



The effectiveness of school-based strategies for the primary prevention of obesity and for promoting physical activity and/or nutrition, the major modifiable risk factors for type 2 diabetes

A Review of Reviews  
March 2002

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To determine the effectiveness of interventions included in the Mandatory Health Programs and Services Guidelines (MHPSG), the following systematic reviews and summary statements were completed and funded by the Public Health Research, Education and Development (PHRED) Program of the Public Health Branch, Ministry of Health and Long-Term Care.

## General standards

### Equal Access

#### Health Hazard Investigation

- Effectiveness of public health in organized response to non-natural environmental disasters 1999
- Effectiveness of environmental awareness interventions 1999

#### Program Planning and Evaluation

- Mass media interventions: Effects on health services use 2001
- A meta-analysis of fear appeals: Implications for effective public health campaigns 2001
- Electronic social support groups to improve health 2000

## Chronic disease and injuries

- Effectiveness of environmental awareness interventions 1999

### Chronic Disease Prevention

- Effectiveness of school-based strategies for primary prevention of eating disorders: A systematic review 2001
- Using school-based programs to improve heart healthy eating behaviours of children 2001
- Effectiveness of interventions to promote healthy eating in pre-school children aged 1 to 5 years: A review 2001
- Effectiveness of smoking cessation interventions 2001
- Limited (information only) patient education programs for adults with asthma 2001
- The effectiveness of health promotion interventions in the workplace 2001
- The effect of exercise training on bone mass among pre- and postmenopausal women 2001
- The effectiveness of the health promoting schools approach and school-based health promotion interventions 2001
- Effectiveness of home based support for older people: Systematic review and meta-analysis 2001

• The effectiveness of school-based interventions in promoting physical activity and fitness among children and youth: A systematic review	2001
• Effectiveness of dust mite control to reduce asthma symptoms	2000
• The effectiveness of interventions for preventing tobacco smoke in public places	2000
• Effectiveness of a telephone intervention as a delivery strategy within the scope of public health nursing practice	2000
• Postpartum smoking relapse prevention strategies:	2000
• Enhancing fruit and vegetable consumption in people four years of age or older	1999
• Coalition effectiveness in heart health, tobacco use reduction and injury prevention	1999
• Smoking cessation during pregnancy	1999
• Community-based heart health programs	1999
• The effectiveness of workplace-based health risk appraisal in improving knowledge, attitudes or behaviours	1999
<b>Early Detection of Cancer</b>	
• Effectiveness of strategies to increase cervical cancer screening in clinic-based settings	2000
• Effectiveness of strategies to increase cervical screening (community-based settings)	2000
<b>Injury Prevention Including Substance Abuse Prevention</b>	
• Effectiveness of a telephone intervention as a delivery strategy within the scope of public health nursing practice	2000
• Effectiveness of video for health education	2000
• Effectiveness of anticipatory care interventions with community-dwelling elderly persons	2000
• Coalition effectiveness in heart health, tobacco use reduction and injury prevention	1999
• Prevention of unintentional injuries in childhood and young adolescence	1999
• Using school-based programs to reduce adolescent risk behaviour	1999
• School-based curriculum suicide prevention programs for adolescents	1999
<b>FAMILY HEALTH</b>	
<b>Sexual Health</b>	
• The effectiveness of public health interventions to reduce or prevent spousal abuse toward women	2001
• The effectiveness of the health promoting schools approach and school-based health promotion interventions	2001
• Peer health promotion interventions for youth	2000
• Using school-based programs to reduce adolescent risk behaviour	1999
• Primary prevention of adolescent pregnancy	1999
• Preventing sexually transmitted diseases (STDs) in adolescents	1999
<b>Reproductive Health</b>	
• Antenatal education for childbirth/parenthood	2001
• The effectiveness of public health strategies to reduce or prevent the incidence of low birth weight in infants born to adolescents: A systematic review	2001
• Postpartum smoking relapse prevention strategies	2000
• Smoking cessation during pregnancy	1999
• Public health home visiting	1999
<b>Child Health</b>	
• The effectiveness of public health interventions to reduce or prevent spousal abuse toward women	2001
• The effectiveness of the health promoting schools approach and school-based health promotion interventions	2001
• Support for breastfeeding mothers	2001
• Effectiveness of pre-school screening for hearing, speech, language and vision	2001
• Antenatal education for childbirth/parenthood	2001

- Parent-training programmes for improving maternal psychosocial health 2001
- Effectiveness of a telephone intervention as a delivery strategy within the scope of public health nursing practice 2000
- Effectiveness of video for health education 2000
- Postpartum smoking relapse prevention strategies 2000
- Smoking cessation during pregnancy 1999
- Using school-based programs to reduce adolescent risk behaviours 1999
- Peer/paraprofessional 1:1 interventions 1999
- Effectiveness of parenting groups with professional involvement in improving parent and child health/development outcomes 1999
- Public health home visiting 1999
- Promotion of healthy feeding in infants under one year of age 1999
- School-based curriculum suicide prevention programs for adolescents 1999

## Infection diseases

- Needle exchange programs 2000

### Control of Infectious Diseases

#### Food Safety

- Effectiveness of food safety interventions 2001
- Food safety in community-based settings 1999

#### Infection Control

- Effective infection control interventions in day care centres 1999

#### Rabies Control

#### Safe Water

#### Sexually Transmitted Diseases

- Effectiveness of video for health education 2000
- Preventing sexually transmitted diseases (STDs) in adolescents 1999

#### Tuberculosis Control

- Enhancing adherence to tuberculosis treatment 1999

#### Vaccine Preventable Diseases

- Effect of patient reminder/recall interventions on immunization rates – A review 2001
- The effectiveness of the health promoting schools approach and school-based health promotion interventions 2001



# Preface

Research is one component in evidence-based decision-making, along with past experience, patient preference, and available resources. Making research results available to consumers, practitioners, policy-makers, and other researchers is essential to fostering evidence-based practice and decision-making. In the Ontario Public Health, Health Promotion and Primary Care area, lack of access to research evidence can be a barrier to using research in policy and practice (Ciliska, Hayward, Dobbins, Brunton & Underwood, 1999; Camiletti & Huffman, 1998).

The Public Health Branch of the Ministry of Health and Long-Term Care and the City of Hamilton fund the Public Health Research, Education and Development (PHRED) Program in Hamilton. A similar program is in place in four other health units across the province. One role of the PHRED Program is to conduct and disseminate clinically relevant public health, health promotion and primary care research, and to foster evidence-based practice and policy-making.

The Effective Public Health Practice Project (EPHPP) is one initiative within the PHRED Program. This project involves public health researchers, practitioners, and policy-makers from across the province. The EPHPP project members conduct systematic reviews that evaluate the effectiveness of relevant interventions. This project, co-ordinated from the City of Hamilton PHRED, has produced numerous reviews and summary statements on the effectiveness of interventions for the Ministry of

Health and Long-Term Care, Public Health Branch. Work is ongoing.

Professional collaboration ensures high-quality scientific work that is clinically relevant to consumers, practitioners, and policy-makers. Members of the PHRED Program located in each of the health units have links with faculties such as health sciences, dentistry, nursing, nutrition, medicine, environmental health and geography at their local universities. The EPHPP also has links to the Cochrane Collaboration, an international research initiative, committed to summarizing and making the highest quality research available world-wide.

The EPHPP is committed to on-going consultation with health units within the province to define and review appropriate public health topics, and to collaboration with other groups equally committed to evidence-based practice and decision-making. In this way, the EPHPP continues to develop research that is timely, evidence-based, and relevant to the delivery of public health services in Ontario.





