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Addressing Obesity in Children and Youth:

Evidence to Guide Action for Ontario

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PROJECT SPONSORS

Heather Manson, MD, FRCPC, MHSc, *Chief*, Health Promotion, Chronic Disease and Injury Prevention (HPCDIP)

Brenda Mitchell, MBA, *Director*, Knowledge Services (KS)

PROJECT LEADS

Heather Manson, MD, FRCPC, MHSc, *Chief*, HPCDIP

Ruth Sanderson, MSc, *Manager*, Analytic Services, KS

PROJECT TEAM

Erin Berenbaum, MSc, *Research Assistant*, HPCDIP

Helen Cerigo, MSc, *Research Coordinator*, HPCDIP

Natalie Greenidge, MHSc, *Epidemiologist*, Analytic Services, KS

Phat Ha, MPH, *Research Coordinator*, HPCDIP

Mariane Héroux, PhD, *Senior Research Coordinator*, HPCDIP

Jeremy Herring, MSc, *Epidemiologist Lead*, Analytic Services, KS

Carly Heung, MPH, *Research Coordinator*, HPCDIP

Erin Hodge, MSc, *Environmental Science Specialist*, Environmental and Occupational Health

Corinne Hodgson, MA, MSc, PhD(c), *Research Coordinator*, HPCDIP

Karin Hohenadel, MSc, *Epidemiologist*, Analytic Services, KS

Christiane Mitchell, MAP, MPH, *Research Assistant*, HPCDIP

Mary Fodor O'Brien, MHSc, RD, *Nutrition Specialist*, HPCDIP

Jennifer Robertson, PhD, *Senior Evaluator*, HPCDIP

Beate Sander, PhD, *Health Economist*, Public Health Sciences

Victoria Zwicker, MPH(c), *Practicum Student* (University of Toronto)

Acknowledgements

INTERNAL REVIEWERS

Kenneth R. Allison, PhD, *Senior Scientist*, HPCDIP
Maria Chiu, PhD, *Postdoctoral Fellow*, HPCDIP
Erin P. Hobin, PhD, *Scientist*, HPCDIP
Chris Mackie, MD, FRCPC, MHSc, *Public Health Physician*, HPCDIP
Laura Rosella, PhD, *Scientist*, Public Health Sciences
Beate Sander, PhD, *Health Economist*, Public Health Sciences
Ingrid Tyler, MD, FRCPC, MHSc, MEd, *Public Health Physician*, HPCDIP

EXTERNAL REVIEWERS

John Garcia, PhD, *Associate Professor* and *Associate Director*, Professional Graduate Programs, School of Public Health and Health Systems, University of Waterloo
Christopher Longo, PhD, *Associate Professor* and *Director*, Health Services Management Program (MBA), DeGroote School of Business, McMaster University
Chris Markham, *Executive Director* and *CEO*, Ontario Physical and Health Education Association (Ophea)
Brian McCrindle, MD, MPH, FRCP(C), FACC, *Staff Cardiologist* and *Section Head*, Epidemiology Cardiology, The Hospital for Sick Children (SickKids)
Bob Nosal, MD, MHSc, FRCPC, *Medical Officer of Health*, Halton Region Public Health
Elizabeth Rael, PhD, *Senior Epidemiologist*, Strategic Policy, Partnerships and Research Branch, Health Promotion Division, Ministry of Health and Long-Term Care (Ontario)
Barb Riley, PhD, *Executive Director*, Propel Centre for Population Health Impact, University of Waterloo

SPECIAL THANKS

Maggie Civak, *Research Operations Coordinator*, Research and Ethics, KS
Aaron Furfaro, *Communications Advisor*, Communications
Allison McArthur, *Library Information Specialist*, Library Services, KS
Sarah Morgan, *Library Technician*, Library Services, KS
Beata Pach, *Manager*, Library Services, KS

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Executive Summary

The increasing prevalence of overweight and obesity in children and youth is a serious public health problem requiring immediate action. Childhood obesity is associated with a complex web of risk and protective factors that provide a variety of pathways by which to intervene. However, the optimal approach to reduce obesity is unclear, with no consensus on the best ways to accomplish this task. In 2012, the Ontario government identified childhood obesity reduction as an important area of action for health, targeting a reduction of 20% over five years. An expert panel was convened to inform and advise the Ministry of Health and Long-Term Care (MOHLTC) on the best way to achieve its childhood obesity reduction target. In preparation for the panel's deliberations, MOHLTC requested that Public Health Ontario (PHO) create an evidence primer to serve as a foundational reference document to inform the work of the panel. This three-part report outlines the following: *(A)* trends in the range of risk factors associated with overweight and obesity in children and youth, as well as strategies for measuring and monitoring; *(B)* the effectiveness of interventions to prevent and treat overweight and obesity in children and youth, as well as the cost-effectiveness of these programs; and *(C)* programs or initiatives implemented by other jurisdictions and Ontario public health units. Adopting both a socio-ecological and a life-course perspective, PHO developed an integrated framework to describe the causal factors that contribute to childhood obesity, and to identify leverage points for the prevention and treatment of childhood obesity.

Causes, Trends, Measuring and Monitoring

Determining the causes of childhood overweight and obesity requires consideration of a complex web of behavioural, social, environmental and biomedical risk and protective factors that begin before birth and continue throughout the life course at the individual, family, community and societal levels. Although there is a genetic component to obesity, many modifiable risk factors are associated with overweight and obesity in children and youth. These include maternal smoking, high birthweight, rapid infant weight gain, consumption of sugar-sweetened beverages, physical inactivity, sedentary behaviour and inadequate sleep. Additionally, there are factors that have shown to be protective against child and youth overweight and obesity, such as breastfeeding, breakfast consumption and physical activity. A substantial number of Ontario's children and youth do not get enough physical activity, and many engage in sedentary behaviours for long periods of the day, a trend that increases with age. Additionally, only half of youth consume the recommended number of vegetable and fruit servings per day, and many children and youth are consuming too many calories from sugar-sweetened beverages.

Measured body mass index (BMI)-for-age is most commonly used for monitoring overweight and obesity in children and youth at the population level. There are several growth charts to define healthy growth ranges and related percentiles of BMI relative to age and sex. Recently, a number of Canadian organizations have recommended the World Health Organization (WHO) growth charts as the standard. Ontario currently lacks a single comprehensive childhood healthy weight surveillance system. While there are limitations to existing data sources, there are 10 surveys in Canada and Ontario collected in community and school settings that could be used to monitor the prevalence of overweight and obesity in children and youth.

Effectiveness of Interventions for the Prevention and Treatment of Overweight and Obesity in Children and Youth

Research on the effectiveness of interventions to prevent obesity evaluated with anthropometric outcomes has primarily focused on interventions in the school environment, and these have been shown to be effective at producing small, but clinically and statistically significant, reductions in measured anthropometric outcomes in children and youth. These are most often characterized as social and behavioural interventions, aimed at increasing healthy eating and physical activity behaviours, and reducing sedentary behaviours. More effective interventions tend to address both sides of the energy balance equation, engage parents, have a longer duration, are culturally sensitive, and include both educational and environmental activities. There is also some evidence of effectiveness for interventions conducted within home, community, and preschool and health care settings, and those that were web- or computer-based.

Three approaches to treatment (i.e., lifestyle, pharmaceutical and surgical) have been assessed for effectiveness in the literature. Lifestyle approaches to treatment were found to be more effective when they included behavioural therapy and, as with prevention interventions, address several risk factors and involve an element of parental involvement. Pharmaceutical and surgical interventions for the treatment of obesity in youth can be effective, but there is limited evidence regarding their long-term safety. As treatment approaches generally target individuals rather than populations, the potential population impact is low when compared to prevention initiatives. However, in order to prevent the complications of obesity in children and youth, obesity treatment approaches play a complementary role. Results suggest that there are both prevention and treatment approaches that meet acceptable cost-effectiveness thresholds, and these interventions can occur in a variety of settings and environments (e.g., message environment, school and after-school settings, and within the health care system).

Who is Taking Action: Jurisdictional and Ontario Public Health Unit Scans

International, national and provincial jurisdictions, and local Ontario public health units (PHUs) are moving forward with comprehensive multi-level strategies based on the available research evidence on causal pathways, despite the limited evidence overall. These interventions occur in message, school, physical activity, food and beverage, and health care and work environments, targeting children and youth across the life course. Various jurisdictions, including PHUs, have focused their efforts on addressing risk and protective factors related to healthy eating and physical activity, recognizing that such an approach is likely to achieve health benefits that reach beyond obesity-related diseases and conditions. Although Ontario does not yet have a comprehensive childhood obesity strategy, the province is already engaged in some of the strategies and initiatives that were frequently supported by the jurisdictions reviewed.

Conclusion

Given the complex pathways that lead to obesity, it is likely that a range of interventions, and intervention approaches, delivered in a variety of environments and settings across the life course of a child will be needed to reduce the prevalence and incidence of obesity. To assess whether established goals are met, evaluation of the implemented interventions and ongoing surveillance, and monitoring of obesity rates and related risk and protective factors will be essential.

1. Introduction

The increasing prevalence of obesity in children and youth is a serious public health problem requiring immediate action. Presently, almost one-third of Canadian children and youth are overweight or obese (1). Childhood obesity is associated with both immediate and long-term health risks, as well as an economic burden to the health care system. This issue is not unique to Canada or Ontario. There is evidence that the prevalence of obesity in children and youth is increasing worldwide, causing both international and local governments to take action (2).

Obesity in Children and Youth: Ontario's Response

In 2010, the Minister of Health in Ontario endorsed a federal, provincial and territorial framework for action to promote healthy weights, signalling a commitment to work with other provinces and sectors toward a sustained response to childhood obesity (3). In January 2012, the government released *Ontario's Action Plan for Health*, where reducing childhood obesity by 20% over five years was identified as a goal (4). In this plan, it was also outlined that the government would convene a panel of content area experts, advocates, health care leaders, non-profit organizations and industry to inform and advise the Minister of Health and Long-Term Care (MOHLTC) on the best way to achieve its childhood obesity reduction target. The Healthy Kids Panel, the expert panel comprised of 18 members, conducted its deliberations between May and December 2012 and released the report *No Time to Wait: The Healthy Kids Strategy* outlining its recommendations in March 2013 (5).

Evidence to Guide Action: Report Context

In preparation for the panel's deliberations, MOHLTC requested that Public Health Ontario (PHO) create an evidence primer to serve as a foundational reference document to inform the work of the panel. This document was to present a synthesis of the evidence on the trends, causes and risk factors of obesity in children and youth, the effectiveness of interventions to prevent and treat overweight and obesity, and the actions that other jurisdictions and PHUS are taking.

PHO initiated a project, which led to this report, in response to a request made at the end of March 2012, with the report delivered at the beginning of July 2012. The main goal of this project was to deliver, within this short timeline, a high-quality and rigorous product that would provide the panel with evidence to inform its recommendation for action in Ontario. Systematic searches with critical appraisal of the literature were used to ensure the full scope of the literature base was reviewed and that the syntheses produced were of high quality. The population of focus for this report was children and youth under 19 years of age. This report also focused on anthropometric outcomes (e.g., changes in weight, BMI, waist circumference, prevalence of overweight or obesity) to measure effectiveness. However, many studies on obesity prevention and healthy weights measure effectiveness as changes in obesity-related risk factors or determinants, such as physical activity and healthy eating. A complete synthesis of the effectiveness of interventions to change obesity-related behaviours was out of scope for this report, although these will likely be a beneficial part of obesity prevention efforts. Additionally, even though it would have been ideal to assess the primary literature for each evidence synthesis, it was not always possible due to the short timeline and the rapidly growing literature base on childhood obesity. In these instances, secondary literature sources, including narrative reviews, systematic reviews and meta-analyses, were synthesized.

Report Structure

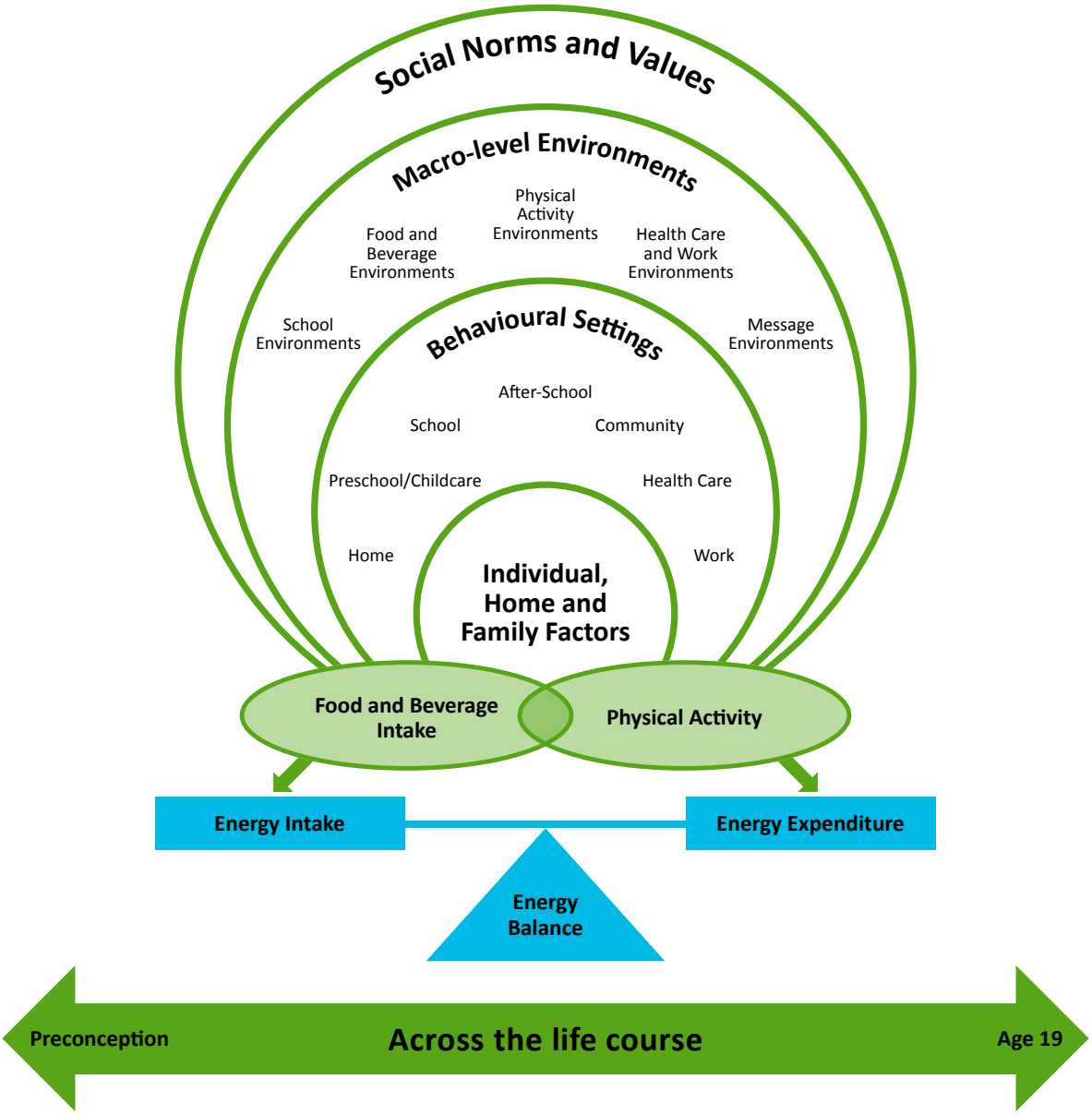
The report is divided into three main sections, with Part A providing an overview of the trends and prevalence of overweight and obesity and their related risk and protective factors in Ontario's children and youth, as well as an overview of the scientific literature on factors that contribute to childhood overweight and obesity and their health consequences. It includes a discussion of different methods by which to measure overweight and obesity, as well as settings where measurement can take place, and explores how best to use existing data to gauge progress on provincial commitments to address childhood overweight and obesity. Part B provides the results of systematic literature reviews looking at *(1)* the effectiveness of obesity prevention interventions;

(2) the effectiveness of obesity treatment approaches; and *(3)* the cost-effectiveness of childhood obesity interventions. Part C examines current PHU, provincial, federal and multi-level government initiatives being conducted that are geared toward addressing obesity in children and youth.

Evidence Review Framework

Adopting both a socio-ecological and a life course perspective, an integrated framework was developed to describe the causal factors that contribute to childhood obesity, and to identify leverage points for the prevention and treatment of childhood obesity throughout the report. This model acknowledges the role of energy imbalance (i.e., energy intake is greater than energy expenditure) over a long period as a fundamental cause of obesity. Energy intake refers to the energy or calories that are consumed when eating and drinking, and energy expenditure takes the form of physical activity. However, this seemingly simple relationship is underpinned by a complex web of factors that modifies how much children eat and move, and their energy balance, and some of these relationships begin before birth. The socio-ecological theory hypothesizes that one's behaviours are not only affected by individual factors, but also by interactions with the larger social and environmental context (6). The Institute of Medicine (IOM) presents a socio-ecological framework depicting these relationships for the issue of childhood obesity, and we have adapted its model for the purpose of synthesizing evidence in this report (Figure 1.1) (7). Our framework also integrates a life course approach, emphasizing the importance of early-life risk factors, the accumulation of behaviours and excess weight through growth and development leading to obesity, and the high risk of obese youth becoming obese adults.

Figure 1.1: Evidence Review Framework



Source: Adapted with permission from: IOM (Institute of Medicine) 2012. Accelerating Progress in Obesity Prevention: Solving the Weight of the Nation. Washington, DC: The National Academies Press. Figure 3.2, page 90.

The innermost layer of the framework depicts individual, home and family factors, including genetic, ethnic identity, psychosocial (e.g., beliefs, attitudes, knowledge), skills, lifestyle and health status factors. This level is surrounded by the key behavioural settings or micro-level environments that affect eating and physical activity behaviours, such as home, preschool, school, after-school, community and health care. These settings often provide focal points for interventions. The macro-level environment stratum encompasses policies, messaging, marketing, regulation, taxation and other sector-level controls.

The IOM Committee on Accelerating Progress in Obesity Prevention identified five intersecting macro-level environments for change to prevent obesity: *(1)* physical activity; *(2)* food and beverage; *(3)* message; *(4)* health care and work; and *(5)* school *(7)*. Although the "work" component of "health care and work environments" may be less relevant for prevention in children, it is maintained in the current report, where appropriate, to capture workplace policies that affect children indirectly or directly (i.e., policies to make workplaces breastfeeding friendly). Where there was no evidence

of these types of policies or interventions, this environment's title was abbreviated to "health care environments." The outermost layer of the framework represents social norms and values. This layer is the pattern of ideology and organization that can reinforce behaviours that promote social obesity, as it has a cascading effect through the other layers of influence in the model.

