	The majority of studies were published in the last decade, highlighting this relatively	The average study quality design score was 45%. In 87% of studies, the effects

	<p>body mass index (BMI) z-scores assessed in eight studies. Nineteen studies examined dietary intake and/or amount of physical activity, six investigated weight-related concerns or behaviours and seven assessed psychosocial measures.</p>	<p>and/or physical activity behaviours) in participants receiving interactive electronic interventions, with 11 out of 15 studies leading to positive changes in measured or reported adiposity outcomes.</p> <p>Among the few prevention interventions in children, two studies reported positive outcomes in predominantly minority populations.</p>	<p>novel research area and the growing interest in the potential application of interactive electronic media in youth obesity management or prevention interventions. While electronic interventions appear a promising approach for the prevention and treatment of obesity in children and adolescents, based on the available evidence it is clear that further high quality research is required to accurately inform the evidence base.</p>	<p>of interactive electronic interventions were not separately evaluated from other intervention components.</p>
<p>Van Cauwenberghe et al., 2010, The Netherlands</p>	<p>Four of the 29 interventions focussing on children reported anthropometric measures and all 29 reported changes in dietary behaviours such as consumption of breakfast, fruit and vegetables, carbonated drinks, fruit juice, water, and overall food intake.</p> <p>Two of the 13 interventions focussing on adolescents reported anthropometric measures and all 13 reported changes in dietary behaviours such as consumption of fruit and vegetables, water,</p>	<p><i>Educational interventions in children:</i></p> <ul style="list-style-type: none"> • Fourteen studies evaluated the effect of education-only interventions in children on dietary behaviour. In six studies, effectiveness was not found and in two studies mixed results were found. Positive effects were found in the short term, the medium term, the long term and in a prospective cohort, and in one study an improvement was mainly found in children from advantaged areas. • Limited evidence that educational interventions in children can alter dietary behaviour positively. • Only four educational studies in children reported the effect on anthropometrics. A well-executed 	<p>In children, it appears that a subscription or distribution programme for fruit and vegetables combined with an educational component is likely to be effective to stimulate the consumption of fruit and vegetables. Studies in children from low socio-economic backgrounds seemed to be effective to improve dietary intake. In adolescents, an educational programme is likely to be effective to promote healthy nutrition. Additionally, evidence was also found for programmes that adapted school lunches or increased the availability of healthy food</p>	<p>Only five of the forty-two studies were overall rated as strong, eight were rated as moderate and twenty-nine were rated as weak. All studies had some methodological weaknesses and none of the included studies fulfilled all the necessary quality criteria. In many studies, selection bias occurred.</p>