# Summary Statement



# Summary Statement

The effectiveness of school-based strategies for the primary prevention of obesity and for promoting physical activity and/or nutrition, the major modifiable risk factors for type 2 diabetes: a review of reviews

## Public Health Mandate

The goal of the Chronic Disease Prevention Program is to reduce premature mortality and morbidity from preventable chronic conditions such as heart disease, diabetes, hypertension, and osteoporosis.

## Background

Approximately 90% of all cases of diabetes in Canada are type 2 diabetes. The Canadian National Survey data for 1999 estimates that 1.2 to 1.4 million Canadians aged 12 years and older may have diabetes. In Ontario alone 628,000 people, or six % of the population, have been diagnosed with diabetes. It is estimated that 60,000 new cases of diabetes are diagnosed every year.

Diabetes was certified as the underlying cause of death for almost 5,500 deaths in 1996 making it the seventh leading cause of death in Canada. The number of deaths in which diabetes was considered to be a contributing factor is five times this number. As well as contributing to premature death, diabetes leads to long-term complications that include heart disease, stroke, kidney failure, limb amputation, blindness, cataracts, and glaucoma.

## Issue

The most recognized environmental trigger for type 2 diabetes is obesity. Approximately 80% of people with diabetes are obese. The Ontario Health Survey (1996/97) showed that 34% of males and 21% of females are overweight. Besides obesity, physical inactivity is another modifiable environmental trigger. The Ontario Health Survey (1996/97) showed that approximately 55% of males and females are physically inactive.

Research has shown that overweight children may become overweight adults, especially if obesity is present in adolescence. By teaching children skills to maintain healthy weights and active lifestyles, there is an opportunity to prevent obesity not only in youth, but later on, when these children become adults. Schools are an ideal setting for primary prevention interventions for children. Schools provide an excellent opportunity for prevention and skill building because of the high numbers of children enrolled, and the continuous contact schools have with children over a number of years.

## Finding the Answers

The databases MEDLINE, EMBASE, Cochrane, CINAHL, Biosis, ERIC, PsycINFO, and Social Science Abstracts were searched from 1990 to January 2002 inclusive. The reference lists of all retrieved articles were reviewed for potentially relevant articles. Seven relevant peer-reviewed journals were

hand-searched from 1996 to January 2002 inclusive. In addition to published literature a search for unpublished material consisted of input from the Ontario Public Health Association Primary Prevention of Diabetes Committee, key informants, and web site searches of Canadian, American, British, and Australian government agency sites.

### What is the Evidence?

To be included in this review of reviews, the article had to be a review, include school-age youth or adolescents in the study population, have one component take place in the school setting, and report outcomes that included a physiologic indicator that estimated the percentage of body fat or metabolic indices, or an increase in physical activity/decrease in physical activity, or healthy eating/nutrition. To be considered relevant, articles had to meet all four criteria. Twenty-three articles met the relevance criteria for the prevention of obesity and promotion of physical activity and nutrition. Quality ratings resulted in seven strong reviews, five moderate reviews, and 11 weak reviews. Only strong and moderate reviews were included in the review of reviews.

### Implications for Practice

School-based interventions should include environmental changes (cafeterias, physical education classes, and lunch or recess interventions).

School-based interventions should be multi-faceted, combining a classroom

program with environmental changes in the school, home, or community.

Interventions should be behaviourally focused. General education programs are effective for knowledge gains only.

A dose-response effect was evident in that effective interventions were longer in duration and had frequent booster sessions.

When measured, age, sex, and ethnic subgroups had different outcomes possibly necessitating the need for interventions to be tailored to the different groups.

### Implications for Research

Many of the inconsistencies in the results reported in the interventions could be the result of the absence of a clearly stated hypothesis with defined outcomes. Most interventions did not state a hypothesis and reported multiple outcomes, some of which could be unachievable or inappropriate.

Successful primary studies should be built on and compared to determine what components of the intervention make it more effective.

Assuring the integrity of the intervention is essential. Those delivering the intervention require adequate training and monitoring.

Future research should focus on behaviour change, not on knowledge acquisition or attitude change.

## Implications for Policy

Public health departments should partner with school boards and researchers to develop, implement, and fully evaluate programs for preventing obesity and promoting physical activity and nutrition.

Effective interventions were longer in duration and had frequent booster sessions. This finding has implications for resources, training and teaching time.

Only projects with rigorous scientific methodology should be funded.

## Source of Information

Micucci S, Thomas H, and Vohra J. The effectiveness of school-based strategies for the primary prevention of obesity and for promoting physical activity and/or nutrition, the major modifiable risk factors for type 2 diabetes: a review of reviews. The Effective Public Health Practice Project, March 2002.

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Abstract



# Abstract

## Objective

The purpose of this review of reviews is to summarize the evidence of the effectiveness of school-based interventions in reducing obesity and promoting physical activity and nutrition in children and adolescents.

## Methods

The search strategy followed the guidelines set out by the Cochrane Collaboration for conducting systematic reviews. The databases MEDLINE, EMBASE, Cochrane, CINAHL, Biosis, ERIC, PsycINFO, and Social Science Abstracts were searched from 1990 to January 2002 inclusive. The reference lists of all retrieved articles were reviewed for potentially relevant articles. Seven relevant peer-reviewed journals were hand-searched from 1996 to January 2002 inclusive. In addition to published literature, a search for unpublished material consisted of input from the Ontario Public Health Association Primary Prevention of Diabetes Committee, key informants, and web site searches of Canadian, American, British, and Australian government agency sites. Two independent reviewers used standardized tools to rate each study for relevance and methodological quality and to extract data.

## Results

Twenty-three articles met the relevance criteria for the prevention of obesity and promotion of physical activity and nutrition. Quality ratings resulted in

seven strong reviews, five moderate reviews, and 11 weak reviews. Although findings were inconsistent, certain trends contributed to the effectiveness of school-based programs. Programs that included an environmental change (cafeteria, physical education classes, curricula, lunch, or recess), were multi-faceted, were longer in duration, had frequent booster sessions, and were based on behavioural theory were more effective than programs that did not.

## Conclusions

The results of synthesizing the outcomes of 12 reviews are inconclusive in determining which aspects of the design and components of a school-based intervention are most effective for reducing obesity and promoting physical activity and/or nutrition in children and adolescents. Some interventions were more effective than others at modifying one criterion, but not another, and effects were not necessarily seen in both sexes. Interventions were more effective at modifying knowledge than behaviour.



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Background



# Background

Diabetes is a chronic disease that affects how insulin is produced and used in the body. In type 1 diabetes, the pancreas produces little or no insulin. It is usually diagnosed in children. Type 1 diabetes is thought to be the result of genetic or environmental determinants. In type 2 diabetes, the pancreas produces insulin but the body cannot use it effectively, or the amount of insulin produced is insufficient. Type 2 diabetes usually occurs in adults over 40 years of age and the incidence rate increases with age. The prevalence of type 2 diabetes is three % in people 35-64 years of age and increases to ten % in people over 65 years of age (Ontario Ministry of Health and Long-Term Care, 1999). The risk factors for type 2 diabetes include genetics, insulin resistance, obesity, history of diabetes related to pregnancy, impaired glucose tolerance, and physical inactivity (Ontario Ministry of Health and Long-Term Care, 1999).

Health Canada and the Ontario Ministry of Health and Long-Term Care report data for type 1 and type 2 diabetes combined. It is estimated by both agencies that approximately 90% of all cases of diabetes in Canada are type 2 diabetes (Health Canada, 1999; Ontario Ministry of Health and Long-Term Care, 1999). The Canadian National Survey (1999) estimates that 1.2 to 1.4 million Canadians aged 12 years and older may have diabetes (Health Canada, 1999). In Ontario alone 628,000 people, or six % of the population, have been diagnosed with diabetes (Ontario Ministry of Health and Long-Term Care, 1999). It is estimated that there are 60,000 new cases of diabetes diagnosed every year in Canada (Health Canada, 1999).