In Part A, complex interrelationships between the multiple levels of influence on childhood overweight and obesity are described (i.e., community/societal, individual/family and biomedical). Causal factors for obesity are arranged by socio-ecological level and by life course stage. In Parts B and C, this framework is used to review and categorize evidence, with interventions, strategies, initiatives and activities first categorized into the macro-level environment (i.e., school, food and beverage, physical activity, health care and work, and message). The interventions, strategies, initiatives and activities identified through the prevention and treatment effectiveness literature searches and jurisdictional scans are further classified as either policy and environmental interventions, social and behavioural interventions or clinical interventions. The distinction between policy and environmental interventions and social and behavioural interventions has been previously used by the U.S. Task Force on Community Preventive Services when describing physical activity interventions (8). As this report also assesses the effectiveness of treatment interventions, the categorization of clinical interventions was necessary. In Part B, given the focus on programmatic activities, wherever possible interventions are also described by setting (i.e., preschool, school, after-school, community, home and health care).

References

(1) Roberts KC, Shields M, de Groh M, Aziz A, Gilbert JA. Overweight and obesity in children and adolescents: results from the 2009 to 2011 Canadian Health Measures Survey. Health Rep. 2012 [cited 2013 Jun 26];23(3):37-41. Available from: http://www.statcan.gc.ca/pub/82-003-x/2012003/article/11706-eng.pdf

(2) World Health Organization. Obesity: Preventing and managing the global epidemic: report of a WHO consultation (WHO technical report series 894). Geneva, Switzerland: World Health Organization;2000 [cited 2013 Jun 26]. Available from: http://libdoc.who.int/trs/WHO_TRS_894.pdf

(3) Public Health Agency of Canada. Actions taken and future directions 2011: curbing childhood obesity: a federal, provincial and territorial framework for action to promote healthy weights. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2011 [cited 2013 Jun 26]. Available from: http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/framework-cadre/2011/hw-os-2011-eng.php

(4) Ontario. Ministry of Health and Long-Term Care. Ontario's action plan for health care. Toronto, ON: Queen's Printer for Ontario; 2012. Available from: http://www.health.gov.on.ca/en/ms/ecfa/healthy_change/docs/rep_healthychange.pdf

(5) Healthy Kids Panel, Ontario. Ministry of Health and Long-Term Care. No time to wait: the healthy kids strategy. Toronto, ON: Queen's Printer for Ontario; 2013 [cited 2013 Jun 26]. Available from: http://www.health.gov.on.ca/en/common/ministry/publications/reports/healthy_kids/healthy_kids.pdf

(6) Bronfenbrenner U. The ecology of human development: experiments by nature and design. Cambridge, Mass: Harvard University Press; 1979.

(7) Institute of Medicine; Committee on Accelerating Progress in Obesity Prevention, et al. Accelerating progress in obesity prevention: solving the weight of the nation. Washington, DC: National Academies Press; 2012 [cited 2013 Jun 26]. Available from: http://www.iom.edu/Reports/2012/Accelerating-Progress-in-Obesity-Prevention.aspx

(8) Zaza S, Briss PA, Harris KW. The guide to community preventive services: what works to promote health? New York, NY: Oxford University Press; 2005.

Part A:
Causes, Trends, Measuring and Monitoring

This part of the report summarizes our current understanding of child and youth overweight and obesity in Ontario. It provides available statistics on the trends and prevalence of overweight and obesity, and their related risk and protective factors in Ontario's children and youth, as well as an overview of the scientific literature on factors that contribute to childhood overweight and obesity, and their health consequences. Causal factors for obesity are arranged by socio-ecological level (i.e., community/societal, individual/family and biomedical) and by life-course stage, consistent with the Evidence Review Framework presented in Chapter 1 (Figure 1.1).

An overview of existing approaches to measuring and monitoring child and youth overweight and obesity in Ontario illustrates that Ontario lacks a comprehensive childhood healthy weight surveillance system. Part A also includes a discussion of the different types of measures of overweight and obesity, as well as settings where measurement can take place, and explores how best to leverage the existing data for gauging progress on the provincial commitment to reduce childhood obesity.

2. Trends, Causes and Risk Factors

Summary

Nearly one-third of Canadian children and youth were overweight or obese in 2009–2011, according to the Canadian Health Measures Survey (CHMS) (1). Furthermore, the prevalence of obesity among Canadian children and youth increased significantly from 6.3% in 1978–1979 to 12.7% in 2004 based on measured height and weight, while the prevalence of overweight increased from 17% to 22%, representing an increase of 102% and 29% respectively. While comparable measured data for Ontario using similar BMI-for-age definitions are not available, 27.1% of youth aged 12 to 17 self-reported a BMI considered overweight or obese in 2009–2010.

Determining causes of childhood overweight and obesity requires consideration of a complex web of behavioural, social, environmental and biomedical risk and protective factors that begin before birth and continue throughout the life course at the individual, family, community and societal levels. Genetics also play a role in the risk of children and youth becoming overweight and obese. Nevertheless, there is consistent evidence that the following modifiable risk factors are causally associated with childhood and youth overweight and obesity:

- Maternal smoking
- High birthweight
- Rapid infant weight gain, associated with low birthweight
- Consumption of sugar-sweetened beverages
- Physical inactivity and sedentary behaviour
- Inadequate sleep

Similarly, the following protective factors are causally associated with childhood and youth overweight and obesity:

- Breastfeeding
- Breakfast consumption

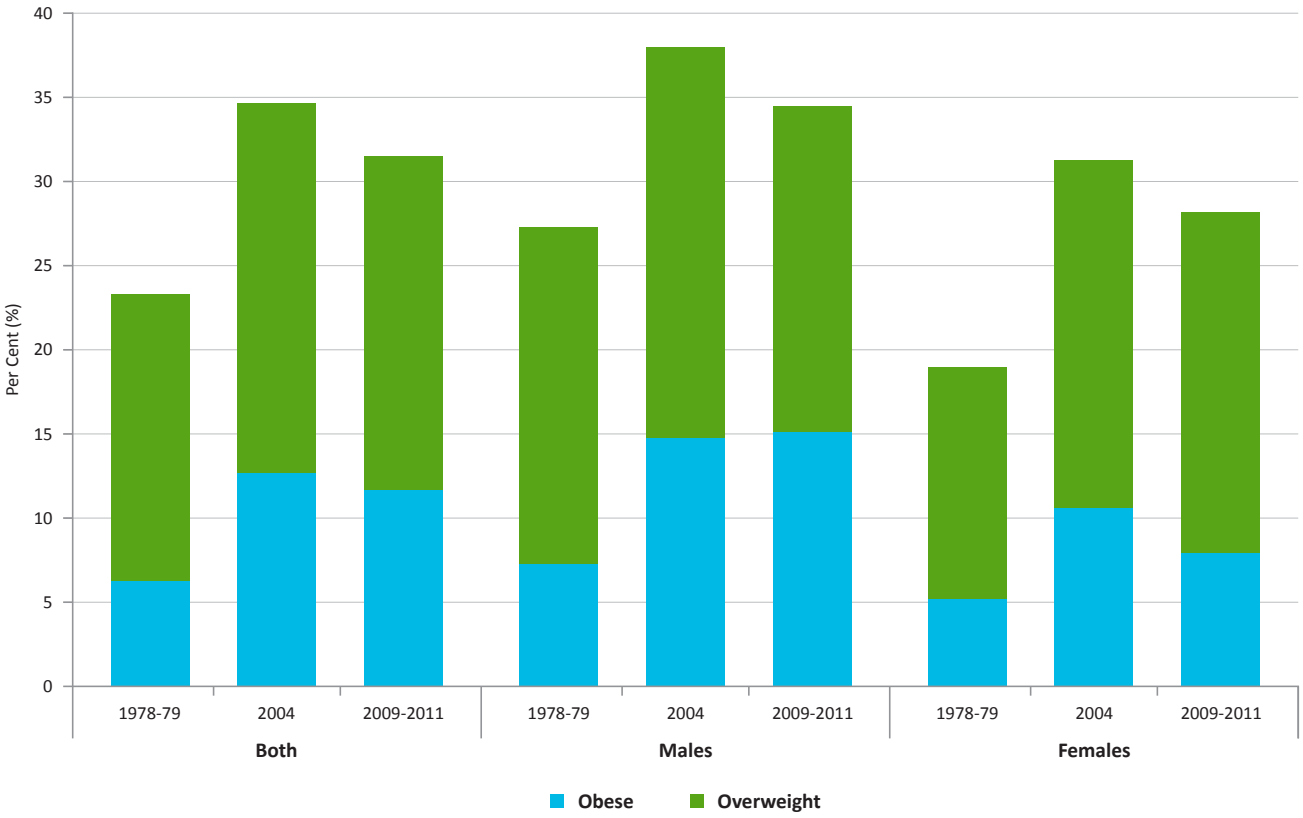
There is less consistent evidence that additional factors may play a causal role. There is some evidence that gestational diabetes, exposure to advertising for high-calorie foods, childhood depression and higher levels of psychosocial stressors, low socio-economic status and a poorly designed built environment increase the risk of overweight and obesity in children and youth. There is some evidence that milk and dairy consumption decreases the risk.

A substantial number of Ontario's children and youth do not get enough daily physical activity. Many engage in sedentary behaviours for a large part of their day, which tends to increase in older age groups. Only half of youth consume the recommended number of vegetable and fruit servings in a day, and calories from sugar-sweetened beverages make up a considerable portion of the diet of children and youth.

Prevalence and Trends of Child and Youth Overweight and Obesity

Nearly one-third of Canadian children and youth were overweight or obese in 2009–2011, according to the Canadian Health Measures Survey (CHMS) (1). Between 1978–1979 and 2004, the prevalence of obesity based on measured height and weight among Canadian children and youth increased significantly from 6.3% to 12.7% while the prevalence of overweight increased from 17% to 22% (2), representing an increase of 102% and 29% respectively (Figure 2.1). Males and females experienced a similar increase in overweight and obesity, although rates in males were higher than in females. Both measured overweight and obesity decreased slightly between 2004 and 2009–2011; however, this difference was not statistically significant (1). Rates of overweight and obesity in children and youth are defined by BMI relative to age and gender, using cut-offs established by WHO. There are a number of different systems of BMI-for-age cut-offs and, depending on the system chosen to define overweight and obesity, estimates based on the same sample can vary. Further discussion of methodological issues related to the different systems of BMI-for-age is presented in Chapter 3. All data presented in figures in this Chapter can be found in Appendix 1.

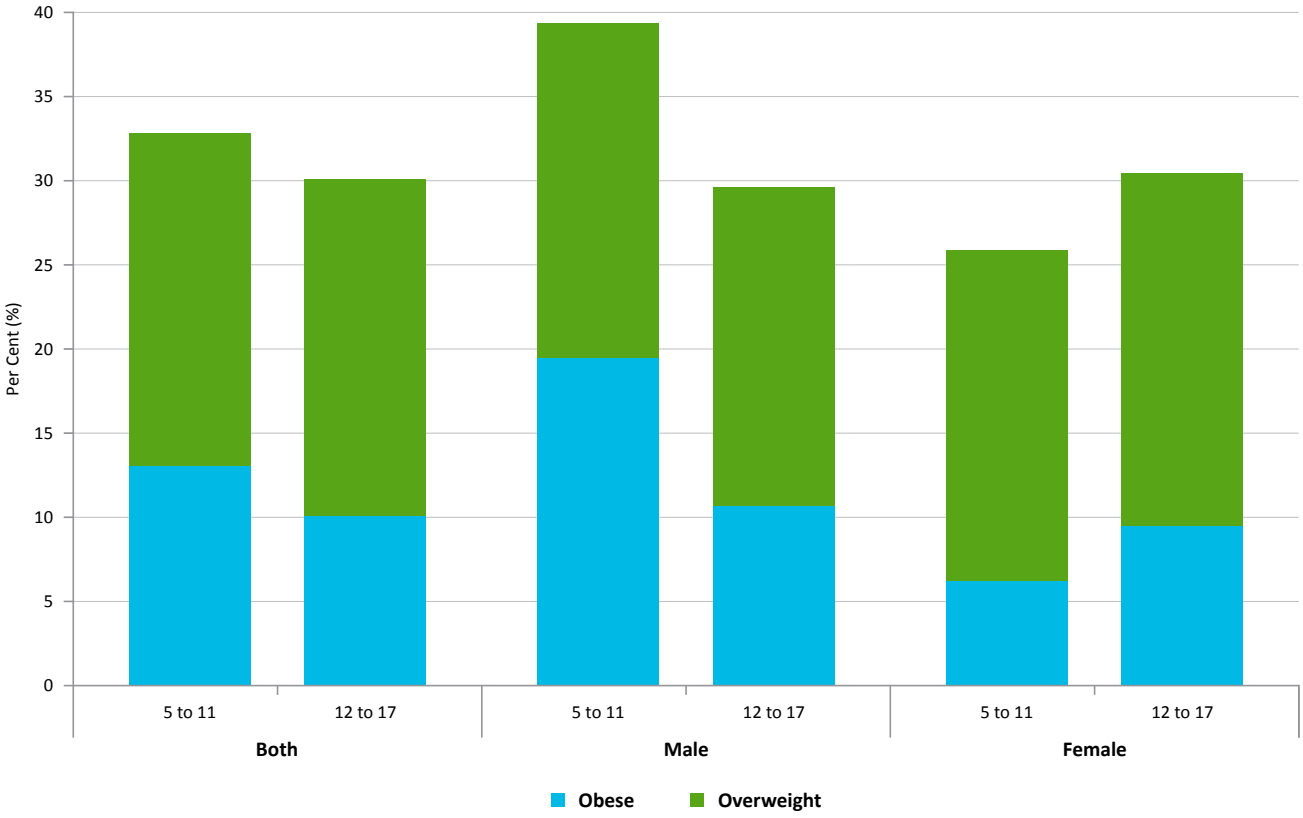
Figure 2.1: Measured Overweight and Obesity Using WHO BMI-For-Age Cut-Offs in Children and Youth, by Sex, Canada, 1978–79 (Ages 2-17), 2004 (Ages 2-17), 2009–11 (Ages 5-17)



Sources: 1) Shields M, Tremblay MS. Canadian childhood obesity estimates based on WHO, IOTF and CDC cut-points. Int J Pediatr Obes 2010 May 3;5(3):265-273; 2) Roberts KC, Shields M, de Groh M, Aziz A, Gilbert JA. Overweight and obesity in children and adolescents: results from the 2009 to 2011 Canadian Health Measures Survey. Health Rep. 2012 Sep;23(3):37-41.

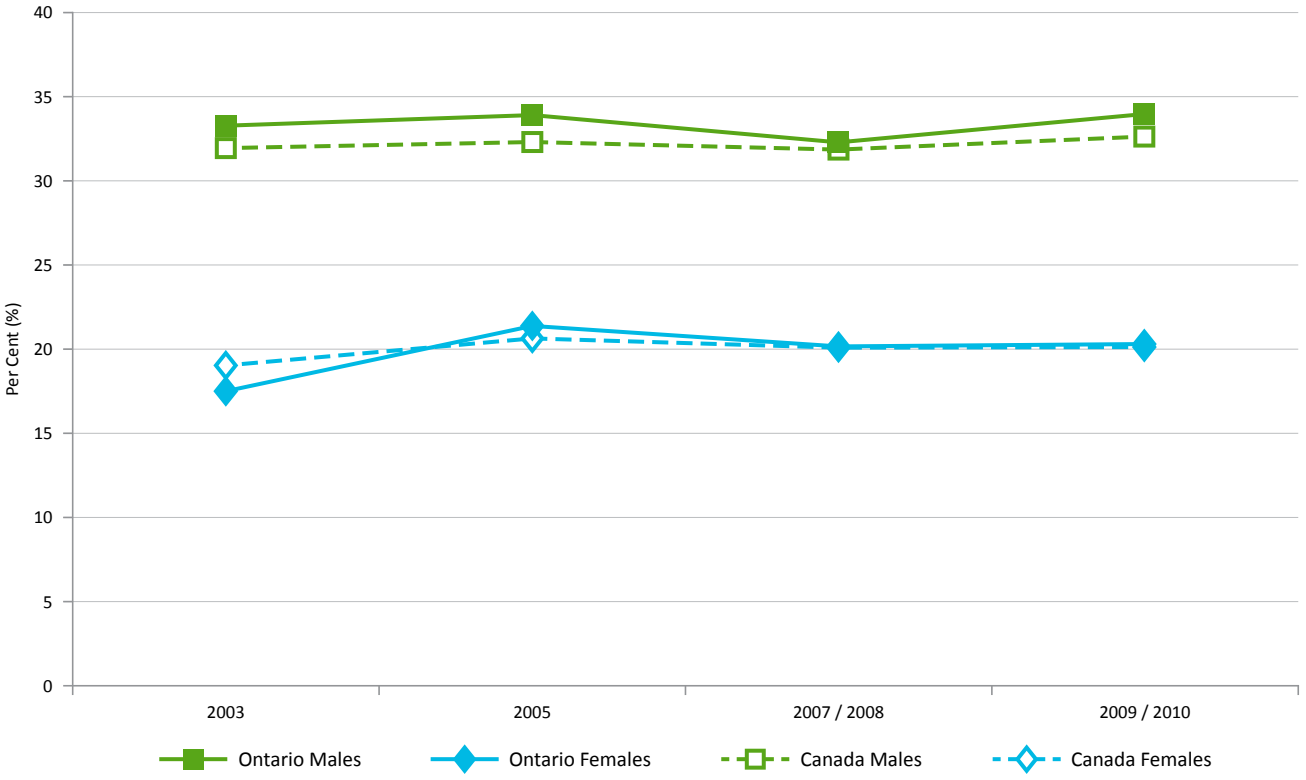
Data from the 2009–2011 CHMS show that when looking at rates of overweight and obesity in children and youth by age, similar rates can be found across all age groups for both sexes combined; however, males aged 5 to 11 were significantly more likely to be obese than those aged 12 to 17 (19.5% versus 10.7%). Additionally, males 5 to 11 were significantly more likely to be obese than females aged 5 to 11 (19.5% versus 6.3%) (Figure 2.2).

Figure 2.2: Measured Overweight and Obesity Using WHO BMI-For-Age Cut-Offs in Children and Youth, by Age Group and Sex, Canada, 2009–11



Source: 1) Roberts KC, Shields M, de Groh M, Aziz A, Gilbert JA. Overweight and obesity in children and adolescents: results from the 2009 to 2011 Canadian Health Measures Survey. Health Rep. 2012 Sep;23(3):37-41.