	<p>carbonated beverages, fish and overall food intake.</p> <p>Although all of the projects conducted an outcome assessment at the end of the intervention period, only seven projects in children and only four in adolescents conducted a follow-up measurement some time after the intervention period had ended.</p>	<p>study discouraging the consumption of carbonated drinks reported a positive effect on the prevalence of obesity after 1 year, but this effect was not sustained after 2 years. However, no significant changes in BMI, centile z-scores and waist z-scores were found at both follow-ups. Two studies found significant negative effects in subgroups at medium term and long term, and one study found no effect on BMI.</p> <ul style="list-style-type: none"> • Inconclusive evidence that educational interventions can contribute to changes in body composition. <p><i>Environmental interventions in children:</i></p> <ul style="list-style-type: none"> • Five studies on fruit and vegetable subscription or distribution programmes and one breakfast distribution programme assessed the effect on fruit and vegetable intakes and on breakfast habits. • Effectiveness was found in the six studies, but only in one study a sustained effect at the long term was detected. • Limited evidence that environmental interventions can improve fruit and vegetable intakes and there is inconclusive evidence that environmental interventions can improve 	<p>and combined this with a nutritional curriculum on food intake.</p> <p>Future studies with the most rigorous design as possible, an appropriate sample size, a follow-up beyond post intervention, the use of more objective measures of dietary behaviour, measurements of body composition and the assessment of implementation issues and cost effectiveness. High-quality interventions are also required with greater length and intensity as low-dose interventions over short periods are unlikely to induce improvements in behaviour and anthropometrics, sufficient integrity, and adequate involvement of the parents and schools. Furthermore, studies should be reported according to certain standards, so that existing studies can be better compared.</p>	
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		<p>breakfast habits.</p> <p><i>Multi-component interventions in children:</i></p> <ul style="list-style-type: none"> • Nine multi-component studies assessed the effect on fruit and/or vegetable intake. All consisted primarily of a fruit and/or vegetables subscription or distribution programme combined with a nutrition education curriculum and all found an improvement in dietary behaviour. • Eight studies reported effects in subgroups only and five studies reported a long-term effect. • This provides strong evidence that multi-component interventions can have a positive effect on fruit and vegetable intakes. <p><i>Children from low socio-economic backgrounds:</i></p> <ul style="list-style-type: none"> • All eight studies targeting children from low socio-economic backgrounds assessed the effect on dietary behaviour. • Two studies reported mixed results, while the other studies reported improvements in dietary behaviour. • Limited evidence that interventions targeted at children with a low socio-economic status are effective in changing dietary behaviour. 		
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		<p><i>Children from ethnic minority populations:</i></p> <ul style="list-style-type: none"> • Only two studies evaluated the effect of an intervention in children from ethnic minority groups (one weak and one moderate). • A significant positive effect on dietary intake was found in both studies. • Inconclusive evidence of effect. 		
Salmon et al., 2007, Australia	For all studies, outcome measures were measured/reported based on physical activity measures, either through Survey or Objective/observational measures.	<p>Studies done in school settings were divided according to intervention strategies. These included 1) curriculum only; 2) curriculum and physical education; 3) curriculum, physical education, and environment; 4) physical education only; 5) physical education and environment; 6) environment only; 7) activity breaks; 8) school and family; and 9) school, family, and community</p> <p>Curriculum Only:</p> <ul style="list-style-type: none"> • Five of the interventions targeting children used curriculum strategies only • Overall findings were ineffective for 4 of the studies. Only one of the studies, assessed through a survey method, showed positive results where the program was delivered to low-socioeconomic status children 9-11 years of age. It is noteworthy that a replication of 	<p>Among children, studies that focused on increasing physical activity during physical education lessons, as well as incorporating curriculum and/or environmental changes, were more effective than curriculum-only interventions. Interventions that utilized activity breaks and those that made simple environmental changes in the school setting also showed promise. Reviewers state that such strategies are likely to be sustainable, little training is required, and they are likely to promote less structured types of physical activity (e.g., active play) that can be performed any time with little equipment. Also, physical activity interventions,</p>	<p>Limitations:</p> <ul style="list-style-type: none"> • Limitations of most curriculum-only, school-based studies include inadequate sample size, control and interventions classes being located in the same schools (contamination was not assessed), and poor measures of physical activity • Many of these studies did not assess the overall physical activity levels • Studies had methodological flaws, which includes: no