Diabetes was certified as the underlying cause of death for almost 5,500 deaths in 1996, making it the seventh leading cause of death in Canada. The number of deaths in which diabetes was considered to be a contributing factor is five times this number (Health Canada, 1999). As well as contributing to premature death, diabetes leads to long-term complications that include heart disease, stroke, kidney failure, limb amputation, blindness, cataracts, and glaucoma.

In 1996 the economic burden in Canada of both type 1 and type 2 diabetes and their complications was estimated to be approximately \$11.5 billion annually. These costs include direct costs to health care and indirect costs such as lost productivity and premature death (Health Canada, 1999). The prevalence of diabetes is expected to more than double by 2016, given the aging population and the fact that risk factors associated with type 2 diabetes are becoming ingrained at the societal level (Ontario Ministry of Health and Long-Term Care, 1999).

Type 2 diabetes, the topic of this review, is considered the most prevalent and modifiable form of the disease. The most recognized environmental trigger for type 2 diabetes is obesity. Approximately 80% of people with diabetes are obese (Ontario Ministry of Health and Long-Term Care, 1999). The Ontario Health Survey (1996/97) showed that 34% of males and 21% of females are overweight (Ontario Ministry of Health and Long-Term Care, 1999). An epidemiological model looking at the cost of obesity in Canada identified type 2 diabetes as

being one of the ten comorbidities attributable to obesity. The study found that obese subjects had a 4.37 (95% CI 2.76-6.93) times' greater risk of acquiring type 2 diabetes than non-obese subjects. Of total direct expenditures to the health care system for type 2 diabetes, obesity was found to contribute to 50.7% or \$423.2 million of the total costs of the disease (based on National Health Expenditures Database forecast for 1997 [Birmingham, Muller, Palepu, Spinelli, & Anis, 1999]).

Over and above obesity, physical inactivity is a modifiable environmental trigger for type 2 diabetes. The Ontario Health Survey (1996/97) showed that approximately 55% of males and females in Ontario are physically inactive (Ontario Ministry of Health and Long-Term Care, 1999). An estimate of the economic burden of physical inactivity in Canada attributed almost 20% or \$123,310 million of direct health care costs for type 2 diabetes to physical inactivity (based on estimates from the National Health Expenditures Database for 1999 [Katzmarzyk, Gledhill, & Shephard, 2000]).

Disease burden to the individual and society, a rapid change in the incidence rate of a disease suggesting preventability, and public or private concern about the disease are three characteristics that define a public health concern (Glasgow et al., 1999). Type 2 diabetes meets all three criteria. The Ontario Ministry of Health and Long-Term Care, Public Health Branch provides Mandatory Health Programs and Service Guidelines (MHPSG) (Ontario

Ministry of Health and Long-Term Care, 1999) to define the minimum standard of care provided within Ontario public health unit regions. One of the primary goals for all public health units is to reduce premature mortality and morbidity from preventable chronic diseases such as heart disease, diabetes, hypertension, and osteoporosis (Ontario Ministry of Health and Long-Term Care, 1997).

Primary prevention strategies incorporate interventions that are intended to reduce the incidence of a disease by promoting health, thereby preventing the disease process from developing (Stanhope & Lancaster, 1996). Research has shown that overweight children may become overweight adults, especially if obesity is present in adolescence (Dietz & Gortmaker, 2001; Story, 1999; Serdula et al., 1993). By teaching children skills to maintain healthy weights and active lifestyles, there is an opportunity to prevent obesity not only in youth, but later on when these children become adults. Schools are an ideal setting for primary prevention programs for children (Centers for Disease Control and Prevention, 1997). Schools provide an excellent opportunity for prevention and skill building because of the high numbers of children enrolled, and the continuous contact schools have with children over a number of years (Story, 1999). School programs can be delivered at low or no cost to families since resources such as educators, food services, gyms, equipment, outdoor playing fields, and physical education programs are already available on-site. Physical education programming, classroom health education, and food

service are three areas where schools have an opportunity to contribute to obesity prevention and to encourage physical activity (Story, 1999). Guidelines from the National Center for Chronic Disease Prevention and Health Promotion recommend that school-based programs acquire the capability to help youth establish lifelong healthy physical activity patterns by delivering programs that are enjoyable, and by creating a physical and social environment that enables physical activity (Centers for Disease Control and Prevention, 1997). Investigating the effectiveness of school-based activities for the primary prevention of obesity and physical inactivity in children is an important concern for public health because these factors are central to diabetes prevention, as well as the prevention of other chronic diseases.



4

Review Question



# Review Question

A preliminary search of the literature revealed no primary studies specifically aimed at school-based primary prevention of type 2 diabetes. This is not surprising given the length of time required to follow school-aged children to the possible onset of type 2 diabetes.

The Ontario Public Health Association Primary Prevention of Diabetes Committee (OPHA Committee) decided to look at the major modifiable risk factors for type 2 diabetes. As discussed previously, obesity and physical inactivity are the main modifiable risk factors for type 2 diabetes. Nutrition and physical inactivity are the main modifiable risk factors for obesity (Dietz & Gortmaker, 2001). It was anticipated that there would be substantial overlap in the literature for obesity, physical inactivity, and nutrition. The decision was made by the OPHA Committee to investigate two research questions.

Are school-based strategies effective in the primary prevention of obesity?

Are school-based strategies effective for promoting physical activity and/or nutrition?

Recently a number of systematic reviews and meta-analyses of the effectiveness of interventions in preventing obesity and promoting physical activity and/or nutrition have appeared in the literature addressing risk factors alone or in combination. Systematic reviews summarize the best available research evidence for a specific review question. Primary studies are retrieved, assessed for relevance and quality using a

systematic method that should be reproducible and then synthesized in a narrative form or meta-analysis to answer the research question. In a systematic review of reviews, reviews are retrieved, assessed for relevance and quality using a systematic method, and then synthesized. In both cases, rigorous methodology of search, retrieval, relevance and validity rating, data extraction, synthesis, and report writing are followed. Explicit pre-set criteria are followed and reported at every stage to attempt to reduce any possible biases that might occur.

Although the methodologies can differ somewhat between reviews and there is some on-going discussion about the limitations of this type of summary, a review of reviews has advantages. A considerable amount of literature can be summarized and, especially in this case, a comparison of interventions to prevent obesity and to promote physical activity and proper nutrition can be possible. The objective of this review of reviews is to integrate the results of reviews of interventions for the primary prevention of obesity and for promoting physical activity and nutrition to ascertain what component of an intervention or combination of components of interventions are most effective in decreasing obesity or promoting physical activity and/or nutrition.



# 5

## Methods

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# Methods

## Search Strategy

The search strategy followed the guidelines of the "Cochrane Reviewers Handbook 4.1.4" (The Cochrane Library, 2001). The databases MEDLINE, EMBASE, Cochrane, CINAHL, Biosis, ERIC, PsycINFO, and Social Science Abstracts were searched from 1990 to January 2002 inclusive. The search strategy is detailed in Appendix 2. The citations identified by the search strategy were captured into Reference Manager, a reference management and bibliographic retrieval software system. Two reviewers scanned the titles and abstracts of the captured citations for potentially relevant articles. The complete citation was requested of all citations deemed potentially relevant by the reviewers. Seven relevant peer-reviewed journals were hand-searched from 1996 to January 2002 inclusive (Appendix 2). In addition to published literature a search for unpublished material consisted of input from the OPHA Committee, key informants and web site searches of Canadian, American, British, and Australian government agency sites. Dissertations were not identified due to the considerable effort it would take to retrieve them and their proven lack of contribution (Vickers & Smith, 2000). Reference lists in all retrieved citations were reviewed and the potentially relevant citations retrieved.