Figure 2.3: Self-Reported Overweight and Obesity Using WHO BMI-For-Age Cut-Offs in Youth Aged 12 to 17, by Sex, Ontario and Canada, 2003 to 2009/2010



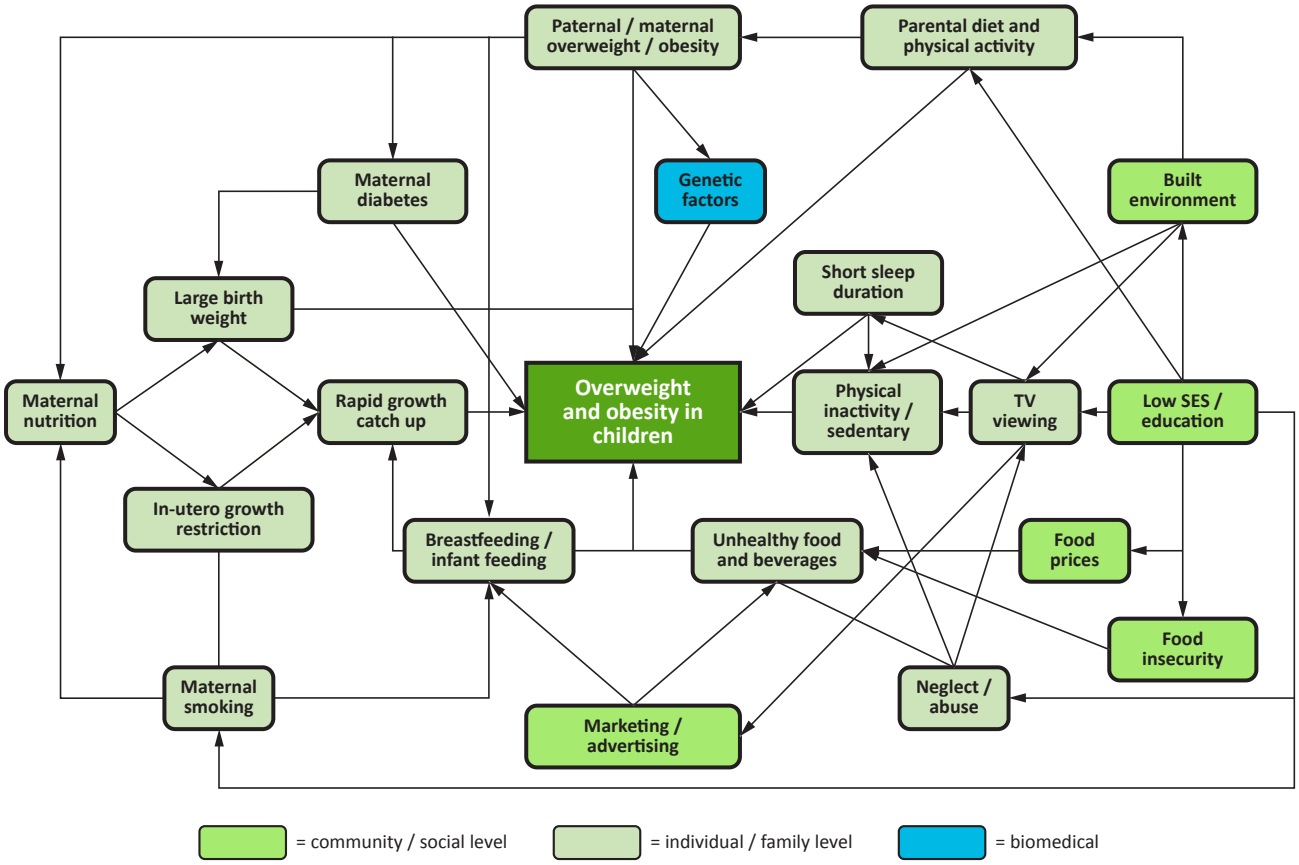
Source: Canadian Community Health Survey 2003 - 2009/2010, Statistics Canada, Canada Share File, Distributed by Ontario MOHLTC. Estimates were made using age in years of respondent.

While measured data is not available at the provincial level for Ontario, given that the self-reported prevalence of overweight and obesity in children and youth in Ontario tends to be similar to the overall Canadian rate, the national measured data can be used to get a picture of the situation in the province. Figure 2.3 compares self-reported Ontario rates to Canadian rates in youth between 2003 and 2009–2010.

The findings from the 2009/2010 Canadian Community Health Survey (CCHS) show that 27.1% of Ontario youth aged 12 to 17 reported a height and weight considered to be overweight or obese, with 19.4% reporting a height and weight considered to be overweight and an additional 7.8% reporting a height and weight considered to be obese. There were no significant differences in rates over time between 2003 and 2009–2010. There were significant differences in self-reported BMI between males and females; in 2009–2010, 33.5% of males versus 20.4% of females reported being overweight or obese. These recent data are only available for self-reported measures of overweight and obesity (which have been shown to underestimate measured BMI in this age group (2)), and only for those aged 12 and older. No comparable measured data for Ontario using WHO BMI-for-age definitions are currently available.

Causal Factors for Child and Youth Overweight and Obesity

Figure 2.4: Selected Potential Causal Factors for Overweight and Obesity in Children and Youth



Source: Adapted with permission from: Monasta et al. 2010 (5).

Evaluating potential causes of childhood overweight and obesity requires consideration of a large number of interacting factors, many of which are not fully understood. At a very basic level, childhood overweight and obesity is often described as an imbalance between energy intake and energy expenditure (3-7). This imbalance, however, is influenced and modified by a complex web of risk and protective factors that begin before birth and continue throughout the life course at the individual, family, community and societal levels (5). The relative importance of each factor is difficult to determine, as these factors impact each other in multiple ways (5,8). Figure 2.4 summarizes the interconnected relationship between a few selected causal factors and overweight and obesity in children and youth.

Due to the sheer number of risk and protective factors and difficulties measuring them in research studies, reported effect sizes may be small. Although effect sizes may be relatively small, their impact remains important because even small modifications in factors that affect a large number of people could translate into large population benefits (5). Table 2.1 summarizes the strength of association between those causal risk and protective factors that are consistently associated with overweight and obesity in children and youth. Other factors less consistently associated with overweight and obesity in the literature are discussed in the text. While many studies provide evidence of associations, few include mechanisms to describe how these factors impact overweight and obesity; in fact, many of these associations happen via multiple pathways.

Table 2.1: Summary of Associations Between Risk or Protective Factors with Consistent Evidence of a Causal Relationship with Childhood Overweight and Obesity

Risk or protective factor	Outcome examined	Direction of association	Reported* odds ratio (OR)†	Comparison Group	Source
Birthweight (high)	Obesity	Increase	2.07 (1.91-2.24)	Subjects with a birthweight less than or equal to 4,000 g	Meta-analysis (9)
Breakfast consumption (irregular)‡	Overweight	Increase	N/A	N/A	Review (8)
Breastfeeding	Overweight	Decrease	<1 month of breastfeeding: 1.0 (0.65-1.55) 4–6 months: 0.76 (0.67-0.86) >9 months: 0.68 (0.50-0.91)	Infants who were not breastfed	Meta-analysis (10)
Maternal smoking	Obesity	Increase	1.64 (1.42-1.90)	Children of mothers who did not smoke during pregnancy	Meta-analysis (11)
Physical inactivity	Overweight and obesity	Increase	Median OR: 1.33	Most active group, various definitions	Systematic review (12)
Rapid infant weight gain	Obesity	Increase	OR range (per 0.67s standard deviation of weight gain): 1.26 to 4.55	–	Systematic review (13)
Sedentary behaviour	Overweight and obesity	Increase	OR range: 1.02 (1.00-1.04) to 1.61 (1.38-2.02)	Various definitions	Systematic review (14)
Sleep (inadequate)	Overweight and obesity	Increase	1.58 (1.26-1.98)	Longer sleep duration, various definitions	Meta-analysis (15)
Sugar-sweetened beverage consumption	Obesity	Increase	1.6 (increase for each sugar-sweetened beverage above each child's baseline consumption at the beginning of the study)	Baseline consumption of sugar-sweetened beverages	Review (16)

* Differences in the reporting of odds ratios reflect the original paper (i.e., decimal places).

† An odds ratio (OR) is a measure of effect size describing the strength of association between the risk/protective factor and the outcome. Odds ratios tend to overestimate the relative risk of an outcome between groups under comparison except when the outcome is rare. A relative risk of 1.5 means that there is a 50% increase in risk, whereas an odds ratio of 1.5 means there is a 50% increase in odds but less than 50% increase in risk. For more details on the difference between interpretation of odds ratios and relative risk, see Davies et al. 1998 (17).

‡ A high-quality odds ratio for irregular breakfast consumption was unavailable.

Behavioural and Modifiable Factors

INDIVIDUAL AND FAMILY LEVEL

Prenatal period

A growing body of evidence suggests that the prenatal period plays an essential role in determining overweight or obesity later in life, as childhood overweight and obesity may be affected by negative events in utero (often referred to as "prenatal programming"). The most common risk factors and conditions that may impact metabolic programming are maternal smoking, maternal malnutrition and gestational diabetes, which can be the result of several other upstream factors (5,7,18,19). Evidence on the impact of endocrine-disrupting chemicals is emerging (20), and some individual studies have suggested that maternal weight or gestational weight gain may play a role (21). Maternal smoking has been consistently associated with childhood overweight and obesity, in part because of its association with low birthweight (also discussed below) (11,18,22), posing an increase in the odds of overweight and obesity by 64% according to a recent meta-analysis (i.e., a study that combines the results of several studies to create a more robust assessment) (11). Gestational diabetes, while less consistently linked with obesity in children and youth, was estimated to increase the odds of youth overweight by 40% in a large cohort study (23). Systematic reviews have identified few individual studies that examine maternal malnutrition, and most results have been inconclusive (5,18).

Infants

Birthweight and infant growth: There is consistent evidence that high birthweights, and some evidence that low birthweights, are associated with overweight and obesity in childhood (5). A meta-analysis found that high birthweight (defined as more than 4,000 g) was associated with a twofold increase in the odds of obesity when compared to subjects with a birthweight less than or equal to 4,000 g (9). Low birthweight infants may also be at risk of childhood overweight and obesity, because they tend to gain weight, or "catch up," more rapidly during the early postnatal period, which leads to increased central fat storage and greater insulin resistance (5,24). Rapid infant growth has been assessed independently and appears to be a risk factor for overweight and obesity later in life (13,24).

Food and nutrition: Food and nutrition choices during infancy impact the risk of overweight and obesity during childhood. Breastfeeding, in particular, has been consistently shown to decrease risk (5,10,25-27). A meta-analysis found that longer-duration breastfeeding is protective against overweight compared to infants who were not breastfed: less than one month of breastfeeding was associated with no change in the odds of overweight; four to six months of breastfeeding was associated with a 24% decrease in the odds of overweight; more than nine months of breastfeeding was associated with a 32% decrease in the odds of overweight (10). The impacts of other nutritional choices in infancy need further study. For instance, preliminary evidence has linked bottle use after 12 months of age to overweight, potentially from excess milk consumption (28), but no clear association has been found between the age of introduction of solid foods and obesity (29). The mismatch of caregiver responsiveness to infant feeding cues, including feeding when the infant is not hungry, may have a role in the development of overweight and obesity by impairing the infant's response to internal states of hunger and satiation (30,31).

Children and youth

Food and nutrition: There is inconsistent evidence that healthier dietary patterns (measured using a variety of indices that assess various aspects of nutrition, including compliance with food guide recommendations, and measures of quality and variety) are associated with BMI at later ages (32), or that vegetable and fruit consumption, a commonly evaluated measure in nutritional studies, is directly protective against child and youth overweight and obesity (14,27,32-34). However, there are substantial challenges to measuring diet quality that may make the detection of a causal association difficult. Known challenges include the unreliability of self- and parent-reporting of child and youth eating patterns, and low validity and reliability of the measures used (14,33). While it is difficult to show that vegetable and fruit consumption directly protects against child and youth overweight and obesity, there is evidence that they are related (32,35). For example, a national study of Canadian children and youth found that those who eat vegetables and fruit at least five times a day are substantially less likely to be overweight or obese than those who ate these foods less often (36). This finding may be explained by the fact that vegetable and fruit consumption has been shown to be a good marker of

overall diet quality or they may replace foods that are more energy dense (i.e., have higher caloric content) (32).

There is consistent evidence that consumption of sugar-sweetened beverages is associated with excess weight gain in children (7,16,37,38). Following school-aged children over time, one study included in a review found that the odds of becoming obese increases 1.6-fold for every additional sugar-sweetened drink consumed per day (16). This likely occurs by increasing fructose consumption and decreasing milk intake (7). There is some evidence that milk, and dairy consumption generally, is protective against weight gain, overweight and obesity among children, although findings are inconsistent (27,33,39). Fruit juice (often, but not always, defined as 100% fruit juice) does not appear to increase the odds of overweight and obesity in children (27,33). There is evidence that diet soda consumption may cause weight gain, but it may simply be a marker of other unhealthy behaviours (33). Additional research is needed to better understand how macronutrients, such as fat, protein, carbohydrate and fibre intake, may contribute to overweight and obesity (27). Studies on intake of macronutrients are especially challenging, because they are difficult to isolate from other factors (for example, carbohydrate intake occurs in both "healthy" foods such as vegetables and "unhealthy" foods such as cookies) (14).

The home and family environment is important in the development of food preferences and consumption habits. The availability of protective and risk-related foods directly predicts their consumption (8), and increasing consumption of food prepared outside of the home, especially "fast food" or "quick service food," has a negative impact on BMI due to oversized portions and energy-dense, nutrient-deficient foods (3,27,33). Eating breakfast, which may be an indicator of other healthy eating habits, has been consistently shown to protect against overweight and obesity in children and youth (8,33). The size of the impact of breakfast consumption on overweight and obesity in children and youth is difficult to determine, although several studies have demonstrated a causal link. In preschool-aged children, irregular breakfast consumption is estimated to nearly double the odds of being overweight (8). There is some evidence that obesity risk decreases with more frequent meals (40), and eating family meals is related to various healthy behaviours, including vegetable, fruit and dairy consumption (8,34). Snack food intake (defined differently across studies, often including both foods that are traditionally thought of as "healthy" and "unhealthy") does not appear to have an impact on excess weight gain or fatness, though there is a weak association between the number of evening eating events and increases in BMI (27,33). Some emerging studies have found that the setting where food consumption takes place also has an impact. For example, a school-based cohort study found that eating in front of the television results in increased caloric intake in youth (41).

Parental attitudes toward feeding their children may also impact overweight and obesity. In particular, restricting children's eating, overfeeding and pressure to eat have been associated with child weight gain (8,42). Using food as a reward is also associated with nutritional problems for children, while parental support and verbal praise have been positively associated with vegetable and fruit consumption (8). Overall parenting techniques may also impact childhood overweight and obesity. Children raised in homes where parents are both nurturing and firm have been shown to eat more healthily, engage in more physical activity and have lower body mass indexes, compared to children who were raised in homes where parents have been characterized in the literature as firm without being nurturing, indulgent or neglectful (43).

Physical activity: There is consistent evidence that physical activity (measured using a variety of indicators that are intended to capture physical fitness or energy expenditure) has an impact on overweight and obesity in children and youth. There is also some evidence that sedentary behaviour (measured using several indicators that examine low-energy activities, the most common being television and computer "screen time") has a role (7,14,33,44-47). Dose-response relationships (i.e., the impact of intensity and duration) remain unclear, and the specific impact of sub-behaviours, such as moderate to vigorous physical activity, aerobic exercise and leisure activity, are not fully understood (12,14,33,45), although there is emerging evidence that even low levels of physical activity may have a positive impact (12). A systematic review of physical activity in children and youth estimated a 33% increase in the odds of becoming overweight or obese in the least active group as compared to the most active group. When only objective measures of physical activity (e.g., accelerometers) were used, the increase in the odds of overweight and obesity rose to nearly fourfold (12). Sedentary behaviour, which may have an impact on weight gain by reducing

time for physical activity in a child's daily routine or decreasing sleep (33), appeared to increase the odds of overweight and obesity by between 2% and 61% in studies included in a systematic review (14).

Sleep: Although sleep is an inherently sedentary behaviour, longer sleep duration is consistently shown to be protective against childhood overweight and obesity (5,15,33,48-50). A meta-analysis of observational studies found that the odds of becoming overweight or obese were 58% higher in children with shorter sleep duration (defined differently across studies) (15). Short sleep duration appears to increase the risk of overweight and obesity directly by disrupting hormone signalling pathways (51) and indirectly by increasing fatigue, thus decreasing physical activity among children, increasing exposure to obesogenic environments (51), and increasing hunger and appetite (52).

Mental health: In the few studies that have been conducted, there is some evidence that childhood depression may be positively linked to overweight and obesity in adulthood (53). There is also some evidence that experiencing higher levels of psychosocial stressors (measured using various indicators) is associated with an increased likelihood of being overweight or obese (53). Other negative emotional states in youth, such as anxiety, anger, low self-esteem (54), abuse or ill treatment (5) and interpersonal violence (including bullying), may also play a role (55). It is likely that many of these factors have a reciprocal relationship with overweight and obesity.

COMMUNITY AND SOCIETAL LEVEL

Physical environment

Exposure to chemicals: There is emerging evidence that exposure to endocrine-disrupting chemicals (i.e., chemicals that interfere with the body's hormone system) may play a role in the development of obesity in children and adults (20,56-58). Endocrine-disrupting chemicals include persistent organic compounds, such as polychlorinated biphenyls (PCBs), and non-persistent organic compounds, such as bisphenol A (BPA). It is hypothesized that obesity development may be affected by the interaction of factors related to energy balance and chemical exposures, especially when exposure occurs during critical growth periods (i.e., in utero and early life). Endocrine-disrupting chemicals could affect obesity, largely through "prenatal programming" (discussed above), by increasing the number of fat cells, and altering pathways responsible for food intake and metabolism, insulin sensitivity and lipid metabolism (20).

Built environment: There is some evidence that the built environment, which includes neighbourhood, community and regional infrastructure, may have an impact on overweight and obesity in children and youth by promoting or prohibiting healthy eating and physical activity. Easy access to foods that are calorie-dense (e.g., through proximity to convenience stores) is associated with increases in the risk of overweight and obesity, whereas the presence of neighbourhood supermarkets and farmers' markets (59) and access to affordable vegetables and fruit (5) is associated with lower childhood BMI and lower prevalence of overweight. The structure of the built environment may also provide opportunities for physical activity or promote inactivity. Neighbourhood features such as walkability and bikeability, mixed land use, accessible destinations and the availability of public transportation may increase physical activity (59). A similar effect has been found in neighbourhoods that include a mix of residential, commercial, retail and recreational destinations (59). Conversely, communities that have poor street connectivity and a lack of destinations within safe walking distance may decrease levels of physical activity (59). In neighbourhoods that lack safe places to play due to heavily trafficked streets, neighbourhood crime and graffiti are likely to prevent children from being active outdoors and promote indoor sedentary behaviour (59). Location is also a factor: youth living in rural, exurban (i.e., in a region beyond the suburbs of a city) and mixed urban environments may be more likely to be overweight than individuals living in some inner-city or suburban areas (60).

Drawing conclusions from research on the impact of the built environment on childhood overweight and obesity is challenging for several reasons: there is a lack of repetition across studies; few consistent findings have been reported; associations often vary by gender, age, socioeconomic status and population density; and for many factors, strong evidence is unavailable (60).