		<p>this program, using a similar self-report measure, was not effective.</p> <ul style="list-style-type: none"> • Conclusion: with only two of 11 curriculum-only studies among children or adolescents being effective, the weight of evidence suggests that curriculum strategies are not effective for promoting physical activity when used in isolation. <p>Curriculum and Physical Education:</p> <ul style="list-style-type: none"> • Two studies combined curriculum and physical education strategies • Both reported positive effect on children's physical activity • Conclusion: Among children, compared with curriculum-only interventions, including a focus on increasing physical activity during physical education lessons may be more effective for increasing children's physical activity during physical education and generally <p>Physical Education (PA) Only/Physical Education and Environment:</p> <ul style="list-style-type: none"> • Two studies focused only on new physical education strategies and two also changed the school environment (2 of the studies consisted of low-mid SES areas and/or families) • Both studies focusing on physical 	<p>involving family (including parents in children's PA interventions) appears to enhance the effectiveness of interventions delivered in the school setting. Although including family and community elements in school-based physical activity interventions showed positive outcomes among adolescents, it was not effect among child</p>	<p>baseline data; poor study design (e.g., no control group, no baseline data); atheoretical, physical activity measures of unknown reliability and validity; and poor reporting of study details (e.g., sample size, response rates, attrition/retention, compliance, year of intervention, duration of intervention)</p> <ul style="list-style-type: none"> • Validation, reliability and sensitivity to behaviour change through survey measures instead of objective measures • Lack of follow-up data on interventions and a lack of reporting of mediators of short-term and long-term behaviour change
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		<p>education only had a positive outcome (where one study had no intervention effect for PA outside of school hours). The other study, although it focused on increase PA in gym class, whether it increased overall PA participation was unknown</p> <ul style="list-style-type: none"> • The other two studies, with also included school environmental changes, was either effective in one of the studies in increasing the observed time spent in vigorous-intensity physical activity during physical education lessons. The other study had no significant effect among girls but a very small statistical significant increase among boys • Conclusion: interventions that focus on physical education lessons among children or adolescents can have a small effect on activity during lessons. The impact on physical activity outside school or overall was equivocal <p>Environment Only:</p> <ul style="list-style-type: none"> • Three studies examined the effect of environmental changes on PA. • Conclusion: Three studies produced small increases in physical activity. However, none assessed overall physical activity participation or whether increases 		
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		<p>in physical activity were maintained beyond the intervention period.</p> <p>Curriculum, Physical Education, and Environment:</p> <ul style="list-style-type: none"> • Only one study targeted children used whole-of-schools strategies including changes to curriculum, physical education, and the physical, social, and organizational school environments • The group-randomized controlled trial showed no effect of the intervention on children's self-reported frequency of activity and sport over the past week • Conclusion: As only two studies (one targeting children and one targeting adolescents) have been published using a whole-of school intervention on young people's physical activity, it is not possible to draw any conclusions about the effectiveness of such strategies <p>Activity Breaks:</p> <ul style="list-style-type: none"> • Two studies have investigated the effectiveness of activity breaks on children's physical activity • Conclusion: Both studies found that the "Promoting Lifetime Activity in youth" (PLAY) intervention had a significant effect on children's overall PA, by 		
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		<p>using either self-reported or objective measures.</p> <p>School and Family:</p> <ul style="list-style-type: none"> • Nine interventions used a combination of school curriculum and family-based strategies to promote children’s physical activity, seven reporting some element of success and two reporting no effects (2 interventions targeted a specific minority groups were found to be effective while one targeting a specific minority group was not effective) • Conclusion: most interventions that incorporated school and family-based components have been shown to be successful in promoting increases in at least some elements of children’s physical activity <p>School and Family/Community:</p> <ul style="list-style-type: none"> • 3 interventions, targeting children, delivered in school also involved the community in some way (one targeting a ethnic minority group that also incorporated a family-based strategies) • Conclusion: All three interventions targeting children were not successful <p>A summary of the outcomes of the</p>		
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		interventions delivered to primary school-aged children using objective measures of physical activity reports positive findings (12 of 18 studies) compared with studies that used survey measures (12 of 34 studies). Further, six studies that used both survey and objective measures demonstrated positive or at least weak effects from the objective measures but no effect based on the survey.		
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Recommendations (Guidelines)	
Guideline, Date, Place	Recommendations
<p>National Institute for Health and Clinical Excellence & National Collaborating Centre for Primary Care , 2006, United Kingdom</p>	<p>Results:</p> <p>School-based:</p> <ul style="list-style-type: none"> • <i>The evidence on the effectiveness of multi-component school-based interventions to prevent obesity (addressing the promotion of physical activity, modification of dietary intake and reduction of sedentary behaviours) is equivocal. Some identified interventions demonstrated a reduction in mean BMI and the prevalence of obesity while the intervention was in place, but this finding was not universal.</i> • <i>School-based physical activity interventions (physical activity promotion and reduced television viewing) may help children maintain a healthy weight</i> • <i>There is limited evidence from one UK-based study to suggest that interventions to reduce consumption of carbonated drinks containing sugar may have a role in reducing the prevalence of overweight and obesity</i> • <i>There is a body of evidence that school-based multi-component interventions addressing various aspects of diet and/or activity in the school, including the school environment are effective in improving physical activity and dietary behaviour, at least while the intervention is in place. However, UK-based evidence to support multi-component interventions (the ‘whole-school approach’) is limited</i> • <i>There is a body of evidence to suggest that short- and long-term school-based interventions to improve children’s dietary intake may be effective, at least while the intervention is in place. This includes interventions aiming to increase fruit and (and to a lesser extent) vegetable intake, improve school lunches and/or promote water consumption</i> • <i>There is evidence from multi-component interventions to suggest that both short- and long-term physical activity focused interventions may be effective, at least while the intervention is in place</i> • <i>No negative outcomes were reported in the identified studies. One multi-component study showed that measures of extreme dieting behaviour remained unchanged</i> • <i>There is a body of evidence to suggest that young people’s views of barriers and facilitators to</i>