## Relevance Testing

Two reviewers independently reviewed titles and abstracts of captured articles for potential relevance. The complete article

was collected for all potential titles chosen by either reviewer.

Two reviewers independently reviewed the retrieved articles for relevance. The reviewers then compared their ratings. When disagreement was noted, discussion took place until consensus on all ratings was achieved. Four relevance criteria were developed and pre-tested by the Effective Public Health Practice Project (EPHPP) to ensure that the articles reflected the topic and the scope of public health practice (Appendix 3). The article had to

- be a review,
- include school-age youth or adolescents in the population under study,
- have one component take place in the school setting, and
- report outcomes that included a physiologic indicator that demonstrated an estimate of % body fat or metabolic indices, or an increase in physical activity/decrease in physical activity, or healthy eating/nutrition.

To be considered relevant, articles had to meet all four criteria.

Reviews specifically addressing the primary prevention of type 2 diabetes in aboriginal children and adolescents were not included in this review of reviews. Information for diabetes among aboriginal people in Canada can be found with the Aboriginal Diabetes Initiative. Reviews reporting the effectiveness of population-wide approaches of other minority populations were included in this review of reviews. Because this

review of reviews addresses primary prevention strategies, children and adolescents who were obese or who already had impaired glucose tolerance were not included.

### Quality Assessment

Following the guidelines set out by Sackett (Sackett, Haynes, Guyatt, & Tugwell, 1991) and others (DuRant, 1994), a tool to assess the methodological quality used by the EPHPP in previous reviews of reviews was implemented (Appendix 4). Quality assessment of the reviews were based on the following seven criteria:

- the search strategy was stated,
- the search strategy was comprehensive,
- the relevance criteria were described,
- all primary studies were assessed for quality,
- the quality assessment included specified criteria,
- findings were integrated beyond describing or listing primary study results, and
- the reported data supported the review's conclusions.

Two reviewers independently reviewed all relevant reviews for quality. The reviewers then compared their ratings. When disagreement was noted, discussion took place until consensus on all ratings was achieved. Relevant reviews were rated "strong" for methodological quality if they met six or seven of the criteria, "moderate" if they met four or five criteria, and "weak" if they met three or fewer criteria.

### Data Extraction

A standardized instrument for data extraction was developed and pre-tested by the reviewers. The instrument was based on the information necessary to answer the research question. Data extracted included years for which data were collected, the number of primary studies included in the review, the type of review (narrative or meta-analysis), the target populations, the setting of the intervention, and the outcomes.

Two reviewers independently extracted data for all relevant reviews. The reviewers then compared their data extraction. When disagreement was noted, discussion took place until consensus on all data extraction was achieved.

# 6 Results

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# Results

## Search Strategy

The literature search resulted in 1,448 articles of which 195 articles were retrieved as potentially relevant .

## Relevance

Twenty-three articles met the relevance criteria for obesity, physical activity, and/or nutrition.

## Quality Assessment

Quality ratings resulted in seven strong reviews, five moderate reviews, and 11 weak reviews. Quality scores by criteria for the 23 reviews are listed in Table 1. The most common criteria that reviews did not perform well on were reporting that they assessed the quality of primary studies (15 of 23 reviews) and reporting a minimum requirement of quality assessment (17 of 23 reviews). Only the 12 strong and moderate reviews will be presented in the remainder of this review of reviews.

## Review Descriptions

A description of the populations included, interventions, and results of the 12 included reviews are presented in Tables 2-5.

One review reported on the primary prevention of obesity (Campbell, Waters, O'Meara, & Summerbell, 2001). Two reviews looked at interventions at improving physical activity only (Dobbins et al., 2001; Stone, McKenzie, Welk, & Booth, 1998), seven reviews focused on improving nutrition only (Sahay,

Rootman, & Ashbury, 2001; Ciliska et al., 1999; McArthur, 1998; White, Carlin, Rankin, & Adamson, 1998; Roe, Hunt, Bradshaw, & Rayner, 1997; Hursti & Sjoden, 1997; Contento et al., 1995), and two reviews included studies that addressed both physical activity and nutrition (Meininger, 2000; Resnicow & Robinson, 1997).

## Theoretical Models

Theoretical models most common to the development of school-based interventions found in the literature were the Social Learning Theory, the Health Belief Model, and the PRECEDE model. Interventions using the Social Learning Theory incorporate a change in environment, provide special training or education, enlist role models, reward participants, encourage participants to believe that something good will happen and promote self-confidence (Hyndman, Libstug, Giesbrecht, Hershfield, & Rootman, 1993). The PRECEDE (predisposing, reinforcing, and enabling constructs in educational/ environmental diagnosis and evaluation) model tries to determine what factors are important to an outcome before the intervention is designed. A five-phase needs assessment, based on the principle of process and participation, is initiated to synthesize the multidimensional and multisectoral nature of health promotion (Green & Kreuter, 1991). The Health Belief Model is based on the assumptions that: a person must believe that they are vulnerable to the disease or condition; a person must perceive that the condition is serious; once the circumstances are assessed, benefits will result from the

recommended behaviour; a precipitating force exists that makes the person want to take action; and the person is capable of succeeding (Green & Kreuter, 1991).

Of the 12 reviews, all but three reviews reported a theoretical framework used by the included studies (Ciliska et al., 1999; McArthur, 1998; White et al., 1998). The theoretical framework was not always stated or obvious in the primary studies included in the reviews. In one review, about half of the studies did not state a theoretical framework nor could one be assigned (Contento et al., 1995). An intervention based on a theoretical model was an inclusion criterion for one review (Sahay et al., 2001). Three reviews included theoretical models in the description of the studies (Campbell et al., 2001; Dobbins et al., 2001; Stone et al., 1998), and four reviews discussed theoretical models in their results (Resnicow & Robinson, 1997; Meininger, 2000; Roe et al., 1997; Hursti & Sjoden, 1997; Contento et al., 1995). The most often cited theoretical model was The Social Learning Theory or Social Cognitive Theory. The Health Belief Model and PRECEDE model were the two other models cited often. Two reviews synthesized outcomes based on theoretical models (Roe et al., 1997; Hursti & Sjoden, 1997). Both concluded that the theoretical model used did not influence the effectiveness of the intervention.

Given that the modifiable risk factors for obesity are poor nutrition and physical inactivity (Dietz et al., 2001), it was thought that the reviews would report on similar outcomes and could be combined.

This turned out not to be the case. Reviews could not be combined because of the inconsistencies in outcome measures reported, and when the same outcome was reported, the methods used were varied. Of the 12 reviews, results were reported by outcome (n=6), intervention component (n=4), category (n=1), and study (n=1). Outcomes were reported as percentage effective (n=7), effect ratios (n=1), and effect sizes (n=1) and in a narrative form (n=3). Of the six reviews reporting outcomes, over 35 different outcomes were reported (Tables 6-9).

It was then anticipated that reviews could be combined within the groupings of obesity, physical activity, nutrition, or a combination of nutrition and physical activity to find out what components of the interventions would be the most effective. This too was not possible due to the inconsistencies in outcome measures reported (Tables 6-9) and variations in methods reported (Tables 2-5) within the groupings.