Social environment

Socioeconomic status: There is some evidence that low socioeconomic status (SES), often measured by parental occupation, education, family income or a combination of these factors, is linked with child and youth adiposity (or body fatness) as both a

precursor to many risk and protective factors and an independent risk factor (5,61,62). There is some evidence that high SES is protective, although the literature is not consistent. The reviews do not draw conclusions about middle-income groups (5,61,62). SES may impact childhood overweight and obesity in many ways. For example, price is a strong predictor of food choice (8) and families living in lower SES neighbourhoods tend to have limited access to food stores with healthy, affordable options (59).

Food insecurity: There is mixed evidence on whether food insecurity or insufficiency, defined as episodes of a family running short of food because of inadequate money, is associated with an increased risk of overweight and obesity in children (5,8,63). This relationship may be due to overconsumption of inexpensive, energy-dense foods and lower intakes of vegetables and fruit or a "feast or famine" phenomena, where overeating occurs when food is available (5,8). Increased parental education, on the other hand, may positively impact risk of overweight and obesity in children and youth in various interconnected ways, including increased income, money management skills, prioritization of healthy eating, nutrition knowledge, parenting skills and access to resources. More specifically, higher maternal education has been linked with factors that may be protective against overweight and obesity in children and youth, including vegetable and fruit consumption, verbal praise, discouragement from sweets and restraint from negative modelling behaviour (8).

Ethnicity: Few studies have examined the role of ethnicity in overweight and obesity in children and youth, although disparities in the prevalence of overweight and obesity in children by ethnicity and race have been observed (64). This influence may stem from both genetic differences and cultural practices, or may be a marker for factors related to education and economics (8). In the home food environment, the impact of traditions, culture, religious practices, ethnicity, race and related social influences are important considerations, since many customs and traditions are centred on food. In a study of family dietary intake, cultural inheritance accounted for 30 to 40% of the dietary intake variance in children (8).

Schools: There is evidence that the school environment plays an important role in childhood overweight and obesity, because of the amount of time children spend in school. Most children eat at least one meal per day at school, as well as snacks. Although most schools that provide meals offer students at least some healthy food choices, the presence of many less healthy options may prevent children from consuming a balanced meal (59). Classroom physical activity, physical education class and school transportation also impact children's energy balance. It has been suggested that many communities have limited access to safe places to walk, bike or play, and, as a result, children are less likely to walk or bike to school (59).

Advertising and media: There is evidence that television advertising and childhood obesity are related; however, it is less clear if this relationship is causal (5,65,66). Among 10 studies included in a systematic review, a significant association was found between the number of advertisements per hour on children's television and the proportion of overweight children, particularly when the promotion of energy-dense foods was considered (r=0.81, $p < 0.005$). There was some suggestion that there may be a small protective correlation between childhood overweight and the number of advertisements encouraging healthier diets (r= -0.56, $p < 0.10$) (66).

Biomedical and Non-Modifiable Risk Factors

Several biomedical and non-modifiable risk factors also play a causal role in childhood overweight and obesity. Some medications (e.g., cortisol), illnesses (e.g., hypothyroidism) and syndromes (e.g., Prader Willi syndrome, Down syndrome) can lead to overweight or obesity in children, although it is estimated that only a small portion of obesity cases result from these factors (3). Also, several mechanisms through which modifiable risk factors have an effect on risk of childhood overweight and obesity are rooted in biomedical factors, such as genetics, leptin receptor concentration (a hormone important in the regulation of body weight) (67) and metabolic programming, which was previously discussed in the section on the prenatal period (68,69).

Genetics play a role in the risk of children and youth becoming overweight or obese. There is little agreement in the literature on how much genetics contribute to the variation in BMI between individuals; estimates range from 20 to 90% (3,5,7,70,71). It is important to consider that the gene pool does not change nearly rapidly enough to explain the recent increase in childhood overweight and obesity (3).

In many cases, it is the interaction between genetic and environmental factors that is of greatest interest as genes exert their influence through behaviours that are directly affected by the social and physical environment. Therefore, early experiences with food and activity may not only establish healthy habits, but may also modify genetic predispositions (70). For example, eating in the absence of hunger, which is correlated with children's weight status in middle school, is a behavioural trait that seems to be influenced by both genetic and environmental factors (70).

For some groups, gene-environment interactions lead to disproportionately high levels of overweight and obesity. For example, First Nations, Inuit and Métis (FNIM) children and youth are more likely to be overweight and obese, and to experience other weight-related risk factors, such as central adiposity (or fatness) than non-FNIM children and youth (72). In addition to genetic differences (72,73), FNIM children and youth experience disproportionately high rates of many risk factors, including unhealthy eating, physical inactivity, sedentary behaviour and low socioeconomic status (72-74).

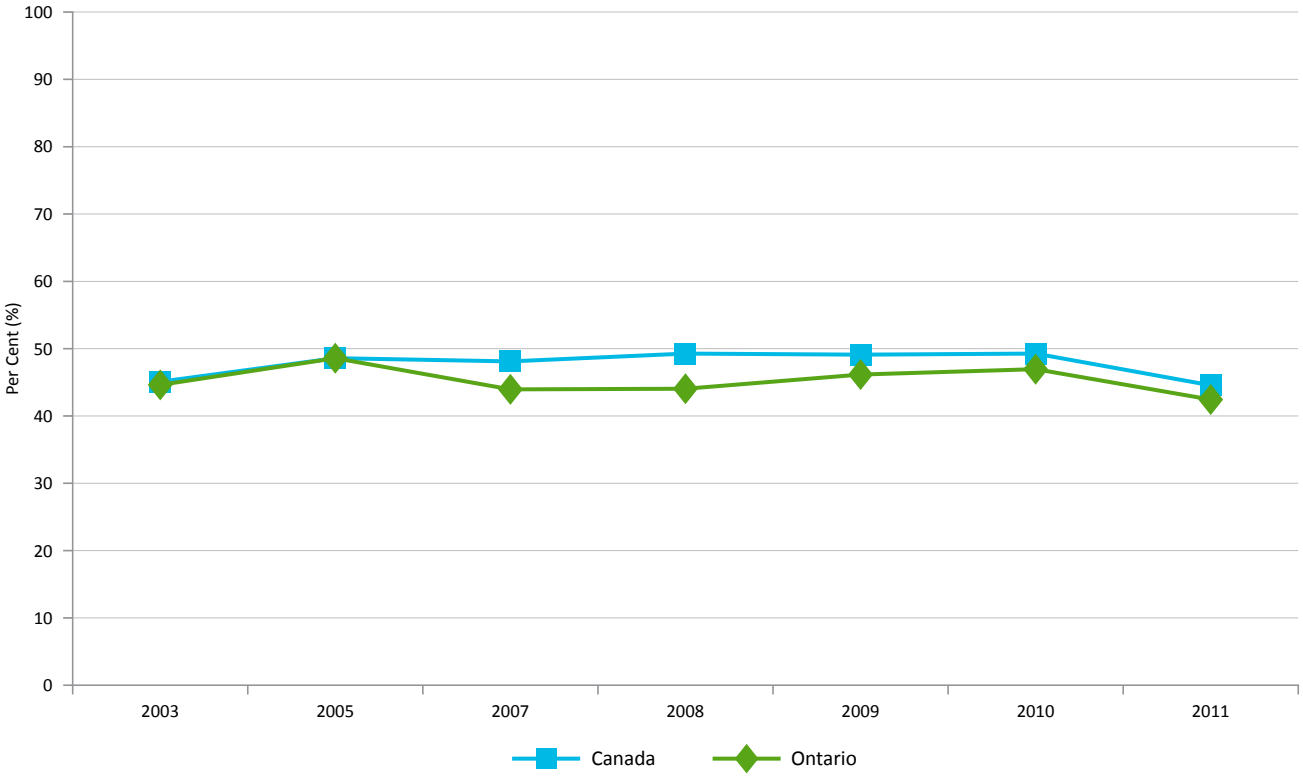
Prevalence and Trends for Related Risk and Protective Factors for Child and Youth Overweight and Obesity

Healthy Eating and Physical Activity Behaviours

HEALTHY EATING

Vegetable and fruit consumption can be used as a marker for a more general pattern of healthy eating and is an important source of vitamins, minerals and fibre. Less than half of youth aged 12 to 19 in Ontario reported that they consume vegetables and fruit at least five times per day, a trend that has remained consistent over time and is similar to the national rate (Figure 2.5).

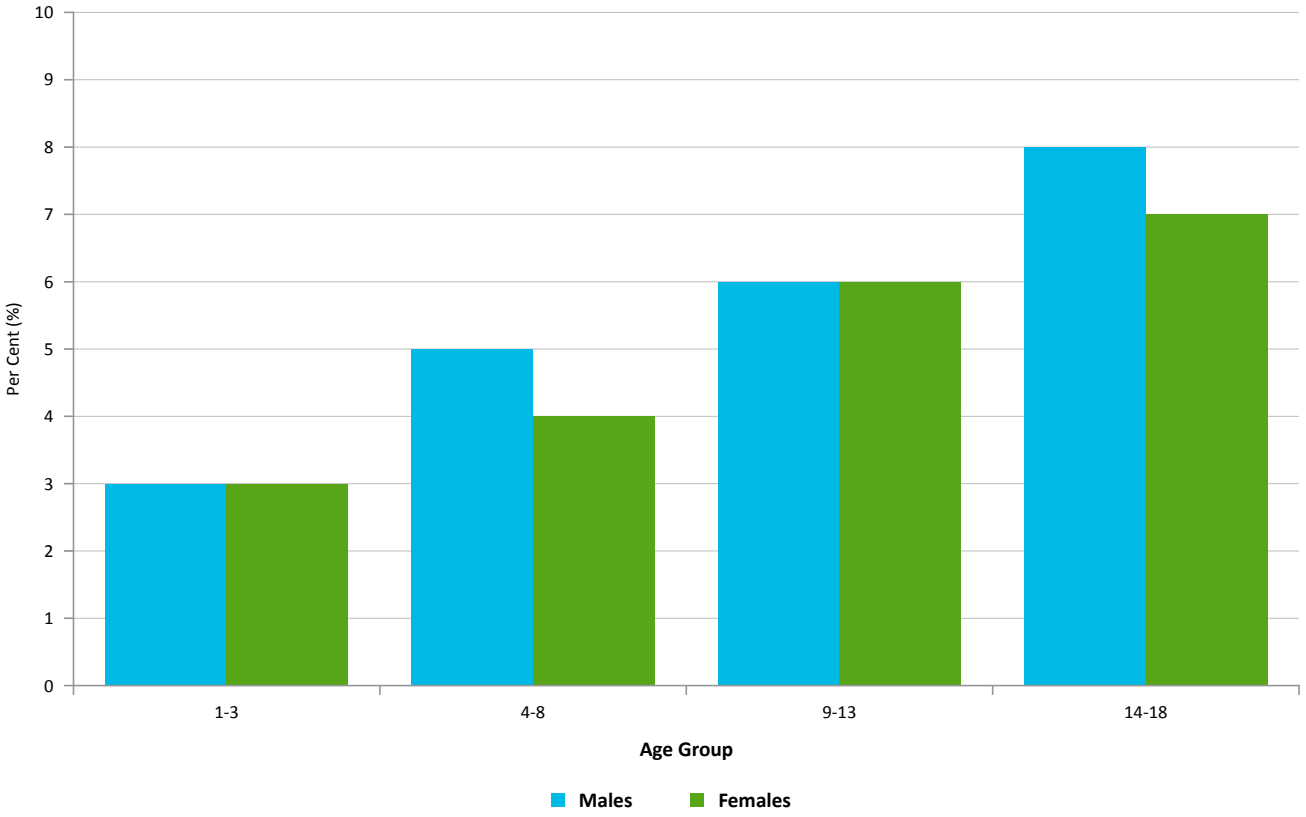
Figure 2.5: Self-Reported Consumption of Vegetables and Fruit at Least Five Times per Day in Youth Aged 12 to 19, Ontario and Canada, 2003 to 2011



Source: Statistics Canada. Table 105-0501 - Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2011 boundaries) and peer groups.

For many children and youth, sugar-sweetened beverages contribute significantly to daily caloric intake. In 2004, it was found that beverages make up almost 20% of the calories consumed by children and youth aged 4 to 18, and 30% in children aged 1 to 3 (75). Consumption of sugar-sweetened beverages (SSBs) is on the rise, with the proportion of daily caloric intake coming from SSBs being higher in older children and youth (Figure 2.6). In Canada, it has been found that 15.1% of students aged 11 to 15 consume soft drinks one or more times per day, every day (76).

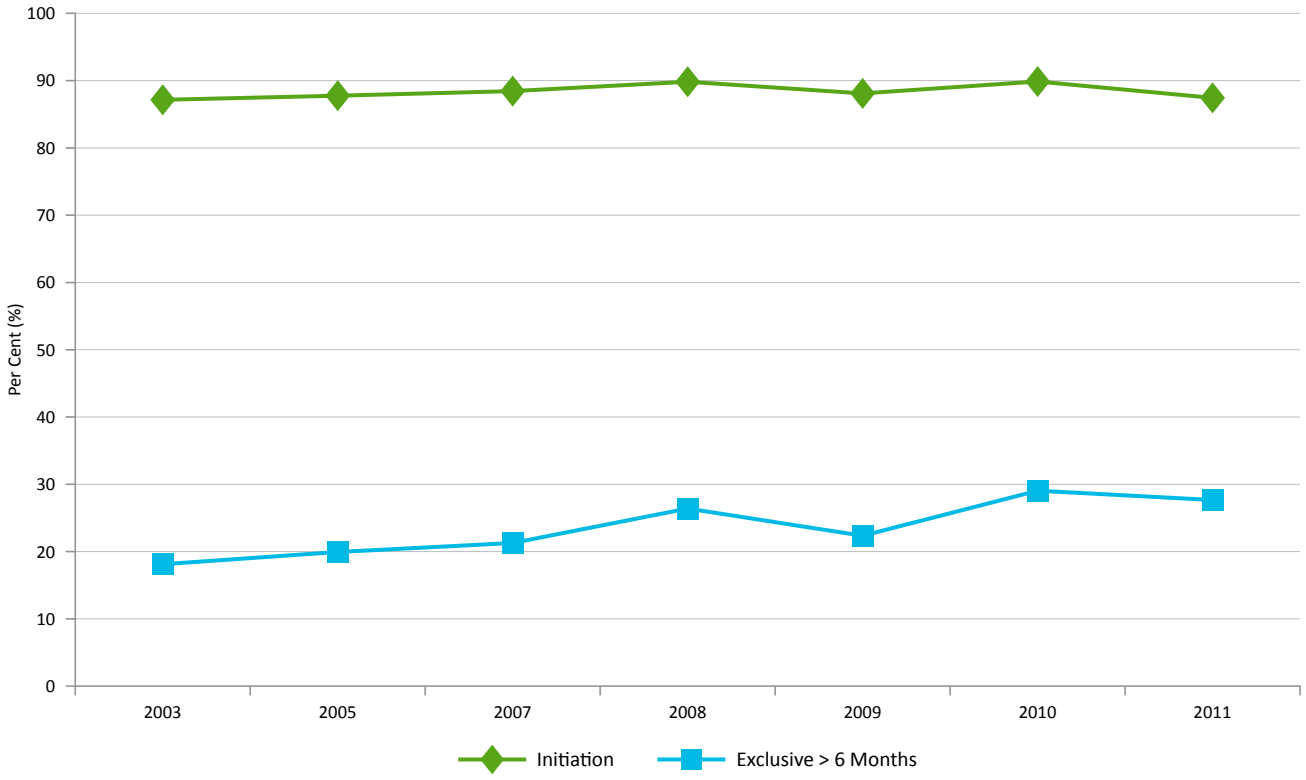
Figure 2.6: Percentage of Daily Calories Derived from Sugar-Sweetened Beverages in Children and Youth Aged 1 to 18 by Sex and Age Group, Canada, 2004



Source: Garriguet D. Beverage consumption of children and teens. Health Rep. 2008 Dec;19(4):17-22.

Breastfeeding during infancy is associated with lower rates of child and youth overweight and obesity. While just over 87.1% of all mothers in Ontario reported trying to breastfeed their last child in 2011, only 27.3% reported breastfeeding exclusively for the recommended duration of at least six months. While the overall proportion initiating breastfeeding has remained unchanged over time, the proportion of those who maintain breastfeeding exclusively for the recommended duration of at least six months has increased significantly (Figure 2.7). Nationally, in 2009–10 significantly fewer mothers in the lowest-income quintile reported breastfeeding their child exclusively for at least six months (23.1%) than mothers in the highest-income quintile (33.0%) (77).

Figure 2.7: Self-Reported Exclusive Breastfeeding Initiation and Exclusive for At Least Six Months (in those who reported being pregnant in the past five years), Ontario, 2003 to 2011

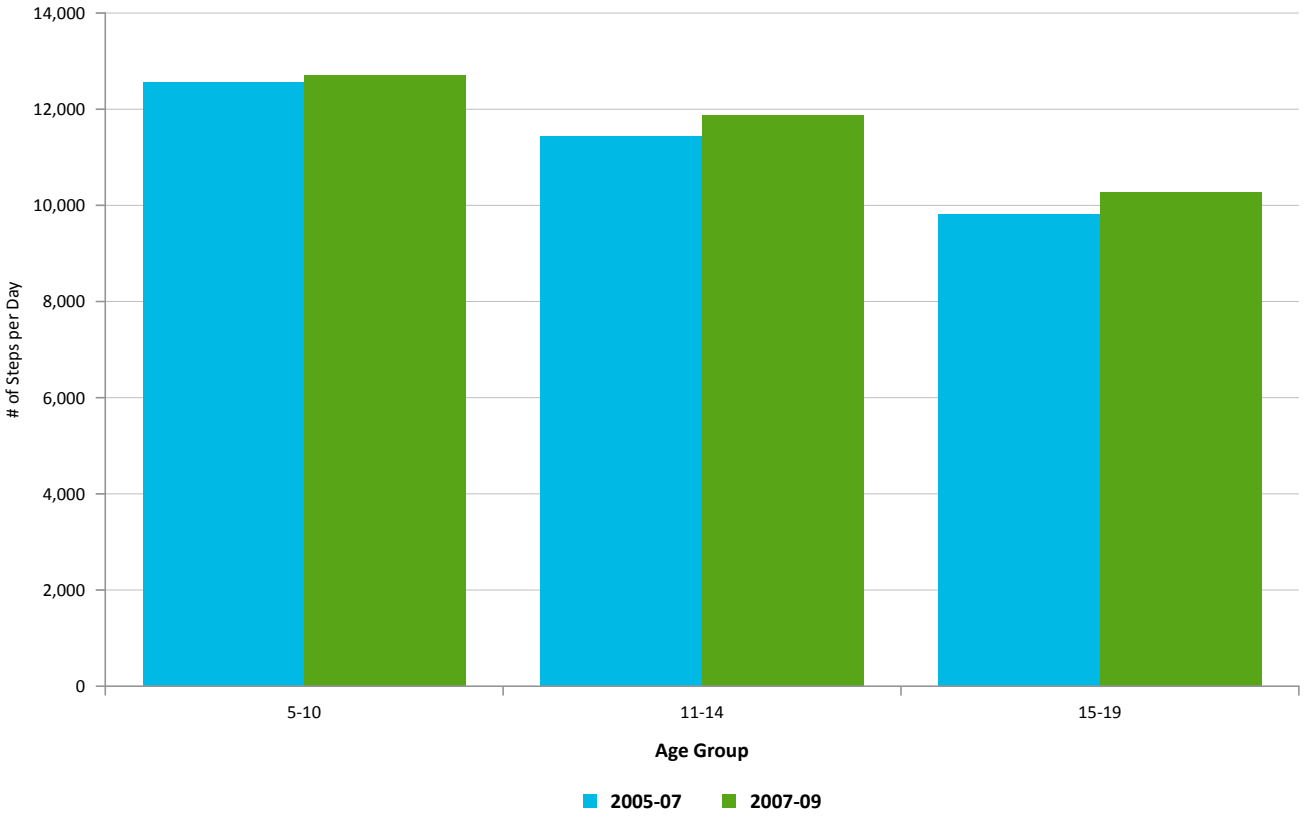


Source: Statistics Canada. Table 105-0501 - Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2011 boundaries) and peer groups.