healthy eating indicated that effective interventions would (i) make healthy food choices accessible, convenient and cheap in schools, (ii) involve family and peers, and (iii) address personal barriers to healthy eating, such as preferences for fast food in terms of taste, and perceived lack of will-power

- *There is a body of evidence to suggest that young people's views on barriers and facilitators suggest that interventions should (i) modify physical education lessons to suit their preferences, (ii) involve family and peers, and make physical activity a social activity, (iii) increase young people's confidence, knowledge and motivation relating to physical activity, and (iv) make physical activities more accessible, affordable and appealing to young people*

Black, minority ethnic groups, vulnerable groups and vulnerable life stages (BMEGs) (results focusing on children):

- *The effectiveness of interventions among African/black American children remains unclear. The majority of identified studies were not adequately powered to identify differences in BMI*
- *There is evidence that school-based intervention are effective in preventing excess weight gain among black American children*
- *There is some evidence that ethnicity may be a risk factor for greater weight gain during childhood, pregnancy and smoking cessation*
- *The effectiveness of interventions among lower-income and other vulnerable groups remains unclear*
- *The effectiveness of tailored physical activity interventions targeted at BMEGs, compared with a non-targeted intervention programme, remains unclear*

The effectiveness of interventions remains unclear when targeting children from BMEGs

Recommendations:

Recommendation should be an addition to already existing recommendation around the related issues (ex: physical activity, diet etc.)

School setting:

- *Ensure school policies and the environment encourage physical activity and a healthy diet*
- *Arrange training for teaching, support and catering staff*
- *Establish links with health professionals and local strategies and partnerships to promote sports*

- *Promote activities that children enjoy and can take part in outside school and into adulthood*
- *Introduce sustained interventions to encourage pupil to develop life-long healthy habits*
- *Taking pupils' views into account*
- *Children should eat meals in a pleasant, sociable environment free from distractions; supervise younger ones at meal time*
- *Involve parents*

Physical Activity recommendations for children and young people:

- Using evidenced informed practices, the amount of physical activity required to prevent obesity is unclear
- Recommended that children and young people should engage at least 60 minutes of moderate to vigorous physical activity each day
- Also recommends at least twice a week activities that aims to improve bone health, muscle strength and flexibility

Audiences (School) and Recommendations:

It is assumed that staff working in schools (or with school-aged children and their families) will have the appropriate competencies to take forward the following recommendations. Where this is not the case, training options should be considered, as should the potential to establish partnerships with local PCTs/appropriate health professionals.