Results of reviews will be presented in a narrative form in the groupings of obesity, physical activity only, nutrition only and physical activity and nutrition.

## Obesity - Table 2

Campbell et al. (2001) conducted a review of the effectiveness of interventions to prevent obesity in children with a follow-up period of greater than one year. After finding only three interventions, Campbell refined their criteria to include interventions with a minimum follow-up period of three

months. Seven studies met the modified inclusion criteria. Because the outcome measures and interventions were so diverse, no attempt was made to combine results or make a general conclusion.

### Physical Activity - Table 3

Dobbins et al. (2001) carried out a review of school-based physical activity interventions applicable to public health practice in Ontario. Nineteen studies met the inclusion criteria. Outcomes were not reported for knowledge, awareness, or attitudes. Dobbins found that there were inconsistent findings with respect to a positive effect on physiological variables or lifestyle behaviours. Compared to usual physical activity programs, school-based physical activity promotion programs were moderately effective in promoting physical activity and duration of physical activity in children and adolescent girls, and were not effective in altering most physiological measures such as blood pressure, body mass index (BMI), and pulse rate. Inconsistent results were attributed to the limitations and difficulties inherent to community-based research and measuring outcomes associated with physical activity, the variability in strategies used, dissimilar and not validated instruments to assess physical activity and physical fitness, and follow-up periods of different durations. The most effective interventions included curricula that promoted increased physical activity during the whole day (recess, lunch, class-time, and physical education classes) and included printed educational materials.

Stone et al. (1998) reviewed fourteen

studies. Studies that reported physical assessment outcomes only were excluded. Stone concluded that improvements in knowledge and attitudes related to physical activity were positively affected. Inconsistent findings were found for increasing out-of-school physical activity or moderate or vigorous activity, and for increasing during-school physical activity or moderate or vigorous activity. Studies reporting the best results used randomized designs and valid and reliable measurement tools. Studies reporting the best results used more extensive interventions and school environmental changes and targeted students in the upper elementary grades.

### Nutrition - Table 4

Ciliska et al. (1999) carried out a review of strategies to enhance consumption of fruits and vegetables applicable to public health practice in Ontario. Five studies met the inclusion criteria. The focus of the review was on the consumption of fruits and vegetables by intervention duration and components. Interventions that were short in duration (<10 weeks) and curriculum-based had no effect on fruit and vegetable consumption. A longer multi-pronged intervention including food services in the school also did not have an effect. Of the two multi-prong interventions that had duration of three years, the one intervention that focused on eating and physical activity had no effect on fruit and vegetable consumption. The intervention that targeted fruit and vegetable intake specifically significantly increased fruit and vegetable intake in the intervention group.

McArthur (1998) conducted a meta-analysis on school-based cardiovascular programs with a nutrition component in children 9-11 years of age. Included studies had to have a quantifiable measure of eating behaviour to be included. Twelve studies met the inclusion criteria. Study quality scores and effect sizes were reported by primary study. McArthur concluded that, although small, there was a positive effect of school-based interventions on heart healthy eating behaviour in 9-11 year old children. Studies with the higher effect sizes also scored the highest in quality.

White et al. (1998) reported on healthy eating interventions in minority ethnic children with the purpose of replicating the intervention in the United Kingdom. Eight studies met the inclusion criteria. Only one study in the review targeted a single minority ethnic group. Studies were divided into four groups: educational interventions; interventions combining nutrition education, physical activity promotion, and food policy; educational interventions combined with physical activity promotion; and supplementation programs. Some success in minority ethnic children was demonstrated in the multi-faceted interventions and success for girls only in the educational and physical activity promotion intervention.

Roe et al. (1997) examined the effectiveness of healthy eating interventions in children, adolescents, and university students. Catering interventions and interventions measuring knowledge only were not included in the review. Outcomes reported were diet and

blood cholesterol only. Ten of the 21 relevant interventions showed a positive effect on dietary intake or blood cholesterol. No differences in effectiveness were found across age groups, theoretical models, or amount of home activity/parental involvement. Longer-lasting and more frequent interventions were associated with a more sustained effect when one was reached.

Hursti and Sjoden (1997) included articles that examined behavioural outcomes as well as other variables. Twenty-four articles met the inclusion criteria. The majority of studies reported some change to dietary behaviour, knowledge, or attitude. Individual goals setting and interventions individualized to individual's readiness for behaviour change led to more positive outcomes. Parental involvement or information alone had no effect. Studies based on the Social Learning Theory were not more successful than studies based on other behavioural models. Boys and girls had different outcomes, a dose-response effect was evident, and implementation took a long time to develop.

Contento et al. (1995) analyzed the effectiveness of nutrition education interventions with a strong evaluation design. Studies reporting on foodservice only interventions were excluded. Interventions were categorized under general nutrition education and behaviourally focused nutrition education interventions. Most general nutrition education programs resulted in knowledge gains and attitude change but not in behavioural change (4 of 17

studies). Successful general nutrition education interventions were longer in duration than the unsuccessful interventions. It was found that 15 hours of nutrition education brought about a change in knowledge, but that it took 50 hours to bring about change in attitude and behaviour.

Behaviourally focused nutrition education interventions showed some success in 18 of 23 interventions. Outcomes often used included the behaviour skills needed to perform the behaviours, behavioural intent, and self-efficacy.

One of the relevance criteria in the Sahay et al. (2000) review was that interventions must be grounded in established theory. Seven studies met the inclusion criteria. Results were reported using effectiveness, plausibility, and practicality criteria. Interventions that were well designed and effective were considered "best practices," interventions that were well designed and not effective were considered "negative," and interventions that were poorly evaluated were considered "promising." "Promising" interventions were then judged whether they were plausible and practical. If not, the intervention was rejected. Four studies were scored as "best practices" and three studies as "promising." No school-based interventions were rated as "negative practices." Interventions were then classified as using a direct education approach, media effort, a combination of direct education and media effort, and a policy approach. Of the four "best practice" interventions, two were direct education programs and two were a

combination of direct education and mass media programs.

## Physical Activity and Nutrition - Table 5

Meininger (2000) took population-wide approaches to the primary prevention of cardiovascular diseases (CVD) and analyzed their effectiveness in minority populations. Ten studies met the inclusion criteria. Seven of 10 studies in the review included multiple ethnic groups in the study populations. Meininger reported that there was no evidence that the interventions were designed to be culturally sensitive. No consistent effects of school-based interventions on the CVD risk factor profiles of children and adolescents in minority populations were found. More recent studies incorporating behavioural and cognitive strategies, in combination with interventions to address the school environment as a whole that included family or total community participation, showed less effect on physiological risk-factor profiles of minority children and adolescents than earlier studies that did not contain the enhancements. Meininger discusses concerns with primary study samples, study designs, theoretical frameworks and methods, providers of the intervention, duration and intensity of duration, and outcome variables reported.

Resnicow and Robinson (1997) reviewed broad-based CVD prevention programs. Studies that focused on a single behavioural or physiological risk factor, targeted school-based nutrition education and not CVD risk factors, or assessed knowledge and attitudes only were not

included. Studies had to include a quantitative assessment of at least one major CVD physiological risk factor or two major CVD behavioural or cognitive risk factors and employ a classroom health education component. Interventions that included a community, home, clinic, or mass media intervention that did not report results separately for the school component were also not included. Sixteen studies met the inclusion criteria. A meta-analysis was not possible due to the insufficient statistical detail and non-comparability of methods and outcomes of the studies. Instead, Resnicow and Robinson computed an effects ratio (ER) using a method similar to the "vote count" that is calculated in qualitative reviews. Weighted and unweighted ERs were calculated for American studies, international studies, combined American and international studies, physical education and food service studies, and by study. Significant positive effects were found for 158 of the 502 comparisons reported. Positive effects occurred more frequently for cognitive (65%) and fitness outcomes (36%) than for blood pressure (18%) and adiposity outcomes (16%). Overall, multiple component interventions were more effective for cognitive, fitness, lipids, and physical activity outcomes and less effective for diet and adiposity outcomes. Resnicow and Robinson acknowledged that there were many limitations to this method of analysis and warned that the results should be considered cautiously.