PHYSICAL ACTIVITY AND SEDENTARY BEHAVIOUR

Inadequate physical activity is a contributing factor to the rising rates of overweight and obesity in children and youth. However, according to the 2009–10 Canadian Physical Activity Levels Among Youth (CANPLAY) survey, only 32% of children and youth in Ontario are meeting the new Canadian Physical Activity Guidelines (measured by having taken at least 13,500 steps per day). While the Activity Guidelines recommend at least 60 minutes of moderate to vigorous physical activity (MVPA) every day (78), it should be noted that this threshold of 13,500 steps per day may lead to an underestimation of those meeting the guideline by as much as 10% (79). Data from 2005–2007 and 2007–2009 show significant differences by age group, as 15- to 19-year-olds report lower levels of physical activity as compared to 5- to 14-year-olds (Figure 2.8).

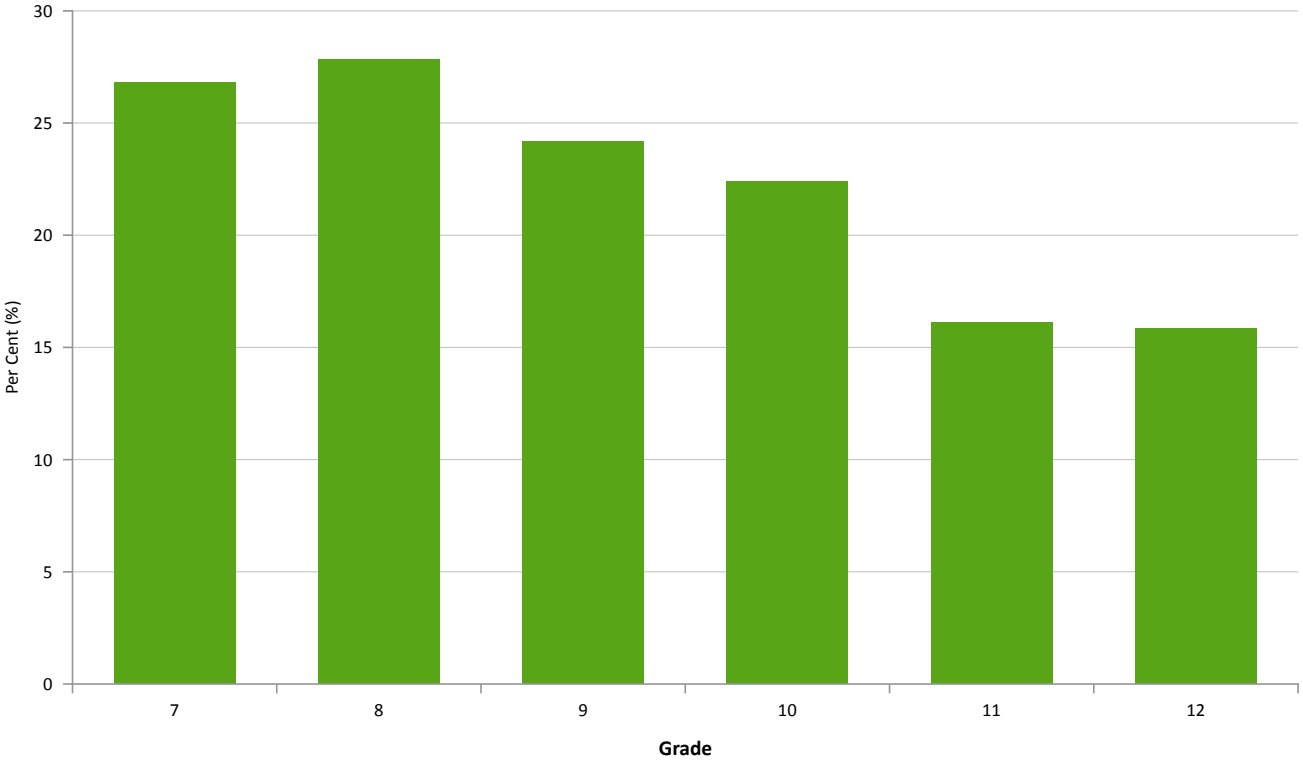
Figure 2.8: Average Daily Steps Taken by Children and Youth Aged 5 to 19 by Age Group, Ontario, 2005-07 to 2007-09



Source: 2005-09 Canadian Physical Activity Levels Among Youth survey, Canadian Fitness and Lifestyle Research Institute.

Only 21.3% of students in grades seven to 12 report being physically active daily for a minimum of 60 minutes per day, according to the 2011 Ontario Student Drug Use and Health Survey (OSDUHS). Males (27.0%) are significantly more likely than females (15.2%) to report being active daily. Daily physical activity significantly decreases as grade level increases, from a high of 27.8% among grade eight students to a low of 15.6% among grade 12 students (Figure 2.9).

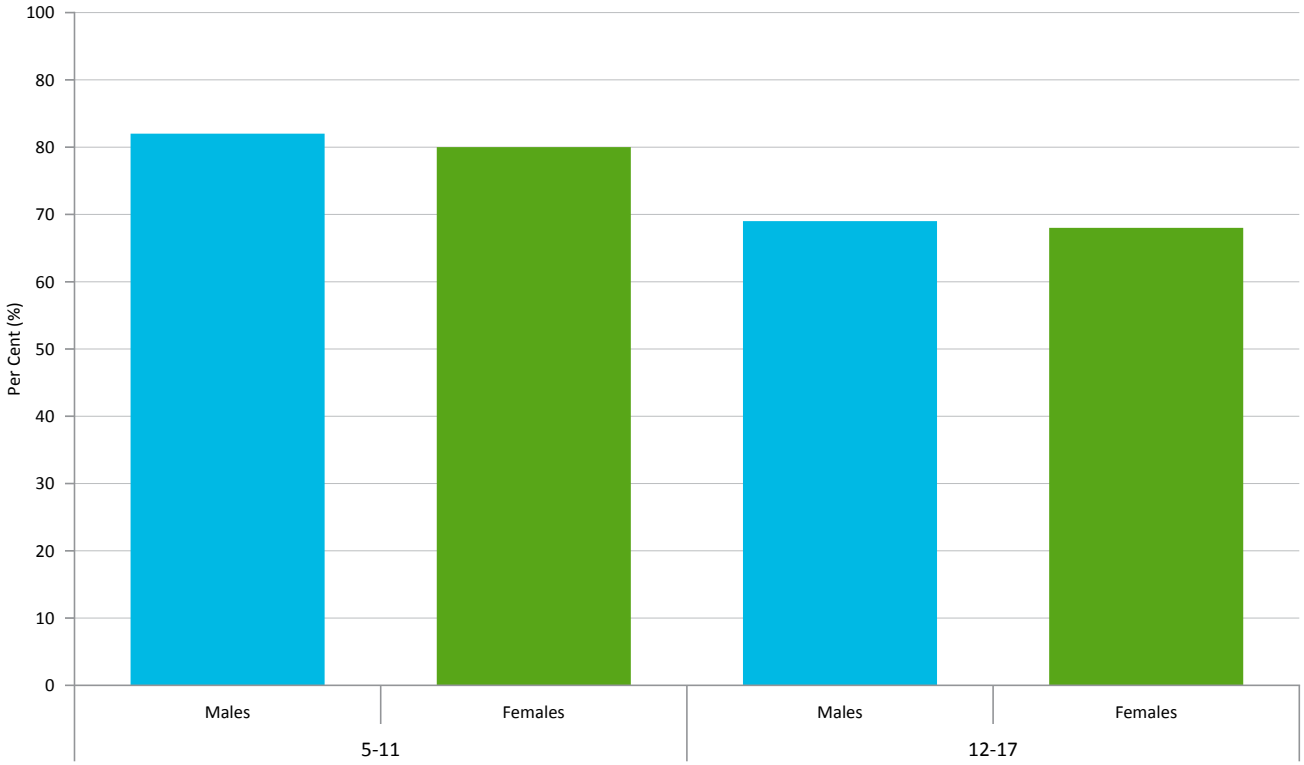
Figure 2.9: Daily Physical Activity during the Past Week in Students Grades 7 to 12, Ontario, 2011



Source: Paglia-Boak A, Adlaf EM, Hamilton HA, Beitchman JH, Wolfe D, Mann RE. The mental health and well-being of Ontario students, 1991-2011: Detailed OSDUHS findings (CAMH Research Document Series No. 34). Toronto, ON: Centre for Addiction and Mental Health. 2012.

It is thought that children and youth may get as much as 30% of their daily physical activity after school (80). Children and youth who are physically active after school also tend to be more active throughout the day (81). In the 2010 Physical Activity Monitor (PAM) survey, 65% of Ontario parents said their 5- to 17-year-olds participate in unorganized physical activity or sport between the time school ends and suppertime, as well as 67% reporting that their children and youth play outdoors during this period (82). About 82% of boys and 80% of girls aged 5 to 11 participate in organized physical activities or sports as reported by the Canadian Fitness and Lifestyle Research Institute (CFLRI). Participation rates decrease in the teenage years, during which only 69% of boys and 68% of girls between 12 and 17 years of age participate in organized physical activities and sports. Rates for Canadian youth are similar to Ontario rates (Figure 2.10).

Figure 2.10: Participation in Organized Physical Activities and Sports by Children and Youth Aged 5 to 17 by Sex and Age Group, Ontario and Canada, 2006–2007



Source: 2006-07 Canadian Physical Activity Levels Among Youth survey, CFLRI.

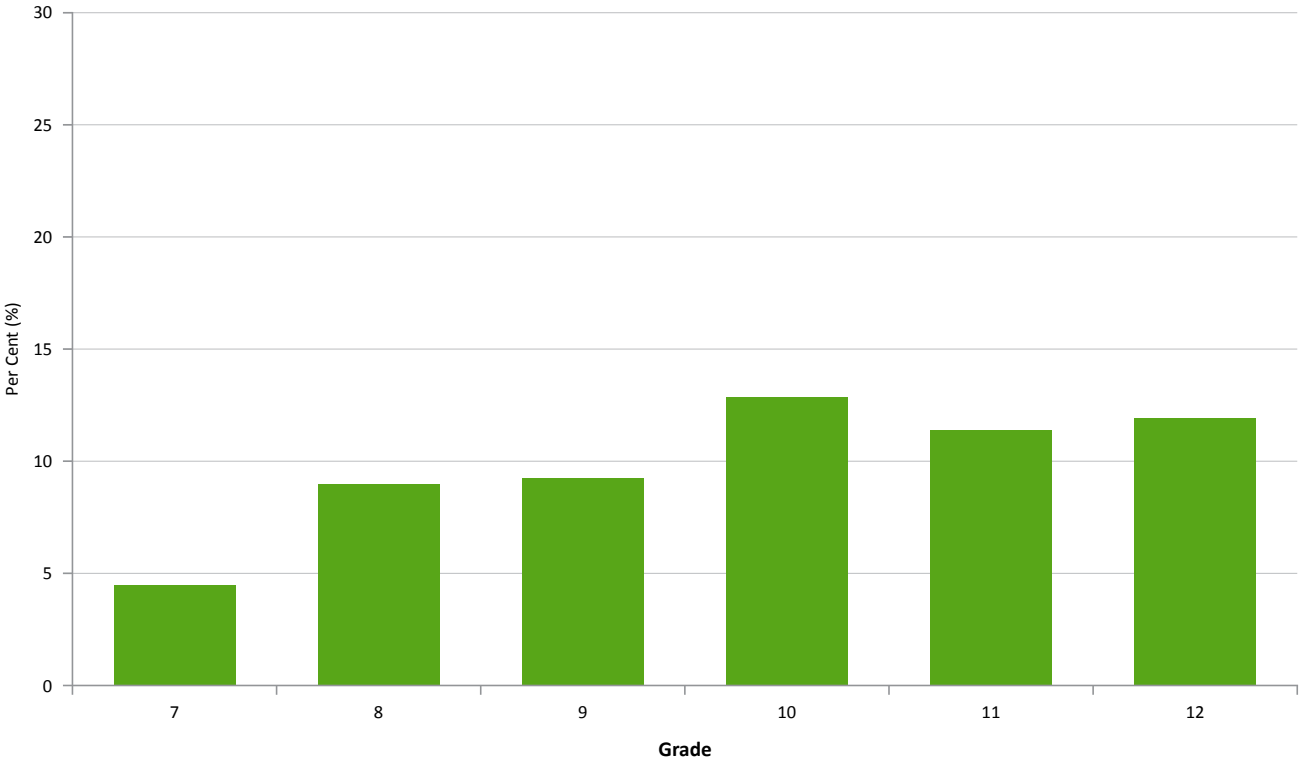
Leisure time is an important opportunity for physical activity; however, 27.3% of Ontario youth aged 12 to 19 reported being physically inactive during leisure time. Leisure-time inactivity varies by sex, with 24.3% of males reporting being inactive in 2011 versus 30.4% of females. Rates of leisure-time inactivity have remained relatively consistent since 2003 (Figure 2.11).

Figure 2.11: Self-Reported Physical Inactivity during Leisure Time in Youths Aged 12 to 19 by Sex, Ontario, 2003 to 2011

Source: Statistics Canada. Table 105-0501 - Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2011 boundaries) and peer groups.

Sedentary behaviour has been a contributing factor to overweight and obesity in children and youth. The 2011 OSDUHS showed that among all students, 10.2% spend at least seven hours a day in front of a TV or computer, with males (11.9%) being significantly more likely than females (8.3%) to report this behaviour. There is a significant grade level effect, as 10th, 11th and 12th graders are more likely to report daily sedentary behaviour than those in earlier grades (Figure 2.12).

Figure 2.12: Sedentary Behaviour (>7 hours "screen time" per day) in Students Grades 7 to 12, Ontario, 2011



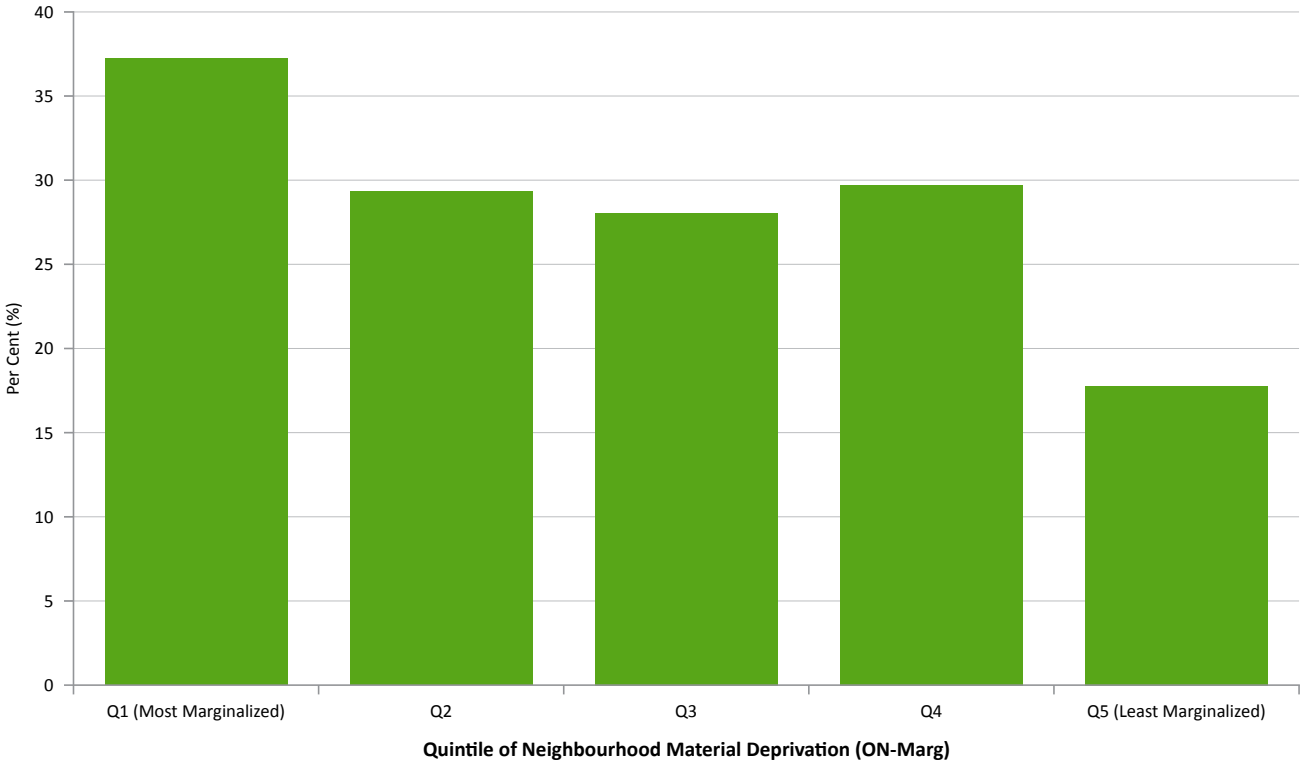
Source: Paglia-Boak A, Adlaf EM, Hamilton HA, Beitchman JH, Wolfe D, Mann RE. The mental health and well-being of Ontario students, 1991-2011: Detailed OSDUHS findings (CAMH Research Document Series No. 34). Toronto, ON: Centre for Addiction and Mental Health. 2012.

Social Environment

SOCIOECONOMIC STATUS

While overweight and obesity are linked to inadequate physical activity and poor eating habits, good nutrition and participation in physical activity are affected by underlying determinants of health. For example, low-income families may be less likely to have the financial means to access nutritious foods, sporting equipment and organized sports. Data from the 2009/2010 CCHS showed that youth aged 12 to 17 living in neighbourhoods in the lowest socioeconomic group reported a BMI considered to be overweight or obese (37.3%) compared to those living in neighbourhoods in the highest socioeconomic group (17.7%), as defined using the material deprivation dimension of the Ontario Marginalization Index (83) (Figure 2.13). There were no significant differences between the middle socioeconomic quintiles in relation to one another.