Recommendation 1: *All schools should ensure that improving the diet and activity levels of children and young people is a priority for action to help prevent excess weight gain. A whole-school approach should be used to develop life-long healthy eating and physical activity practices.*

Recommendation 2: *Head teachers and chairs of governors, in collaboration with parents and pupils, should assess the whole school environment and ensure that the ethos of all school policies helps children and young people to maintain a healthy weight, eat a healthy diet and be physically active, in line with existing standards and guidance. This includes policies relating to building layout and recreational spaces, catering (including vending machines) and the food and drink children bring into school††, the taught curriculum (including PE), school travel plans and provision for cycling, and policies relating to the National Healthy Schools Programme and extended schools.*

Recommendation 3: *Head teachers and chairs of governors should ensure that teaching, support and catering staff receive training on the importance of healthy-school policies and how to support their*

	<p><i>implementation.</i></p> <p>Recommendation 4: <i>Schools should establish links with relevant organisations and professionals, including health professionals and those involved in local strategies and partnerships to promote sports for children and young people.</i></p> <p>Recommendation 5: <i>Interventions should be sustained, multicomponent and address the whole school, including after-school clubs and other activities. Short-term interventions and one-off events are insufficient on their own and should be part of a long-term integrated programme</i></p> <p>Recommendation 6: <i>Staff delivering physical education, sport and physical activity should promote activities that children and young people find enjoyable and can take part in outside school, through into adulthood. Children's confidence and understanding of why they need to continue physical activity throughout life (physical literacy) should be developed as early as possible.</i></p> <p>Recommendation 7: <i>Children and young people should eat meals (including packed lunches) in school in a pleasant, sociable environment. Younger children should be supervised at mealtimes and, if possible, staff should eat with children.</i></p> <p>Recommendation 8: <i>Staff planning interventions should consider the views of children and young people, any differences in preferences between boys and girls, and potential barriers (such as cost or the expectation that healthier foods do not taste as good).</i></p> <p>Recommendation 9: <i>Where possible, parents should be involved in school-based interventions through, for example, special events, newsletters and information about lunch menus and after-school activities.</i></p>
Centers for Disease Control and Prevention (CDC), 2011, United State	<p>Recommendations:</p> <p>Guideline 1: <i>Use a coordinated approach to develop, implement, and evaluate healthy eating and physical activity policies and practices through the following strategies:</i></p> <ul style="list-style-type: none"> • <i>Coordinate healthy eating and physical activity policies and practices through a school health council and school health coordinator</i> <ul style="list-style-type: none"> ○ <i>Establish a school health council and designate a school health coordinator at the district level</i> ○ <i>Establish a school health team and designate a school health coordinator at the school level</i> • <i>Assess healthy eating and physical activity policies and practices</i> • <i>Use a systematic approach to develop, implement, and monitor healthy eating and physical activity</i>

policies

- *Identify and involve key stakeholders from the beginning of the policy process*
- *Draft a policy language*
- *Adopt, implement, and monitor healthy eating and physical activity policies*
- *Evaluate healthy eating and physical activity policies*
 - *Conduct process evaluation of nutrition and physical activity policies and practices*
 - *Conduct outcome evaluation of healthy eating and physical activity policies, programs, and practices*

Guideline 2: *Establish school environment that support healthy eating and physical activity*

- *Provide access to healthy foods and physical activity opportunities and to safe spaces, facilities, and equipment for healthy eating and physical activity*
 - *Provide adequate and safe spaces and facilities for healthy eating*
 - *Ensure that spaces and facilities for physical activity meet or exceed recommended safety standards*
 - *Develop, teach, implement, and enforce safety rules*
 - *Maintain high levels of supervision during structured and unstructured physical activity programs*
 - *Increase community access to school physical activity facilities*
- *Establish a climate that encourage and does not stigmatize healthy eating and physical activity*
 - *Adopt marketing techniques to promote healthy dietary choices*
 - *Use student rewards that support health*
 - *Do not use physical activity as punishment*
- *Create a school environment that encourage a healthy body image, weight, and size among all students and staff members, is accepting of diverse abilities, and does not tolerate weight-based teasing*