## Summary

In most cases, there was evidence to show that multi-component interventions were more effective in modifying risk factors for obesity, physical activity and nutrition than single component interventions. Multi-component interventions included a combination of an environmental component, a classroom component, and an attempt to involve the family or community. As well, interventions that were sustained for greater periods of time and had more contact hours were found to be more effective.

# 7

## Discussion



# Discussion

The results of this review of reviews are consistent with the British Health Technology Assessment (HTA) review of reviews (Lister-Sharp, Chapman, Stewart-Brown, & Sowden, 1999). The HTA reviewed school-based health promotion interventions in nutrition, exercise, safety, psychological aspects of health, sexual health, substance use, personal hygiene, environmental issues, and family life education. The HTA review of reviews concluded that school health promotion could be effective in changing child and adolescent behaviour but does not do so consistently. They recommended a multifaceted approach and combining a classroom program with environmental changes in the school, home, or community or some combination of thereof.

While large-scale studies do exist, basing policy or program decisions on the results of one study can be problematic. For reasons not clearly identified, the results of the one study may not be generalizable to other settings. Combining results across studies of adequate methodological rigor usually adds strength to the findings of the primary studies. This is the rationale behind the necessity of replicating findings before the adoption of an intervention. In situations where many studies have already been completed, systematic reviews summarize the results across them. When the overall effectiveness of interventions is reported as inconclusive, it does not necessarily mean that one individual study may be ineffective, but that when combined, the total results are inconclusive. The same is true, only more so, for a reviews of

reviews. By definition, a review of reviews does not focus on individual studies but focuses on the synthesized results of studies presented in reviews. The reasons for inconsistencies in results found in this review of reviews are varied and should be examined.

The results of this review of reviews are equivocal about recommending one intervention design or component that would assure effectiveness. There are many reasons for taking in this position. First, many of the reviews did not specifically address the same research question as this review of reviews: the primary prevention of obesity or the promotion of physical activity or nutrition. As well, the primary studies synthesized did not necessarily address the question of the review they were reported in. Most of the primary studies were multi-component interventions that focused on CVD. The reviews then synthesized the outcomes based on their research question only. It is possible that components of an intervention not reported in the review may have had a negative, positive, or synergistic effect on the target population. For example, in a multicomponent intervention, nutrition strategies and outcomes were not reported in reviews reporting on physical activity strategies and outcomes only. The Child and Adolescent Trial for Cardiovascular Health Program (CATCH) was reported in reviews that looked at physical education only, nutrition only, and physical activity and nutrition. One intervention that reported outcomes on CVD risk factors found that positive results were observed 80% of the time for smoking, 65% of the time for

cognitive outcomes, 36% of the time for fitness outcomes, and 16% of the time for adiposity (Resnicow & Robinson, 1997). It has been suggested that these kind of outcomes could be the result of more emphasis being put on quitting smoking than on preventing adiposity (Fulton, McGuire, Caspersen, & Dietz, 2001).

Reviews synthesized different combinations of intervention strategies. Interventions synthesized were based on different theoretical models, intervention strategies, ranges in intensity and duration, delivery models, and lengths of follow-up. The effectiveness of interventions that might have been successful when investigated individually may be weakened by interventions that were not successful (e.g., multi-component interventions grouped together with single-component interventions).

When results of interventions are combined, there is the assumption that the populations are similar; however, this turned out not to be the case in the reviews included in this review of reviews. Study populations synthesized in the reviews were of children and adolescents of different sexes, ethnic groups, ages, social economic status, and geographical locations. Evidence from interventions included in the reviews showed that children are more amenable to changes in behaviour than adolescents (Meininger, 2000), and that there is a difference in results reported by gender (Dobbins et al., 2001; Hursti & Sjoden, 1997), ethnicity (Meininger, 2000; White et al., 1998), and country (Resnicow & Robinson, 1997). These findings

underscore the need to compare interventions with similar target populations and the need for future research to study interventions in children at an early age. Interventions should also be tailored to target populations of different genders, ethnic groups and countries of origin. Qualitative work may aid in understanding which unique program features are most successful with which subgroups.

All reviews discussed measurement issues as a challenge when comparing primary studies. Measures were mainly subjective measurements of physical activity and dietary habits (survey, self-report questionnaires, proxy-reports, and diaries) that depend on the recall, quantification, and categorization abilities of children and adolescents. A study in physical activity assessment demonstrates the great variability of correlation coefficients between self-reported measures and direct observation ( $r=-0.10$  to  $0.88$ ) (Sirard & Pate, 2001).

In addition to challenges in measurement, there were difficulties in combining the outcomes reported in the reviews. As stated previously, more than 35 outcomes were reported in the 12 reviews. The International Obesity Task Force recently concluded that BMI ( $\text{kg}/\text{m}^2$ ) was a reasonable measure for assessing fatness in children and adolescents (Dietz & Bellizzi, 1999). The article goes on to say that albeit reasonable, BMI as an index of adiposity is problematic when used in assessing fatness across different populations because white children have a higher percentage of body fat than

black children with the same BMI (Dietz & Bellizzi, 1999). There is also disagreement associated with the use of knowledge as an outcome. Knowledge was an outcome that is most often reported by the reviews. Knowledge was reported in six reviews and purposely omitted in three reviews. There is evidence to show that increased knowledge does not change behaviour (White & Skinner, 1988; Atkinson & Nitzke, 2001) and evidence to show that a change in knowledge is a necessary step before a change in behaviour can occur (Hyndman et al., 1993).

It is generally accepted that implementation integrity of school-based programs is also a concern. The implementation of policies was reviewed for physical activity (Sirard & Pate, 2001) and physical activity and nutrition (McGraw et al., 2000). Both concluded that there was a considerable variation in how interventions in classroom curricula, physical activity programs, and food service programs were defined and measured. Measurements of quantity (dose or completeness) and quality (fidelity) were predominantly measured by self-report with very little attempt at ensuring their reliability and validity. In spite of these shortcomings, a dose-response effect was demonstrated in one review (Hursti & Sjoden, 1997).

In contrast to the inconsistencies in outcomes and units reported in the reviews is the consistency in studies across the reviews and groupings of this review of reviews. In the 184 primary studies included in the reviews, many interventions were common to several

reviews. For example, the Know Your Body Program was reported 35 times, Stanford Adolescent Heart Health Program 9 times, Nutrition in a Changing World 8 times, and CATCH 8 times to name a few. Of the 184 primary studies, 56 studies were referred to once. This replication of primary studies has the potential to influence the findings of this review of reviews, which synthesizes the results of reviews that report on the same programs over and over again.

Consistencies in the studies reported also occurred within the reviews. Of the 43 studies in one review (Contento et al., 1995), five studies reported on the Know Your Body Program and five studies reported on the Nutrition in a Changing World Program. Programs were implemented in multiple locations but all followed the same program format. Two other reviews (Resnicow & Robinson, 1997; Roe et al., 1997) reported the Know Your Body Program five times. The problem with reporting the same program multiple times in a review is that it has the potential to weight the results of that program heavier when it is compared to programs that are only reported once. If the argument for including the program multiple times in a review is that it was implemented in different locations, it brings to question the generalizability of the program. It is essential that programs include an evaluation component, even if they have been implemented in other locations, to ensure that effectiveness is monitored.