Figure 2.13: Self-Reported Overweight and Obesity (Youth Aged 12 to 17) by Quintile of Neighbourhood Material Deprivation (ON-Marg), Ontario, 2009/2010



Sources: 1) Canadian Community Health Survey 2009/2010, Statistics Canada, Canada Share File, Distributed by Ontario MOHLTC; 2) Ontario Marginalization Index (ON-Marg) 2006, Distributed by the Chair in Research on Urban Neighbourhoods, Community Health and Housing (CRUNCH), McMaster University

Parents with low levels of literacy or numeracy skills are less able to make informed food choices due to a lack of understanding of food labels (84). Children and youth living in low-income families often do not have enough to eat nor access to enough nutritious foods, as healthy foods cost more than foods high in fat, sugar or starch (85). The cost of nutritious food is often measured using the Nutritious Food Basket survey, which is a tool that is a measure of the cost of basic healthy eating that represents current nutrition recommendations and average food purchasing patterns (86). The provincial average for the 2011 Nutritious Food Basket for a reference family of four was $177.83 per week, a 5% increase from 2010. From 2003 to 2008, the cost of the Nutritious Food Basket increased more than 11% (87).

Both Ontario and Canadian data show that as income increases, so does participation in organized physical activities or sports. In 2006–2007, there was a 15% difference in participation rates between Ontario children and youth living in higher-income families and those living in lower-income families (88). Beyond socioeconomic status, there are other barriers to participation in physical activity. Generally, girls (compared to boys), those with lower parent education levels (compared to higher) and youth (compared to children) are less active. Those who are perceived to be less skilled based on their body composition may face additional barriers in accessing both specialized and integrated physical activity opportunities (78).

FOOD ENVIRONMENT

The food environment also plays a role in the development of healthy eating behaviours. For example, advertisements aimed at children and youth most often promote high-calorie foods, such as fast foods, candy and pre-sweetened cereals. In Canada, it has been found that commercials for healthy food make up only 4% of the food advertisements shown during children's viewing time (89). Household food insecurity may be an indicator of access to healthy and nutritious foods, and is typically associated with limited financial resources (90). In 2007–2008, 9.7% of Canadian households with children reported moderate or severe food insecurity (91).

PHYSICAL ACTIVITY ENVIRONMENT

As noted earlier, the physical environment plays an important role in the development of child and youth overweight and obesity. Policies can affect the physical environment by creating supportive environments for physical activity. This can include school policies to encourage daily physical activity and the availability of public recreation facilities. A Canadian survey found that only 35% of schools have programs designed to encourage active transportation (such as walking or biking to school) (92). Another Canadian survey found that 44% of students receive only one day of physical activity per week, while 25% and 22% report receiving three or four days per week and daily physical activity respectively (93). Additionally, the same survey found that only 60% of parents reported that available community facilities and programs meet their child's physical activity needs well or very well (94).

Weight and Behavioural Risk Factors Among First Nations, Inuit and Métis

Overweight and obesity rates among First Nations, Inuit and Métis (FNIM) children and youth are higher than the overall Canadian population. Data show that about 55% of First Nations children on reserve and 41% of Aboriginal children and youth living off reserve are either overweight or obese. Additionally, children and youth living on reserve have less access to organized sports, as well as less access to healthy foods (84). FNIM peoples in Canada have undergone a significant nutritional transition whereby traditional diets and associated physical activities have been replaced with patterns of consumption that increase the risk of becoming overweight or obese. This is coincident with food-system changes, including the introduction of Western foods, loss of environmental resources that provide access to traditional dietary sources from fishing, hunting and trapping, and the development of dependence on market foods (95).

Outcomes Associated with Child and Youth Overweight and Obesity

Children and youth who are overweight or obese are more likely to experience specific adverse health consequences, both in the short term and in the longer term when they reach adulthood. Consequences of child and youth overweight and obesity include psychological issues, and the development of risk factors for diabetes and cardiovascular disease, while longer-term outcomes include persistence of obesity into adulthood, as well as increased risk of chronic disease, premature mortality, and impaired social, educational and economic prospects. A relatively large and fairly consistent body of evidence demonstrates that overweight and obesity in children and youth have adverse consequences on premature mortality and physical morbidity in adulthood (96).

Children and youth who are overweight or obese are more likely to become obese adults (97), although this effect is more pronounced when obesity occurs in youth versus only in childhood (98). One longitudinal study in the United States (Bogalusa Heart Study) found that 87% of obese children and 66% of overweight children went on to become obese adults (99). A Canadian longitudinal study (Physical Activity Longitudinal Study) found that the likelihood of being overweight or obese in adulthood was over six times greater (95% CI: 2.2-17.2) in overweight or obese youth when compared to healthy weight youth, and that 83% of overweight or obese youth in the study remained overweight or obese as adults (100).

Overweight and obese children and youth are more likely to have a number of health complications, such as bone or joint deformation during growth, sleep apnea and asthma, as well as hypertension, type 2 diabetes and other risk factors (101). Data from a large U.S. longitudinal study (NHANES III) found that the prevalence of asthma among children differed significantly when comparing the group with the highest BMI to the lowest (14.9% versus 8.7%) (102). Additionally, overweight and obese children and youth are more likely to suffer from mental health issues, such as low self-esteem and poor body image, which increase their risk for depression (103).

Overweight and obesity in children leads to the development of a number of risk factors during childhood for cardiovascular-related conditions, including hypertension (i.e., high blood pressure), insulin-resistance, dyslipidemia (i.e., high cholesterol) and other risk conditions for diabetes and cardiovascular disease (104). Table 2.2 summarizes the increased odds of overweight and obese children and youth developing risk conditions for diabetes and cardiovascular disease found in one large-scale longitudinal study (105).

Table 2.2: Summary of Increased Risk of Diabetes and Cardiovascular Risk Conditions in Overweight and Obese Children and Youth Found in the Bogalusa Heart Study, Louisiana, U.S.A., 1972–1996

Risk condition	Odds ratio (OR)	95% Confidence interval
Elevated total cholesterol levels	2.5	2.0 – 3.0
Low high-density lipoprotein (HDL) levels	3.4	2.8 – 4.2
High low-density lipoprotein (LDL) levels	3.0	2.4 – 3.6
Elevated triglyceride levels	7.1	5.6 – 8.6
High fasting insulin levels	12.6	10.0 – 16.0
High systolic blood pressure	4.5	3.6 – 5.8
High diastolic blood pressure	2.4	1.8 – 3.0

Additionally, it has been found that the risk of death from ischemic heart disease later in life among persons who were overweight or obese as youth is 2.9 times higher for males and 3.7 times higher for females (95% CI: 2.3-3.6 and 2.3-5.7 respectively) when compared to their normal weight counterparts (106).

Type 2 diabetes is increasingly being diagnosed among younger age groups and is strongly linked to obesity (107). Estimates from the U.S. show that 45% of diabetes cases in children are type 2, and over 90% of these children are overweight or obese (108). It is not clear if the level of risk for cardiovascular disease for adolescents with type 2 diabetes is equivalent to that for adults; however, any increased risk would lead to adverse cardiovascular outcomes much earlier in life (109). Although there is a consistent body of evidence for associations between increased childhood BMI and cardiovascular outcomes later in life, there is a lack of evidence for effects occurring independent of adult overweight and obesity (110).

References

(1) Roberts KC, Shields M, de Groh M, Aziz A, Gilbert JA. Overweight and obesity in children and adolescents: results from the 2009 to 2011 Canadian Health Measures Survey. Health Rep. 2012;23(3):37-41.

(2) Shields M, Tremblay MS. Canadian childhood obesity estimates based on WHO, IOTF and CDC cut-points. Int J Pediatr Obes. 2010;5(3):265-273.

(3) Anderson PM, Butcher KE. Childhood obesity: trends and potential causes. Future Child. 2006;16(1):19-45.

(4) Bleich SN, Ku R, Wang YC. Relative contribution of energy intake and energy expenditure to childhood obesity: a review of the literature and directions for future research. Int J Obes (Lond). 2011;35(1):1-15.

(5) Monasta L, Batty GD, Cattaneo A, Lutje V, Ronfani L, Van Lenthe FJ, et al. Early-life determinants of overweight and obesity: a review of systematic reviews. Obes Rev. 2010;11(10):695-708.

(6) Strock GA, Cottrell ER, Abang AE, Buschbacher RM, Hannon TS. Childhood obesity: a simple equation with complex variables. J Long Term Eff Med Implants. 2005;15(1):15-32.

(7) Vos MB, Welsh J. Childhood obesity: update on predisposing factors and prevention strategies. Curr Gastroenterol Rep. 2010 [cited 2013 Jun 26];12(4):280-287. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3056648/

(8) Rosenkranz RR, Dzewaltowski DA. Model of the home food environment pertaining to childhood obesity. Nutr Rev. 2008;66(3):123-140.

(9) Yu ZB, Han SP, Zhu GZ, Zhu C, Wang XJ, Cao XG, et al. Birth weight and subsequent risk of obesity: a systematic review and meta-analysis. Obes Rev. 2011;12(7):525-42.

(10) Harder T, Bergmann R, Kallischnigg G, Plagemann A. Duration of breastfeeding and risk of overweight: a meta-analysis. Am J Epidemiol. 2005 [cited 2013 Jun 26];162(5):397-403. Available from: http://aje.oxfordjournals.org/content/162/5/397.full.pdf+html

(11) Ino T. Maternal smoking during pregnancy and offspring obesity: meta-analysis. Pediatr Int. 2010;52(1):94-9.

(12) Janssen I, Leblanc AG. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. Int J Behav Nutr Phys Act. 2010 [cited 2013 Jun 26];7:40. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2885312/pdf/1479-5868-7-40.pdf

(13) Ong KK, Loos RJF. Rapid infancy weight gain and subsequent obesity: systematic reviews and hopeful suggestions. Acta Paediatr.2006;95(8):904-8.

(14) te Velde SJ, van Nassau F, Uijtdewilligen L, van Stralen MM, Cardon G, De Craemer M, et al. Energy balance-related behaviours associated with overweight and obesity in preschool children: a systematic review of prospective studies. Obes Rev. 2012;13 Suppl 1:56-74.

(15) Chen X, Beydoun MA, Wang Y. Is sleep duration associated with childhood obesity? a systematic review and meta-analysis. Obesity (Silver Spring) 2008;16(2):265-74.

(16) Harrington S. The role of sugar-sweetened beverage consumption in adolescent obesity: a review of the literature. J Sch Nurs. 2008;24(1):3-12.

(17) Davies HT, Crombie IK, Tavakoli M. When can odds ratios mislead? BMJ. 1998 [cited 2013 Jun 26];316(7136):989-991. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1112884/

(18) Huang JS, Lee TA, Lu MC. Prenatal programming of childhood overweight and obesity. Matern Child Health J. 2007;11(5):461-73.

(19) Kim SY, England JL, Sharma JA, Njoroge T. Gestational diabetes mellitus and risk of childhood overweight and obesity in offspring: a systematic review. Exp Diabetes Res. 2011 [cited 2013 Jun 26] ;2011:541308. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3179897/

(20) Heindel JJ, vom Saal FS. Role of nutrition and environmental endocrine disrupting chemicals during the perinatal period on the aetiology of obesity. Mol Cell Endocrinol. 2009;304(1–2):90-6.

(21) Oken E. Maternal and child obesity: the causal link. Obstet Gynecol Clin North Am. 2009;36(2):361-77, ix-x.

(22) Oken E, Levitan EB, Gillman MW. Maternal smoking during pregnancy and child overweight: systematic review and meta-analysis. Int J Obes (Lond). 2008 [cited 2013 Jun 26];32(2):201-10. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2586944/

(23) Gillman MW, Rifas-Shiman S, Berkey CS, Field AE, Colditz GA. Maternal gestational diabetes, birth weight, and adolescent obesity. Pediatrics. 2003;111(3):e221-6.

(24) Monteiro POA, Victora CG. Rapid growth in infancy and childhood and obesity in later life--a systematic review. Obes Rev. 2005;6(2):143-154.

(25) Beyerlein A, von Kries R. Breastfeeding and body composition in children: will there ever be conclusive empirical evidence for a protective effect against overweight? Am J Clin Nutr. 2011 [cited 2013 Jun 26];94(6 Suppl):1772S-1775S. Available from: http://ajcn.nutrition.org/content/94/6_Suppl/1772S.full.pdf+html

(26) Singhal A. Does breastfeeding protect from growth acceleration and later obesity? Nestle Nutr Workshop Ser Pediatr Program. 2007;60:15-25; discussion 25-9.

(27) Summerbell CD, Douthwaite W, Whittaker V, Ells LJ, Hillier F, Smith S, et al. The associations between food, nutrition, physical activity, and the risk of weight gain, overweight and obesity: a systematic review of the epidemiological evidence. Int J Obes (Lond) 2009;33(S3):S1-92.

(28) Bonuck KA, Huang V, Fletcher J. Inappropriate bottle use: an early risk for overweight? literature review and pilot data for a bottle-weaning trial. Matern Child Nutr. 2010;6(1):38-52.

(29) Moorcroft KE, Marshall JL, McCormick FM. Association between timing of introducing solid foods and obesity in infancy and childhood: a systematic review. Matern Child Nutr. 2011;7(1):3-26.

(30) DiSantis KI, Hodges EA, Johnson SL, Fisher JO. The role of responsive feeding in overweight during infancy and toddlerhood: a systematic review. Int J Obes (Lond). 2011;35(4):480-92.

(31) Hurley KM, Cross MB, Hughes SO. A systematic review of responsive feeding and child obesity in high-income countries. J Nutr. 2011 [cited 2013 Jun 26];141(3):495-501. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3040906/

(32) Smithers LG, Golley RK, Brazionis L, Lynch JW. Characterizing whole diets of young children from developed countries and the association between diet and health: a systematic review. Nutr Rev. 2011;69(8):449-67.

(33) Must A, Barish EE, Bandini LG. Modifiable risk factors in relation to changes in BMI and fatness: what have we learned from prospective studies of school-aged children? Int J Obes (Lond). 2009 [cited 2013 Jun 26];33(7):705-715. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3586424/

(34) Newby PK. Are dietary intakes and eating behaviors related to childhood obesity? a comprehensive review of the evidence. J Law Med Ethics. 2007;35(1):35-60.

(35) Field AE, Gillman MW, Rosner B, Rockett HR, Colditz GA. Association between fruit and vegetable intake and change in body mass index among a large sample of children and adolescents in the United States. Int J Obes Relat Metab Disord. 2003;27(7):821-6.

(36) Shields M. Overweight and obesity among children and youth. Health Rep. 2006 [cited 2013 Jun 26];17(3):27-42. Available from: http://www.statcan.gc.ca/pub/82-003-x/2005003/article/9277-eng.pdf

(37) Libuda L, Kersting M. Soft drinks and body weight development in childhood: is there a relationship? Curr Opin Clin Nutr Metab Care. 2009;12(6):596-600.

(38) Gibson S. Sugar-sweetened soft drinks and obesity: a systematic review of the evidence from observational studies and interventions. Nutr Res Rev. 2008;21(2):134-47.

(39) Louie JCY, Flood VM, Hector DJ, Rangan AM, Gill TP. Dairy consumption and overweight and obesity: a systematic review of prospective cohort studies. Obes Rev. 2011;12(7):e582-92.

(40) Koletzko B, Toschke AM. Meal patterns and frequencies: do they affect body weight in children and adolescents? Crit Rev Food Sci Nutr. 2010;50(2):100-5.

(41) Wiecha JL, Peterson KE, Ludwig DS, Kim J, Sobol A, Gortmaker SL. When children eat what they watch: impact of television viewing on dietary intake in youth. Arch Pediatr Adolesc Med. 2006;160(4):436-42.

(42) Clark HR, Goyder E, Bissell P, Blank L, Peters J. How do parents' child-feeding behaviours influence child weight? implications for childhood obesity policy. J Public Health (Oxf). 2007 [cited 2013 Jun 26];29(2):132-41. Available from: http://jpubhealth.oxfordjournals.org/content/29/2/132.full.pdf+html

(43) Sleddens EF, Gerards SM, Thijs C, de Vries NK, Kremers SP. General parenting, childhood overweight and obesity-inducing behaviors: a review. Int J Pediatr Obes. 2011;6(2-2):e12-27.

(44) Must A, Tybor DJ. Physical activity and sedentary behavior: a review of longitudinal studies of weight and adiposity in youth. Int J Obes (Lond). 2005;29 Suppl 2:S84-96.

(45) Reilly JJ. Physical activity, sedentary behaviour and energy balance in the preschool child: opportunities for early obesity prevention. Proc Nutr Soc. 2008;67(3):317-25.

(46) Jimenez-Pavon D, Kelly J, Reilly JJ. Associations between objectively measured habitual physical activity and adiposity in children and adolescents: Systematic review. Int J Pediatr Obes. 2010;5(1):3-18.

(47) Reichert FF, Baptista Menezes AM, Wells JC, Carvalho Dumith S, Hallal PC. Physical activity as a predictor of adolescent body fatness: a systematic review. Sports Med. 2009;39(4):279-94.

(48) Cappuccio FP, Taggart FM, Kandala NB, Currie A, Peile E, Stranges S, et al. Meta-analysis of short sleep duration and obesity in children and adults. Sleep. 2008 [cited 2013 Jun 26];31(5):619-26. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2398753/pdf/aasm.31.5.619.pdf

(49) Hart CN, Jelalian E. Shortened sleep duration is associated with pediatric overweight. Behav Sleep Med. 2008;6(4):251-67.

(50) Patel SR, Hu FB. Short sleep duration and weight gain: a systematic review. Obesity (Silver Spring). 2008;16(3):643-53.

(51) Must A, Parisi SM. Sedentary behavior and sleep: paradoxical effects in association with childhood obesity. Int J Obes (Lond). 2009 [cited 2013 Jun 26];33 Suppl 1:S82-6. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3586418/pdf/nihms-388336.pdf

(52) Van Cauter E, Knutson KL. Sleep and the epidemic of obesity in children and adults. Eur J Endocrinol. 2008 [cited 2013 Jun 26];159 Suppl 1:S59-66. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2755992/pdf/EJE080298.pdf

(53) Gundersen C, Mahatmya D, Garasky S, Lohman B. Linking psychosocial stressors and childhood obesity. Obes Rev. 2011;12(5):e54-e63.

(54) Incledon E, Wake M, Hay M. Psychological predictors of adiposity: systematic review of longitudinal studies. Int J Pediatr Obes. 2011;6(2-2):e1-11.

(55) Midei AJ, Matthews KA. Interpersonal violence in childhood as a risk factor for obesity: a systematic review of the literature and proposed pathways. Obes Rev. 2011 [cited 2013 Jun 26];12(5):e159-72. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3104728/pdf/nihms290170.pdf

(56) Tang-Péronard JL, Andersen HR, Jensen TK, Heitmann BL. Endocrine-disrupting chemicals and obesity development in humans: a review. Obes Rev. 2011;12(8):622-36.