Guideline 3: *Provide a quality school meal program and ensure that students have only appealing, healthy food and beverage choices offered outside of the school meal program*

- *Promote access to and participation in school meals*
 - *Encourage participation in school meal programs among all students*
- *Provide nutritious and appealing school meals that comply with the Dietary Guidelines for Americans*
 - *ensure that meals meet federal defined nutrition standards*
 - *ensure that schools have kitchen facilities and equipment needed to cook quality, appealing meals*
 - *Use healthy food preparation methods and purchasing techniques*
- *Ensure that all food and beverages sold or served outside of school meal programs are nutritious and*

appealing

- *Establish strong nutrition standards for competitive foods consistent with the IOM Nutrition Standards for Foods in Schools*
- *Use the contracting process to improve the nutritional quality of competitive foods and beverages*
- *Market healthier foods and beverages*
- *Use fundraising activities and student rewards that support health*

Guideline 4: *Implement a comprehensive physical activity program with quality physical education as the cornerstone*

- *Require students in grades K-12 to participate in daily physical education that uses a planned and sequential curriculum and instructional practices that are consistent with national or state standards for physical education*
 - *Require daily physical education for students in grades K-12*
 - *Implement physical education curricula consistent with national or state physical education standards*
 - *Include protocols for students assessment in physical education*
- *Provide a substantial percentage of each student's recommended daily amount of physical activity in physical education class*
 - *Implement curricular and instructional practices to increase student physical activity during physical education*
- *Use instructional strategies in physical education that enhance students' behavioural skills, confidence in their abilities, and desire to adopt and maintain a physically active lifestyle*
 - *Incorporate instructional strategies to improve students' behavioural skills in physical education and physical activity program*
 - *Incorporate instructional strategies in physical education to improve students' confidence in their ability to be physically active and maintain physical activity behaviours*
 - *Incorporate instructional strategies in physical education and physical activity programs that lead to positive attitudes and perceptions toward physical activity*
- *Provide ample opportunities for all students to engage in physical activity outside of physical education class*
 - *Require daily recess*
 - *Provide physical activity breaks during the school day*
 - *Offer students opportunities to participate in intramural physical activity programs during after-school hours*
 - *Offer interscholastic sports*

- *Implement and promote walk- and bicycle-to-school programs*
- *Ensure that physical education and other physical activity programs meet the needs and interests of all students*
 - *Promote and ensure inclusion of all students*

Guideline 5: *Implement health education that provides students with the knowledge, attitudes, skills, and experiences needed for healthy eating and physical activity*

- *Require health education from prekindergarten through age 12*
- *Implement a planned and sequential health education curriculum that is culturally and developmentally appropriate, address a clear set of behavioural outcomes that promote healthy eating and physical activity, and is based on national standards*
 - *Implement a planned and sequential curriculum that is culturally and developmentally appropriate*
 - *Implement a curriculum that address a clear set of behavioural outcomes that promote healthy eating and physical activity*
 - *Implement health education curricula that are consistent with the National health Education Standards*
- *Use curricula that are consistent with scientific evidence of effectiveness in helping students improve healthy eating and physical activity behaviours*
- *Use classroom instructional methods and strategies that are interactive, engage all students, and are relevant to their daily lives and experiences*
 - *Use interactive learning strategies*
 - *Use methods and strategies that are developmentally appropriate*
 - *Integrate computer-based instruction into health education*

Guideline 6: *Provide students with health, mental health, and social services to address healthy eating, physical activity, and related chronic disease prevention*