# Implications for public health practice and policy



## Implications for public health practice and policy

Although the findings were inconsistent, certain trends were evident for contributing to the effectiveness of school-based programs.

1. School-based interventions should be multi-faceted, combining a classroom program with environmental changes in the school, home, or community.
2. School-based interventions should include environmental changes (cafeterias, physical education classes, class-time, lunch, or recess).
3. Interventions should be behaviourally focused. General education programs are effective for knowledge gains only.
4. A dose-response effect was evident in that effective interventions were longer in duration and had frequent booster sessions
5. When measured, age, sex, and ethnic groups had different outcomes, possibly necessitating the need for interventions to be tailored to the different groups.



# 9

## Implications for research



# Implications for research

1. Many of the inconsistencies that were present may have been the result of the absence of a prior definitions of primary versus secondary outcomes. Instead of multiple outcomes, some of which could be unachievable or inappropriate, a clearly stated hypothesis with defined outcomes may lead to more consistent results.
2. Successful primary studies should be built on and compared to determine what components of the intervention make it more effective.
3. Assuring the integrity of the intervention is essential. Those delivering the intervention require adequate training and monitoring.
4. Future research should focus on behaviour change, not on knowledge acquisition or attitude change.
5. Only studies with rigorous scientific methodology should be funded.



# 10

## Conclusions



# Conclusions

The result of synthesizing the outcomes of 12 reviews are inconclusive in determining the design and components of a school-based intervention that will make it most effective in reducing obesity and promoting physical activity and/or nutrition in children and adolescents. Some interventions were more effective than others at modifying one criterion, but not another, and the effect was not necessarily seen in both sexes. Interventions were more effective at modifying knowledge than behaviour.

More rigorous research and reporting is needed to better understand what mechanisms are necessary to change the behaviour of children and adolescents to reduce obesity and promote physical activity and nutrition in a school-based setting. Attention should be focused on measurement issues and health outcome indicators.



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Table 1 – Quality assessment scores for all reviews

Search strategy	Search complete	Relevance criteria	Quality	QA minimum	Integrate findings	Conclusions supported	Final Score
Campbell, 2001	Y	Y	Y	Y	N	Y	strong
Dobbins, 2001	Y	Y	Y	Y	Y	Y	strong
Resnicow, 1997	Y	Y	Y	U	Y	Y	strong
Ciliska, 1999	Y	Y	Y	Y	Y	Y	strong
McArthur, 1998	Y	Y	Y	Y	Y	Y	strong
White, 1998	Y	Y	Y	Y	Y	Y	strong
Roe, 1997	Y	Y	Y	Y	Y	Y	strong
Stone, 1998	Y	Y	Y	N	Y	Y	moderate
Meininger, 2000	Y	Y	Y	N	Y	Y	moderate
Contento, 1995	Y	Y	Y	U	N	Y	moderate
Sahay, 2000	Y	Y	Y	U	N	Y	moderate
Hursti, 1997	Y	Y	Y	N	Y	Y	moderate
Perez-Rodriggo, 2001	N	N	N	N	N	Y	weak
Fulton, 2001	Y	Y	N	N	N	U	weak
Dietz, 2001	N	N	N	N	N	N	weak
Manios, 2000	N	N	N	N	N	Y	weak
Nicholson, 2000	N	Y	N	N	N	Y	weak
Story, 1999	N	N	N	N	Y	U	weak
Pender, 1998	N	N	N	N	N	U	weak
Keays, 1995	Y	Y	N	N	Y	U	weak
Resnicow, 1993	N	N	N	N	N	Y	weak
Contento, 1992	N	N	N	N	N	Y	weak
Sallis, 1991	N	N	N	N	N	U	weak
Y=yes N=no U=undetermined							

## Table 2 – Included reviews -Obesity

Author	Time Span	Inclusion Criteria*	n	Population	Length of Intervention	Results
Campbell et al., 2001 strong	1985-1999	minimum of 3 month follow-up	6	children	NR	Limited data that prevented the combination of outcomes. Results were reported for individual studies only.

NR=Not reported

Table 3 – Included reviews  
– Physical activity only

Author	Time Span	Inclusion Criteria*	n	Population	Length of Intervention	Results
Dobbins et al., 2001 strong	1985-2000	applicable to public health, studies measuring knowledge only were excluded, weak studies excluded	19	children, adolescents	5 wks – 6 yrs	Outcome physical activity rates (n=3) 33% physical activity duration (n=6) 50% television viewing (n=3) 67% mean systolic BP (n=10) 30% mean diastolic BP (n=9) 33% mean blood cholesterol (n=8) 63% body mass index (n=11) 42% maximal oxygen uptake (n=2) 50% pulse rate (n=6) 50%
Stone et al., 1998 moderate	1980-1997	quantitative assessment of PA, English only	14	grades 3 to college	2 wk – multi-yr	improvements in knowledge and attitudes when measured out-of-school physical activity (n=11) 67%

PA=physical activity

Table 4 – Included reviews  
– Nutrition only

Author	Time Span	Inclusion Criteria*	n	Population	Length of Intervention	Results
Ciliska et al., 1999 Strong	1980-1998	applicable to public health, intervention altered fruit and/or vegetable consumption, weak studies excluded quantifiable measure of eating behaviour, children 9-11 years, the individual as unit of analysis members of minority ethnic populations in UK	5	school-aged children	9 wk – multi-year	Outcome% effective increased fruit and vegetable intake 3-yr multi-pronged (n=2) 50% 16 wk intensive multi-pronged (n=1) 0 <10 wk curriculum (n=2) 0
McArthur 1998 strong	1980-1998		12	9-11 yrs of age	1 mo – multi-yr	Study n P valueES(d) Coates, 1981 89 <0.01 0.94 Coates, 1981 89 <0.01 0.9 Bush, 1989 233 0.33 0.13 Nader, 1989 103 0.02 0.39 Nader, 1989 103 0.01 0.52 Cohen, 1989 56 <0.01 1.69 Cohen, 1989 164 <0.01 1.05 Davis, 1995 842 0.03 0.08 Davis, 1995 924 0.24 0.16 Leupker, 1996 1,130 <0.001 0.15 Johnson, 1991 15 >0.25 0.83 Hopper, 1996 80 <0.05 0.48 ES(d)=effect size
White et al., 1998 strong	1985-1996		8	9-17 yrs of age	NR	Results for minority populations only Outcome % effective Classroom-based education (n=4) total cholesterol (n=3) 33% health knowledge (n=3) 33% consumption dairy, desserts (n=3) 33% dietary knowledge (n=3) 33% fat intake (n=3) 33% serum cholesterol (n=3) 33% Classroom-based nutrition education, PA, promotion and food policy (n=2) energy from sat fat, sodium dietary knowledge 50% anthropometric measures 100% serum cholesterol 100% Classroom-based PA (n=1) 100% health knowledge 100% dietary intake girls only

Author	Time Span	Inclusion Criteria*	n	Population	Length of Intervention	Results
Contento et al., 1995 moderate		evidence of instrument reliability and validity, excluded food service interventions, weak studies	40	school age	NR	Behaviourally focused interventions Behavioural change (n=23) 79% General Nutrition Programs Behavioural change (n=17) 23%