(57) La Merrill M, Birnbaum LS. Childhood obesity and environmental chemicals. Mt Sinai J Med. 2011 [cited 2013 Jun 26];78(1):22-48. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3076189/pdf/nihms-253603.pdf

(58) Newbold RR. Impact of environmental endocrine disrupting chemicals on the development of obesity. Hormones (Athens). 2010;9(3):206-17.

(59) Rahman T, Cushing RA, Jackson RJ. Contributions of built environment to childhood obesity. Mt Sinai J Med. 2011;78(1):49-57.

(60) Dunton GF, Kaplan J, Wolch J, Jerrett M, Reynolds KD. Physical environmental correlates of childhood obesity: a systematic review. Obes Rev. 2009;10(4):393-402.

(61) Carter MA, Dubois L. Neighbourhoods and child adiposity: A critical appraisal of the literature. Health Place. 2010;16(3):616-28.

(62) Shrewsbury V, Wardle J. Socioeconomic status and adiposity in childhood: a systematic review of cross-sectional studies 1990-2005. Obesity (Silver Spring). 2008;16(2):275-84.

(63) Eisenmann JC. Insight into the causes of the recent secular trend in pediatric obesity: common sense does not always prevail for complex, multi-factorial phenotypes. Prev Med. 2006;42(5):329-35.

(64) El-Sayed AM, Scarborough P, Galea S. Ethnic inequalities in obesity among children and adults in the UK: a systematic review of the literature. Obes Rev. 2011;12(5):e516-34.

(65) Carter OB. The weighty issue of Australian television food advertising and childhood obesity. Health Promot J Austr. 2006;17(1):5-11.

(66) Lobstein T, Dibb S. Evidence of a possible link between obesogenic food advertising and child overweight. Obes Rev. 2005;6(3):203-208.

(67) Venner AA, Lyon ME, Doyle-Baker PK. Leptin: a potential biomarker for childhood obesity? Clin Biochem. 2006;39(11):1047-56.

(68) Koletzko B, von Kries R, Monasterolo RC, Subias JE, Scaglioni S, Giovannini M, et al. Infant feeding and later obesity risk. Adv Exp Med Biol. 2009;646:15-29.

(69) Dyer JS, Rosenfeld CR. Metabolic imprinting by prenatal, perinatal, and postnatal overnutrition: a review. Semin Reprod Med. 2011;29(3):266-76.

(70) Kral TV, Faith MS. Influences on child eating and weight development from a behavioral genetics perspective. J Pediatr Psychol. 2009;34(6):596-605.

(71) Hinney A, Vogel CI, Hebebrand J. From monogenic to polygenic obesity: recent advances. Eur Child Adolesc Psychiatry. 2010 [cited 2013 Jun 26];19(3):297-310. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2839509/pdf/787_2010_Article_96.pdf

(72) Anderson KD, Baxter-Jones ADG, Faulkner RA, Muhajarine N, Henry CJ, Chad KE. Assessment of total and central adiposity in Canadian Aboriginal children and their Caucasian peers. Int J Pediatr Obes. 2010;5(4):342-50.

(73) Haman F, Fontaine-Bisson B, Batal M, Imbeault P, Blais JM, Robidoux MA. Obesity and type 2 diabetes in Northern Canada's remote First Nations communities: the dietary dilemma. Int J Obes (Lond). 2010;34 Suppl 2:S24-31.

(74) Ng C, Young TK, Corey PN. Associations of television viewing, physical activity and dietary behaviours with obesity in aboriginal and non-aboriginal Canadian youth. Public Health Nutr. 2010;13(9):1430-7.

(75) Garriguet D. Beverage consumption of children and teens. Health Rep. 2008;19(4):17-22.

(76) Social Program Evaluation Group, Queen's University at Kingston. Health Behaviour in School-aged Children: a World Health Organization cross-national study: survey data 2005/2006. Submitted to: Public Health Agency of Canada. Ottawa, ON: Her Majesty the Queen in Right of Canada; [2008].

(77) Statistics Canada [homepage on the Internet]. Ottawa, ON: Statistics Canada; 2012. Duration of exclusive breastfeeding in canada: key statistics and graphics (2009-2010); 2012 Jun 27 [cited 2013 Jun 26]. Available from: http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/prenatal/exclusive-exclusif-eng.php

(78) Active Healthy Kids Canada. Report card on physical activity for children and youth: Ontario report card supplement. Toronto, ON: Active Healthy Kids Canada;2011 [cited 2013 Jun 26]. Available from: http://dvqdas9jty7g6.cloudfront.net/resources/OntarioReportCardFINAL7.pdf

(79) Colley RC, Janssen I, Tremblay MS. Daily step target to measure adherence to physical activity guidelines in children. Med Sci Sports Exerc. 2012;44(5):977-82.

(80) Veitch J, Cleland V, Salmon J, Hume C, Timperio A, Crawford D. Children's and adolescents' physical activity during the critical window: summary report. Burwood, VC: Centre for Physical Activity and Nutrition Research; No date.

(81) Mota J, Santos MP, Ribeiro JC. Differences in leisure-time activities according to level of physical activity in adolescents. J Phys Act Health. 2008;5(2):286-93.

(82) Canadian Fitness and Lifestyle Research Institute. 2010 physical activity monitor. Ottawa, ON: Canadian Fitness and Lifestyle Research Institute; 2010.

(83) ON-Marg: Ontario Marginalization Index. Hamilton, ON: McMaster University; 2006 [cited 2013 Jun 26]. Available from: http://www.crunch.mcmaster.ca/ontario-marginalization-index

(84) Canada. Parliament. House of Commons. Standing Committee on Health. Healthy weights for healthy kids. 39th Parliament, 1st Session, 2006-07. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2007. Available from: http://www.parl.gc.ca/content/hoc/Committee/391/HESA/Reports/RP2795145/hesarp07/hesarp07-e.pdf

(85) Basrur S. 2004 Chief Medical Officer of Health report: healthy weights, healthy lives. Toronto, ON: Queen's Printer for Ontario; 2004 [cited 2013 Jun 26]. Available from: http://www.mhp.gov.on.ca/en/heal/healthy_weights.pdf

(86) Ontario. Ministry of Health and Long-Term Care. Ontario public health standards 2008. Toronto, ON: Queen's Printer for Ontario; 2008 [cited 2013 Jun 26]. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/ophs_2008.pdf

(87) Bryan-Pulham A. The cost of healthy eating in Oxford County: 2011 annual report on the Nutritious Food Basket Survey. Woodstock, ON: Oxford County Public Health & Emergency Services; 2012 [cited 2013 Jun 26]. Available from: http://www.oxfordcounty.ca/Portals/15/Documents/News%20Room/2012ReportsPubs/Foodsecurityreport20120330.pdf

(88) Ungerleider C (Canadian Council on Learning). Looking to the future: measuring child and youth well-being in Ontario. A profile of Ontario's children and youth. Submitted to: Ontario. Ministry of Children and Youth Services. Toronto, ON: Queen's Printer for Ontario; 2009 (Unpublished report).

(89) Impact of media use on children and youth. Paediatr Child Health. 2003;8(5):301-306.

(90) Tarasuk V. Health implications of food insecurity. In: Raphael D. Social determinants of health: Canadian perspectives. 2nd ed. Toronto, ON: Canadian Scholars' Press Inc.; 2009. p. 205-221.

(91) Statistics Canada [homepage on the Internet]. Ottawa, ON: Statistics Canada; 2010. CANSIM Table 105-0546: household food insecurity measures, by presence of children in the household, Canada, provinces and territories, occasional (number otherwise noted), CANSIM (database); 2010 May 26 [cited 2013 Jun 26]. Available from: http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=1050546&paSer=&pattern=&stByVal=1&p1=1&p2=-1&tabMode=dataTable&csid=

(92) O'Loghlen S, Pickett JW, Janssen I. Active transportation environments surrounding Canadian schools. Can J Public Health. 2011;102(5):364-8.

(93) Canadian Fitness and Lifestyle Research Institute. 2005 physical activity monitor. Bulletin 3: Physical activity programming in the school environment. Ottawa, ON: Canadian Fitness and Lifestyle Research Institute; 2007 [cited 2013 Jun 26]. Available from: http://www.cflri.ca/media/node/375/files/pam2005_sec3.pdf

(94) Canadian Fitness and Lifestyle Research Institute. 2005 Physical Activity Monitor. Bulletin 5: Local opportunities to be active. Ottawa, ON: Canadian Fitness and Lifestyle Research Institute; 2007 [cited 2013 Jun 26]. Available from: http://www.cflri.ca/media/node/379/files/pam2005_sec5.pdf

(95) Earle L. Traditional aboriginal diets and health. Prince George, BC: National Collaborating Centre for Aboriginal Health; 2011[cited 2013 Jun 26]. Available from: http://www.nccah-ccnsa.ca/docs/social%20determinates/1828_NCCAH_mini_diets_health_final.pdf

(96) Reilly JJ, Kelly J. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. Int J Obes (Lond). 2011;35(7):891-8.

(97) Freedman DS, Khan LK, Serdula MK, Dietz WH, Srinivasan SR, Berenson GS. The relation of childhood BMI to adult adiposity: the Bogalusa Heart Study. Pediatrics. 2005;115(1):22-27.

(98) Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. N Engl J Med. 1997 [cited 2013 Jun 26];337(13):869-73. Available from: http://www.nejm.org/doi/pdf/10.1056/NEJM199709253371301

(99) Freedman DS, Dietz WH, Srinivasan SR, Berenson GS. Risk factors and adult body mass index among overweight children: the Bogalusa Heart Study. Pediatrics. 2009;123(3):750-7.

(100) Herman KM, Craig CL, Gauvin L, Katzmarzyk PT. Tracking of obesity and physical activity from childhood to adulthood: the Physical Activity Longitudinal Study. Int J Pediatr Obes. 2009;4(4):281-8.

(101) Ezzati M, Hoorn SV, Lopez AD, Danaei G, Rodgers A, Mathers CD, et al. Comparative quantification of mortality and burden of disease attributable to selected risk factors. In: Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray CJL, editors. Global burden of disease and risk factors. Washington, DC: World Bank; 2006 [cited 2013 Jun 26]. Chapter 4. Available from: http://www.ncbi.nlm.nih.gov/books/NBK11813/

(102) von Mutius E, Schwartz J, Neas LM, Dockery D, Weiss ST. Relation of body mass index to asthma and atopy in children: the National Health and Nutrition Examination Study III. Thorax. 2001 [cited 2013 Jun 26];56(11):835-8. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1745951/pdf/v056p00835.pdf

(103) Strauss RS. Childhood obesity and self-esteem. Pediatrics. 2000;105(1):e15.

(104) Reilly JJ, Methven E, McDowell ZC, Hacking B, Alexander D, Stewart L, et al. Health consequences of obesity. Arch Dis Child. 2003 [cited 2013 Jun 26];88(9):748-52. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1719633/pdf/v088p00748.pdf

(105) Freedman DS, Dietz WH, Srinivasan SR, Berenson GS. The relation of overweight to cardiovascular risk factors among children and adolescents: the Bogalusa Heart Study. Pediatrics. 1999;103(6 Pt 1):1175-1182.

(106) Bjorge T, Engeland A, Tverdal A, Smith GD. Body mass index in adolescence in relation to cause-specific mortality: a follow-up of 230,000 Norwegian adolescents. Am J Epidemiol. 2008;168(1):30-7.

(107) Shaw J. Epidemiology of childhood type 2 diabetes and obesity. Pediatr Diabetes. 2007;8 Suppl 9:7-15.

(108) Fagot-Campagna A. Emergence of type 2 diabetes mellitus in children: epidemiological evidence. J Pediatr Endocrinol Metab. 2000;13 Suppl 6:1395-1402.

(109) Daniels SR, Arnett DK, Eckel RH, Gidding SS, Hayman LL, Kumanyika S, et al. Overweight in children and adolescents: pathophysiology, consequences, prevention, and treatment. Circulation. 2005;111(15):1999-2012.

(110) Park MH, Falconer C, Viner RM, Kinra S. The impact of childhood obesity on morbidity and mortality in adulthood: a systematic review. Obes Rev. 2012;13(11):985-1000.

3. Measuring and Monitoring

Summary

Assessing success in achieving any obesity reduction goal relies on the ability to establish baseline measurements for childhood obesity and related risk factors, and monitor these over time to account for the investment in obesity reduction and prevention programs. Body mass index (BMI)-for-age is the indicator that is broadly utilized both across international jurisdictions and within Ontario PHUs to monitor childhood overweight and obesity. Measured BMI is a more accurate indicator of overweight and obesity than self-reported BMI. BMI-for-age is defined as weight divided by height squared, and is assessed relative to other children of the same age and gender. There are different BMI-for-age systems in use around the world, which result in variations in overweight and obesity rates in children and youth. A number of Canadian organizations, including Dietitians of Canada, have recommended that WHO growth charts be utilized as the Canadian standard for measuring BMI-for-age.

Within Ontario, there are challenges in finding opportunities to systematically measure childhood height and weight and related risk factors, whether during physician visits, on entry to the school system, during schooling or at home. While there are substantial limitations to existing data sources, there are 10 surveys in Canada and Ontario collected in the community and school settings that could be used to monitor the prevalence of overweight and obesity in children and youth. Some systems monitor health of First Nations, Inuit and Métis children and youth; however, most have limitations in terms of providing data concerning specific geographic, ethnic or other sub-populations of interest. Most of the existing systems collect self- or parent-reported height and weight, as opposed to measured height and weight, and, as a result, may under- or overestimate overweight and obesity on a population level. Existing data collection systems that could be leveraged as they compile measured height and weight include the nutrition-focused survey of the Canadian Community Health Survey (CCHS), Canadian Health Measures Survey and electronic medical/health record (EMR/EHR) data from primary care physicians.

Measuring and Monitoring Child and Youth Overweight and Obesity

Using available data, it is difficult to present a comprehensive picture of overweight and obesity in children and youth, including related risk and protective factors. The data presented in the previous Chapter were collected from a number of different surveys and independent studies. Limitations include inconsistency in age groups in these surveys and studies, and many rely on self-reported measures of overweight and obesity. A further discussion of data issues, surveillance and measurement follows.

Context for Measurement and Monitoring in Ontario

The Ontario Public Health Standards outline the role of local PHUs in obesity surveillance and the promotion of healthy child and youth development that includes healthy weights. Boards of health are mandated to "conduct epidemiological analysis of surveillance data, including monitoring of trends over time, emerging trends and priority populations in accordance with the Population Health Assessment and Surveillance Protocol, 2008, in the areas of ... healthy eating, healthy weights, and physical activity" (1). Measurement of overweight and obesity in children and youth has been identified as a surveillance gap in Ontario, with a number of potential challenges for consideration and resolution (2).

The need for a surveillance system in Ontario to monitor the prevalence of healthy weights at the population level and track changes over time was identified by the Council of Ontario Medical Officers of Health (COMOH) in 2008 (2). They identified that the surveillance system should include the measurement of height and weight of a representative sample of Ontario children and youth, as well as physical activity and inactivity measures, dietary patterns and eating behaviours related to childhood obesity. The need to include surveillance of sub-groups known to be at higher risk for overweight and obesity and the social and environmental factors that contribute to elevated risk were also addressed.

The Association of Local Public Health Agencies (alPHa), with funding from the former Ministry of Health Promotion and Sport (MHPS) and with co-leadership by Public Health Ontario (PHO), piloted a healthy weight surveillance system in the school system linked with the public health oral health screening program in children in the second grade. The initial pilot phase was completed in 2010, although subsequent phases were not undertaken.

There are many reasons to collect child and youth height and weight data. Data can be used for surveillance to describe trends in weight status over time in the population. It can also be used to identify demographic and geographic sub-groups at greatest risk of overweight and obesity to help target prevention and treatment programs, and monitor progress toward health objectives. In addition to surveillance, this same data can also be used for screening or evaluation purposes.

Measurement of overweight and obesity in children and youth can be positioned as one component of a broader approach to measuring and monitoring efforts to reduce childhood obesity. The need for measured height and weight has been identified as being imperative for the successful evaluation of any implemented obesity prevention strategy, in order to track progress in meeting goals (3). An initial set of core indicators has been identified by a Federal/Provincial/Territorial (F/P/T) panel to monitor childhood and youth obesity and related risk factor trends in Canada (Appendix 2), and concurrent efforts exist to establish a plan for the measuring and monitoring of progress on the F/P/T framework for Action to Promote Healthy Weights (4). This initial set of indicators supports a broader evaluation framework comprised of three components that are key to measuring, monitoring and reporting on progress under the framework (1):

- Surveillance to provide relevant information on obesity trends and their determinants
- Monitoring and reporting to gauge progress on actions of multiple sectors and allow for modification of approach
- Knowledge translation to ensure that options under consideration are informed by evidence

Generally, there are two types of data collection: cross-sectional (in which a defined population is studied at one point in time) and longitudinal (in which a group of individuals is followed over time). Provincially, representative and repeated cross-sectional data could identify trends over time and

patterns in overweight and obesity prevalence rates in children and youth and help to identify the impact of interventions or policies on anthropometric outcomes. A cohort approach, on the other hand, would allow for examination of relationships between initial levels of risk factors and the onset of overweight and obesity and other health outcomes. It is important to note that repeat cross-sectional data can also be linked to other data sets containing outcome data for the same individual to form cohorts, provided that common information is collected within each data set to facilitate record linkage.

Examples of Jurisdictions Measuring Child and Youth Overweight and Obesity

There are a number of other countries that are collecting, or plan to collect, measurements of height and weight in children and youth as part of initiatives to lower rates of overweight and obesity. Table 3.1 provides some examples of those jurisdictions collecting this data as part of their plans to achieve their target reductions.

Table 3.1: Selected Examples of Countries with Plans for Monitoring Child and Youth Overweight and Obesity

Jurisdiction	Specific indicators and measurements	Measurement and monitoring plans
Australia	BMI-for-age	Measurement of height and weight in children has been conducted as part of the 1995 National Nutrition Survey, 2007 Australian National Children's Nutrition and Physical Activity Survey, and will be a part of the 2011/13 Australian Health Survey (5)
Canada	% of children aged 2 to 17 whose measured BMI-for-age indicates overweight or obese	The measurement and monitoring plan will measure and report on collective progress in reducing childhood overweight and obesity, learn from successful initiatives and modify approaches as appropriate (4); plan to monitor trends using 2004 CCHS data, including physical measures with discussions under way to repeat collection of physical measures in 2015
Denmark	BMI-for-age	Recommends the following as an action for the public sector: "Establish guidelines for municipal health services with a view to the monitoring of children's height and weight (establishing of child examination programmes involving regular reporting and central registration of height and weight measures)" (6)
England	BMI-for-age at school entry (aged 4 to 5 years) and grade 6 (aged 10 to 11 years)	The strategy includes plans to use an existing measurement program to track success (the National Child Measurement Program [NCMP]). The strategy also stated that the government would explore participation in the WHO European childhood obesity surveillance initiative to provide internationally comparable data (7)
France, Spain, Belgium	BMI-for-age	Follows protocol established by EPODE (French acronym for "Together Let's Prevent Childhood Obesity"), which calls for biannual height and weight measurements for children aged 5 to 12 (8)
United States	Self-reported BMI-for-age (height and weight) using Centers for Disease Control and Prevention (CDC) growth charts	Progress will be monitored through the CDC's annual National Health and Nutrition Examination Survey (NHANES), which is aggregated every two years; target is 2.5% reduction (absolute) in rates of overweight and obesity, 5% reduction by 2020 (9)
WHO European Childhood Obesity Surveillance Initiative (COSI)	BMI-for-age in children aged 6 to 9	The system aims to routinely measure trends in overweight and obesity in primary schoolchildren in order to understand the progress of the epidemic in this population group and to permit inter-country comparisons within the European Region (includes Belgium [Flemish region], Bulgaria, Cyprus, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Norway, Portugal, Slovenia, Spain, Sweden and the former Yugoslav Republic of Macedonia) (10)

PHUs in Ontario have also undertaken data collection at the local level as part of their population health assessment and surveillance activities for chronic disease prevention. Currently, PHUs utilize different measures and focus on different age groups. Table 3.2 outlines details of the 17 out of 36 PHUs that have collected height and weight data within the past seven years.