- *Assess student needs related to physical activity, nutrition, and obesity, and provide counselling and other services to meet those needs*
 - *Assess eating and physical activity behaviours of students*
 - *Schools initiating BMI measurement programs should implement safeguards*
 - *Counsel students on how to achieve healthy eating and physical activity recommendations*
 - *Manage the physical activity and nutritional needs of students with chronic health conditions*
- *Ensure students have access to needed health, mental health, and social services*
 - *Refer students to community-based health-care providers and healthy eating and physical activity services*

- *Provide leadership in advocacy and coordination of effective school physical activity and nutrition policies and practices*
 - *Advocate on behalf of students to create a healthy, safe, and supportive school environment that allows students to make healthy dietary and physical activity choices both in and out of school*

Guideline 7: *Partner with families and community members in the development and implementation of healthy eating and physical activity policies, practices, and programs*

- *Encourage communication among schools, families, and community members to promote adoption of healthy eating and physical activity behaviours among students*
 - *Communicate frequently and use various dissemination methods*
- *Involve families and community members on the school health council*
 - *The school health council should indentify strategies for establishing partnerships with families and community members*
- *Develop and implement strategies for motivating families to participate in school-based programs and activities that promote healthy eating and physical activity*
 - *Provide various formats for involving families and offer frequent opportunities for participation*
- *Access community resources to help provide healthy eating and physical activity opportunities for students*
 - *Involve staff members from universities, hospitals, health centres, and other health organizations in school initiatives*
 - *Recruit parent, family, and community volunteers to assist with healthy eating and physical activity initiatives*
 - *Link to out-of-school programs that promote healthy eating and physical activity*
- *Demonstrate cultural awareness in healthy eating and physical activity practices throughout the school*
 - *Customize activities and communication to reflect the culture of the community*

Guideline 8: *Provide a school employee wellness program that includes healthy eating and physical activity services for all school staff members*

- *Gather data and information to determine the nutrition and physical activity needs of school staff members and assess the availability of existing school employee wellness activities and resources*
 - *Determine employee health-related costs*
 - *Assess the status of school employee wellness activities, and indentify the nutrition and physical activity interests and needs of school employee*
- *Encourage administrative support for the staff involvement in school employee wellness*

- Obtain administrative support for school employee wellness programs that include healthy eating and physical activity
- Establish a school employee wellness committee, and identify a leader for the committee
- Develop, implement, and evaluate healthy eating and physical activity programs for all school employee
 - Implement activities to promote healthy eating and physical activity that emphasize informational, behavioural skills, and policy and environmental approaches
 - Evaluate and adapt the school employee wellness program

Guideline 9: Employ qualified persons, and provide professional development opportunities for physical education, health education, nutrition services, and health, mental health, and social services staff members, as well as staff members who supervised recess, cafeteria time, and out-of school-time programs

- Require the hiring of physical education teachers, health education teachers, and nutrition services staff members who are certified and appropriately prepared to deliver quality instruction, programs, and practices
 - Require the hiring of certified physical education teachers to teach physical education in grades K-12
 - Require the hiring of certified health education teachers to teach health education in grades K-12
 - Require the hiring of qualified nutrition service directors, managers , and staff
- Provide school staff members with annual professional development opportunities to deliver quality physical education, health education, and nutrition services
 - Provide annual professional development opportunities for physical education teachers
 - Provide annual professional development opportunities for health education teachers
 - Provide annual professional development opportunities for nutrition series staff members
- Provide annual professional development opportunities for school health, mental health, and social services staff members and staff members who lead or supervise out-of-school-time programs, recess, and cafeteria time
 - Provide annual professional development opportunities to school health, mental health and social services staff members
 - Provide annual professional development opportunities to staff members who lead or supervise healthy eating and physical activity program during out-of-school time
 - Provide annual professional development opportunities for staff members who lead or supervise recess and cafeteria time

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