NR=not reported  
PA=physical activity

Table 5 – Included reviews –  
Physical activity and nutrition

Author	Time Span	Inclusion Criteria*	n	Population	Length of Intervention	Results
Resnicow & Robinson, 1997  moderate	1980-1999	broad-based CVD prevention, single risk factor excluded, employed a classroom health education component, if multi-component reported separate for school-based, knowledge and attitudes only excluded, nutrition not targeting CVD excluded	16	grades 1-10	7 wks – 5 yrs	Outcome diet 35/141 43% physical activity 2/12 42% smoking 10/13 82% blood pressure 15/67 13% lipids 16/60 35% fitness 15/43 37% adiposity 7/77 23% psychosocial 58/89 65%
Meininger, 2000  moderate	1986-1999	population wide, conducted in US, include anthropometric or physiological CVD risk factors including BP, lipid profile and/or obesity	10	elementary, middle or high school	5 wks – 5 yrs	Results for minority populations only Outcome body mass or skinfolds (n=9) 33% blood pressure (n=9) 33% lipid profile variable (n=7) 57% fitness level or heart rate (n=6) 67% increase exercise (n=5) 80% dietary intake (n=8) 75% knowledge (n=8) 100%

ER=effects ratio  
BP=blood pressure  
CVD=cardiovascular disease

## TABLE 6 – Primary study outcomes reported in reviews measuring obesity

no combined outcomes reported

Table 7 – Primary study outcomes  
Reported in reviews measuring  
physical activity alone

	Dobbins, 2001	Stone, 1998
Lifestyle Behaviours		
physical activity rates	X	
physical activity duration	X	
television viewing	X	
physical activity		X
fitness		X
cardiovascular fitness		X
out of school physical activity		X
inactivity		X
increased weight/flex exercise		X
Physical Health Status		
systolic blood pressure	X	
diastolic blood pressure	X	
mean blood cholesterol	X	
body mass index	X	
maximal oxygen uptake	X	X
pulse rate	X	
% fat		X
knowledge, attitude and beliefs		X

TABLE 8 – Primary study outcomes reported in reviews measuring nutrition

	Ciliska 1999	McArthur 1998	White 1998	Roe 1997	Sahay 2000	Hursti 1997	Contento 1995
attitude					X		
knowledge			X			X	
self-efficacy							
behaviour					X	X	X
Diet	X			X	X		
dairy			X				
desserts			X				
fruit	X						
vegetables	X						
fruit & vegetables	X						
fat			X	X		X	
sodium			X				
cholesterol		X	X				
Physical Activity		X					
aerobic activities							
Physiological indicators						X	
Blood Pressure		X					
Lipids							
blood cholesterol			X	X			
Fitness							
cardiovascular			X				
Adiposity							
weight		X					
anthropometry			X				
Smoking		X					

TABLE 9 – Primary study outcomes reported in reviews measuring physical activity and nutrition

	Resnicow, 1997	Meininger, 2000
Psychosocial	X	
Knowledge		X
Diet	X	X
Physical Activity	X	X
Blood Pressure	X	X
Lipids	X	X
Fitness	X	X
Adiposity	X	
body mass		X
skinfolds		X
weight change		X

# 12

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# 13

## Appendices

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# Appendix 1 - Terms of reference

## **Preamble:**

An Advisory Panel has been constituted to provide guidance for the systematic review of interventions for the primary prevention of Type II Diabetes.

## **Role:**

- Attend regular teleconference.
- Make decisions regarding the systematic review (i.e. precise question).
- Provide relevant literature.
- Provide contact with key informants.
- Approve relevance criteria for review of reviews.
- To critique/assist in writing the final review
- Liaison with other relevant government departments and agencies to provide a broader context for development of the final product
- Dissemination of the results

## **Accountability:**

The membership will be accountable to the Chair, Helen Thomas.

## **Membership:**

OPHA , Fiona Knight, Program Management Consultant  
Ministry of Health and Long-Term Care, Charles Clayton  
OPHEA/Diabetes Primary Prevention Workgroup, Michelle Brownrigg,  
Canadian Diabetes Strategy, Health Canada, Louise Aubrey  
Food & Fitness in Focus, Stefa Katamay  
Ministry of Tourism, Culture & Recreation, Nerissa Pineda  
Toronto Public Health, Diabetes Primary Prevention Workgroup, Sari Simkins  
Canadian Diabetes Association, Donna Lillie  
Nutrition Resource Centre, Colleen Loque

**Corresponding Member:** OPHA, Jack Lee

**Chair:** Helen Thomas, PHRED, Effective Public Health Practice Project

**Meetings:** Monthly or at the call of Chair

**Quorum:** 50% plus one member

**Records:** To be kept by Fiona and circulated to members following each meeting

# Appendix 2 - Search Strategy

Primary prevention of type 2 diabetes

Search strategy – Keywords

Reviews	Effectiveness	Public Health	Interventions	Topic
review	effective:	health promotion	intervention:	*
meta analysis	evaluat:	health education	program:	
	outcome:	primary prevention	strateg:	
	impact	public health	project:	
	evidence	preventive health services	campaign:	
	efficacy	prevention	coalition:	
		community development	surveillance	
		education	legislation	

\* Topics

topic 1= diabetes

topic 2= obesity

topic 3 = physical activity, exercise

topic 4 = nutrition

## Appendix 2 – Hand searching

American Journal of Health Promotion

American Journal of Public Health

Canadian Journal of Public Health

Health Education & Behaviour/ Health Education Quarterly

Journal of Health Education

Journal of Nutrition Education

Journal of School Health

# Appendix 3 - Review of reviews Relevance tool

## School-based Primary Prevention of Diabetes

Ref. ID: \_\_\_\_\_

Author: \_\_\_\_\_

Reviewer: SM JV

Relevance Criteria:

The article is a review (narrative, systematic or meta-analysis) Y N

School-age youth or adolescents are the population of the review Y N

Interventions examined are primary prevention Y N

One component of the study intervention is implemented in the school setting (there may also be Involvement from family or community) Y N

Outcomes reported include an increase in physical activity/decrease in physical inactivity, physiologic and/or healthy eating/nutrition for children or adolescents in school- based interventions Y N

Reviewer Decision:

Include in critical appraisal (only if answer 'yes' to all 5 relevance criteria). Y N

If Discrepancy in Inclusion Decision:

Reason for discrepancy:

Oversight Y N

Difference in interpretation of criteria Y N

Differences in interpretation of study Y N

Additional Comments:

**FINAL DECISION      INCLUDE IN STUDY** Y N

Bibliographic References

Please remember to check reference list for potentially relevant studies.

# Appendix 4 - Quality assessment tool for reviews

## SCHOOL-BASED INTERVENTIONS FOR TYPE 2 DIABETES

1. Was the search strategy for primary studies stated?	Y	N	U
2. Was the search comprehensive? (Score Yes if 2 different databases e.g. social science, medical were searched) Electronic databases: nursing, medical, social science (English only or other languages) Other sources: key informants, reference lists	Y	N	U
3. Were the relevance criteria for the primary studies described? Criteria include: participants, interventions, outcome, design	Y	N	U
4. Was the quality (strengths and weaknesses) of the primary studies assessed?	Y	N	U
5. Did the quality assessment include: (Minimum requirement: 3/6 of the following criteria)	Y	N	U
<ul style="list-style-type: none"> <li>study design</li> <li>study sample / population</li> <li>confounders</li>   <li>intervention</li> <li>outcome measures</li> <li>follow up</li> </ul>			
6. Does the review integrate the findings beyond describing or listing primary study results?	Y	N	U
7. Is the reported data from all studies adequate to support the review's conclusions?	Y	N	U

QUALITY RATING (circle one)

TOTAL SCORE \_\_\_\_\_

(total score 6-7)  
**STRONG**

(total score 4-5)  
**MODERATE**

(total score 3 or less)  
**WEAK**