Table 3.2: Measurement Activities in Ontario Public Health Units

Public health unit	Year(s)	Population	Measures	Description
Eastern Ontario Health Unit	2000, 2003, 2007, 2010	Youth in grades 7 to 12	Self-reported height and weight	Collected as part of Youth Risk Behaviour Survey (YRBS), modelled after CDC survey (11)
Halton Region Health Department	2006, 2009/10, 2012, planned for every 3 years	Children in kindergarten, and youth in grade 7 and 10	Parent-reported height and weight (kindergarten), self-reported height and weight (grade 7 and 10)	Collected as part of Halton Youth Survey (HYS) and Kindergarten Parent Survey (KPS) (12)
Middlesex-London Health Unit	2006	Children in grades 1 to 6	Measured height and weight	Collected as part of a one-time research study of overweight and obesity in the region (13)
Oxford County Public Health and Emergency Services	Annually since 2007	Children aged 2 to 5	Parent-reported height and weight	Collected as part of screening done at Preschool Health Fair, parents were responsible for measurement beforehand (14)
Peel Public Health	2004, 2011	Youth in grades 7 to 12	Measured height and weight	Collected by public health nurse as part of the Peel School Health Survey (15)
Porcupine Health Unit	Annually to 2008/09	Children in grade 6	Measured height and weight	Annual survey focused on specific communities within health unit jurisdiction each year to provide population estimates for that community. Measurement was conducted by dietetic staff
Region of Waterloo Public Health	2006	Children in grade 6	Measured height and weight	Collected by public health nurse as part of a onetime study "Food and Physical Activity Behaviours of Grade 6 Students in Waterloo Region" (16)
Toronto Public Health	2014	Youth in grades 7 to 12	Measured height and weight, self-reported height and weight	To be collected by public health nurse as part of the Student Health Assessment Project (17)
Various PHUs (Durham[abc], Haliburton Kawartha Pine Ridge[ac], Lambton[a], Leeds Grenville & Lanark[a], Niagara[b], North Bay Parry Sound[b], Ottawa[abc], Peel[c], Sudbury[c], York[abc])	2008[a], 2010[b], 2012[c]	Youth in grades 7 to 12	Self-reported height and weight	Extra sample for Ontario Student Drug Use and Health Survey (OSDUHS) purchased by these public health units to facilitate local-level reporting

Approaches to Measurement of Overweight and Obesity in Children and Youth

There are a number of ways in which obesity can be measured, some of which are more appropriate for population-level surveillance than others. In obesity surveillance, there is a reliance on indicators that are a proxy for body fatness. The most commonly used approaches for population health surveillance are body mass index (BMI)-for-age, a measure of weight relative to a given height; measures of skinfold thickness; and measures of girth, such as the waist, hip or neck circumference. For the majority of the population, these different measures will come to the same conclusion; however, for some sub-populations (e.g., those with muscular body types or thin frames with increased stomach fat), BMI-for-age may not classify overweight or obesity correctly, whereas the alternative measures mentioned above may.

BODY MASS INDEX (BMI)-FOR-AGE

BMI-for-age has been recommended as the most appropriate single indicator of overweight and obesity in children and youth outside of research settings (18-20) that is sufficient for most monitoring purposes (21). BMI-for-age is calculated by dividing an individual's weight by the square of their height to produce a ratio that is expressed in kg/m^2. BMI-for-age is not a perfect surrogate for body fat, and can lead to some measurement error and misclassification.

Although BMI-for-age is considered a poor estimator of percentage of body fat in normal-weight children (22), its accuracy increases with the degree of body fatness (23). Additionally, in contrast to obese children, some studies have found that children who are overweight do not actually have excess body fatness (24). A higher BMI-for-age can be a result of increased levels of either fat or fat-free mass (e.g., muscle, bone), the latter which would lead to the misclassification of overweight status (25).

Use of growth charts for determining BMI-for-age

Measuring BMI-for-age in children and youth requires the use of growth charts to define healthy growth ranges and related percentiles of BMI relative to age and sex. There are a number of different systems of BMI-for-age cut-offs, and, depending on the system chosen to define overweight and obesity, estimates based on the same sample can vary. Table 3.3 outlines the differences in methods between the three commonly used systems of BMI-for-age categorization, specifically those developed by the Centers for Disease Control and Prevention (CDC) in the U.S. (26), the International Obesity Task-Force (IOTF) (27) and the WHO (28). Rates of overweight and obesity in children and youth in Canada have historically used the IOTF growth charts. More recently, a number of Canadian organizations, including Dietitians of Canada, have recommended WHO growth charts as the standard for measuring BMI-for-age in Canada (56).

Table 3.3: CDC, IOTF and WHO Growth Chart Methodology Differences

System	Year developed	Reference population	Reference data years	Cut-offs used in relation to reference population
CDC	2000	United States (aged 0 to 19 years)	1963–1994	Overweight: Between 85th and 95th percentile, Obese: 95th percentile and above
IOTF	2000	Brazil, Great Britain, Hong Kong, Netherlands, Singapore, United States (aged 0 to 25 years)	1963–1993	Overweight: Z-score tracked back from BMI of 25 at age 18 (IOTF-25), Obese: Z-score tracked back from BMI of 30 at age 18 (IOTF-30)
WHO	2006/2007	Brazil, Ghana, India, Norway, Oman (aged 0 to 5 years), United States (aged 0 to 19 years)	1997–2003 (aged 0 to 5 years), 1963–1974 (aged 5 to 19 years)	Overweight: Between 1 standard deviation (84th percentile) and 2 standard deviations (97.7th percentile), Obese: 2 standard deviations and above

A key difference between these three BMI-for-age systems is that the IOTF system cut-offs only define cut-offs for overweight and obesity, while the WHO and CDC systems allow for calculation of a range of percentiles across all weights (21). Another important difference between the systems is the reference population against which the height and weight measurements are compared. While the entire child and youth population was used in the CDC and IOTF definitions, the WHO excluded those deemed to have an unhealthy weight (28). The impact of using WHO growth charts as compared to others to monitor BMI-for-age on a population of children and youth is that more children will be identified as overweight or obese. However, this is offset by the higher percentile threshold used in the WHO definition of obesity as compared to the CDC (29). The prevalence of obesity in children and youth estimated using WHO growth charts tend to be closer to those derived from using CDC estimates, and both of these tend to give higher estimates than those that come from using the IOTF cut-offs (30). For example, estimates of obesity rates in children and youth in Canada from the 2004 Canadian Community Health Survey (CCHS) are 12.5%, 8.2% and 12.7% when using the CDC, IOTF and WHO cut-offs respectively. Using the same data, the IOTF cut-offs yield the most conservative estimates of overweight and obesity (CDC, 28.4%; IOTF, 26.2%; WHO, 34.7%) (30). A detailed comparison of growth charts is provided in Appendix 3.

To ensure comparability with existing measurement systems, height and weight measurements that comprise BMI should also be collected by using techniques that match those used in the reference growth charts as closely as possible (21). For example, if using WHO growth charts, the technique should align with the WHO European Childhood Obesity Surveillance Initiative, which was used to collect data to develop WHO charts.

Z-scores

Like BMI for percentile, z-scores describe weight status relative to a standard population. A z-score describes the number of standard deviation (SD) units that an observation is above or below the population average. Standard deviation itself is a measure of how much variation exists from the population average. A low standard deviation indicates that the data tend to be very close to the average, whereas high standard deviation indicates the data are spread out over a large range of values. A positive z-score indicates the weight status is higher than the average, and the larger the z-score the further the weight status is away from the average of the reference population of the same age and gender. The advantage to using z-scores over percentiles is that z-scores can be useful for characterizing those with a BMI that exceeds the percentile levels available on BMI-for-age charts (31). While not offering any advantages over percentiles for surveillance in the population, in a clinical setting z-scores can be used to monitor and track progress in individuals beyond these upper definitions of obesity.

Self-report versus measured BMI

Direct measurements of height and weight (i.e., measured BMI) have been shown to be more accurate than self-reported measures where the individual (or parent) reports height and weight based on past knowledge (21). Comparing the results from two different samples from surveys occurring at similar points in time, one self-reported (CCHS 2003) and the other measured (CCHS 2004 Nutrition Focused Module), indicates that self-reported BMI underestimates the prevalence of overweight and obesity in youth. Specifically there was an 8.3% difference in the combined rate of overweight and obesity in males aged 12 to 17 (24.0% versus 32.3%) and an 11.6% difference in females aged 12 to 17 (14.2% versus 25.8%) (32). A 2011 report comparing measured and self-reported obesity prevalence also found that self-reported obesity in children and youth tends to be lower than measured estimates (33).

Conversely, when parents are asked to report the height and weight of their children, rates of overweight and obesity tend to be higher than when measured (21). A recent Canadian report found that when comparing parent-reported BMI to measured BMI, misclassification errors for overweight or obese were substantial, especially in the youngest age groups (mainly due to an underestimation of height) (34). However, results have been inconsistent across other studies and parental error has not been studied as extensively as self-report error (21).

SKINFOLD THICKNESS

Skinfold thickness measurements are generally more highly correlated with total body fatness than BMI-for-age (25,26). A skinfold thickness measurement is done by taking the double layer of skin and subcutaneous fat lifted as a fold and measuring with calipers at specific sites on the body, such as the biceps or triceps on the

arm (35). The rationale for using this measure as an indicator of overweight and obesity is that subcutaneous fat levels are highly correlated with total body fat. Additionally, their validity and measurement properties are well established, although the association varies by the degree of body fatness (i.e., they are more valid as a measure of body fat at higher levels) (36,37). Skinfold thickness cut-offs provide similar information to BMI-for-age and can only correctly identify obese children, and provide no additional information about excess body fat nor inform about overweight children (38,39). There are several practical reasons that make skinfold measurement challenging to use. Most importantly, reliability for skinfold measurement is much lower than for height and weight (40). Reliable measures are those that produce consistent results under consistent conditions. Obtaining reliable skinfold thickness measurements requires substantial experience and regular practice, often more than is available in clinical and community settings (41). While skinfold thickness measurements remain important in many research and clinical applications, they may not be well-suited to being a routine part of surveillance of child and youth overweight and obesity.

WAIST AND NECK CIRCUMFERENCE

Waist circumference may be a better predictor of future obesity-related health consequences than BMI-for-age. The measurement of waist circumference is designed to capture information regarding the distribution of abdominal (or central) body fat. Increased levels of abdominal body fat have been linked to increased health risks in both children and adults (42). Waist circumference is better than BMI in predicting insulin resistance, blood pressure, serum cholesterol levels and triglyceride levels, particularly in youth (43,44). Additionally, the ratio of waist circumference to height has been shown to be associated with cardiovascular risk factors (45). As a measure of total body fatness, waist circumference does not add any more information than BMI-for-age or skinfold thickness in identifying obese children (38). Waist circumference is easier to measure and its reliability is better than skinfold thickness, although not as reliable as measuring height and weight (40).

Similar to waist circumference, neck circumference is meant to provide a measure of central body fat. Neck circumference has been found to be a fairly reliable and easy-to-use tool to determine overweight and obesity in children (46), although not as accurate as waist circumference (47).

OTHER MEASURES

There are other measures that could be used in the monitoring of overweight and obesity in children and youth. Bioelectrical impedance analysis (BIA) measures the opposition of body tissues to a small alternating current that is imperceptible to the subject and can be used to estimate body water, fat-free mass and body fat (48). Dual-energy X-ray absorptiometry (DXA) provides precise measurements of body composition in humans, including fat mass, lean body mass and bone mass (49). Underwater weighing uses a specially constructed tank and suspended chair to distinguish adipose tissue from lean body mass (50). These measures have not been evaluated for use in surveillance and often may be too difficult to implement beyond the clinical setting (21).

MEASUREMENT ISSUES IN SUB-POPULATIONS

BMI-for-age is dependent on the reference population on which is it based and there is the potential that these cut-offs may not be applicable to some sub-populations. BMI-for-age may not correctly identify body fatness in populations with muscular body types or those with thin frames with increased stomach fat (21), and considerations should be made for measurement in children and youth who are unable to stand up unaided. In contrast to adult populations, the validity of these cut-offs in determining child and youth overweight and obesity in different ethnic populations has not been fully established (51,52). In Ontario, it has been found that adults of East Asian descent have a higher level of body fat at any given level of BMI than both Caucasian and South Asian adults (53). One other Canadian study found that adults of Aboriginal, Chinese and South Asian descent displayed risk factors for metabolic disease at much lower levels of BMI than those of European descent (54). In the U.S., it has been found that children of African descent display lower body fat for BMI compared to Hispanic and Caucasian children (55). Taking into account these noted differences between ethnic groups, the Dietitians of Canada recommend using the WHO cut-offs for all children, as they represent the overall best available charts for monitoring the growth of Canadian children (56).

Settings for Measurement of Overweight and Obesity

Child and youth surveillance data can be collected in three different settings: community (e.g., broader community-based surveys); schools; and primary health care. Table 3.4 identifies these settings and some key considerations for each in terms of generalizability (i.e., how representative is the data of the population) and feasibility (e.g., how easily can the data be collected).

Table 3.4: Differences in Community, School and Primary Care Settings for Measurement

Setting	Generalizability	Feasibility
Community	Relies on scientifically sound sampling methodology to ensure representativeness; however, children in the youngest age groups are often excluded	Among the easiest and most cost-effective to collect
School	Generally covers most of the under-18 population; however, attendance in kindergarten is not mandatory, some may drop out before the age of 18, and children and youth in private schools are often not included	Gaining access to children and youth in the school setting can be time intensive as involvement/ consent of multiple stakeholders is required
Primary health care	Generally covers most of the under-18 population; however, not all children and youth regularly visit a primary health care physician	To ensure the collation of information on a regional or provincial level, this requires information technology infrastructure and data standards be put in place across the province, which will require significant financial investments

Overall, there is a challenge in finding opportunities to systematically measure childhood height and weight and related risk factors, whether during physician visits, on entry to the school system, during schooling or at home. It is particularly important to note that measurement in schools requires a great degree of collaboration and cross-sectorial cooperation between those undertaking the monitoring and boards of education. Potential, unintended consequences when children participate in school-based BMI measurements have been identified, including effects on body image and self-esteem (57), teasing, victimization and bullying (58), disordered eating (59) and parental promotion of dieting (60). Surveillance programs for population-level monitoring may be considered less controversial than screening programs for individual-level monitoring, because they typically do not involve the communication of sensitive information to parents and do not entail follow-up care (61). Collecting height and weight in conjunction with the universal public health oral health screening program (conducted in grade 2 in Ontario) may offer an ideal opportunity to collect data with minimal additional resources (62), and may minimize the impact of negative consequences as it may be normalized as part of an overall health assessment. The setting with the lowest risk of unintended consequences may be the primary health care setting, in which the clinician responsible for the individual's care would collect height and weight as part of a routine check-up (63).

Data Sources to Use for Measurement and Monitoring

There are a number of surveys in Ontario and Canada that currently collect height and weight information on children and youth. While there are substantial limitations to existing data sources, there are 10 surveys collected in the community and school settings that could be used to monitor the prevalence of overweight and obesity (Table 3.5). Some monitor health within First Nations, Inuit and Métis children and youth; however, most have limitations in terms of providing data concerning specific geographic or ethnic groups, or other sub-populations of interest. Most of the existing systems collect self-reported, as opposed to measured, height and weight, and, as a result may underestimate overweight and obesity on a population level. None of the existing surveys being collected in an ongoing manner cover all age groups of children and youth.

Table 3.5: Data Sources for Monitoring Overweight and Obesity in Children and Youth

Survey	Population	Measures	Limitations
Canadian Community Health Survey (CCHS) Annual Component, Statistics Canada (2001/2002, 2003, 2005, 2007–2008, 2009–2010, 2011–2012)	Youth aged 12 to 19 (sample of 1,829 in Ontario in 2010)	▪ Derived BMI from self-reported height and weight	▪ Self-reported data could lead to biased estimates of overweight and obesity ▪ Does not include children under 12 years old
Canadian Community Health Survey (CCHS) Nutrition Focused Module, Statistics Canada (2004)	Children and youth aged 2 to 17 (sample of 3,917 in Ontario)	▪ Measured height and weight ▪ Self-reported height and weight	▪ Unstable estimates at the health planning region (local level) in these age groups ▪ Not being collected in an ongoing manner, although may be repeated in 2015
Canadian Health Measures Survey (CHMS), Statistics Canada (2007–2009, 2009–2011, 2011–2013)	Children and youth aged 6 to 17 (approximate sample of 1,600 in Canada per cycle)	▪ Measured height and weight ▪ Measured waist circumference ▪ Skinfold measurement ▪ Self-reported height and weight	▪ No estimates at provincial and local level ▪ Unstable estimates for some age groups at the national level ▪ Expensive
National Longitudinal Survey of Children and Youth (NLSCY), Statistics Canada & Human Resources and Skills Development Canada (1994/1995–2008/2009, every 2 years)	Cohort of children aged 0 to 11 in 1994, 0 to 21 in 2006 (35,795 children in cohort in Canada as of 2008/2009)	▪ Parent-reported height and weight for children 0-11 years old during the survey ▪ Self-reported height and weight for youth 12 years and older	▪ Self-reported and/or parent-reported data could lead to biased estimates of overweight and obesity ▪ No estimates at provincial and local level available
Health Behaviour in School-aged Children (HBSC), WHO (1989–2010, every 4 years)	Youth in grades 6 to 10 (sample of 26,078 in Canada, 3,692 in Ontario in 2010)	▪ Self-reported height and weight	▪ Self-reported data could lead to biased estimates of overweight and obesity ▪ Can only be reported at provincial level in recent years
Ontario Student Drug Use and Health Survey (OSDUHS), Centre for Addiction and Mental Health (CAMH) (1977–2011, every 2 years)	Youth in grades 7 to 12 (sample of 9,228 in Ontario in 2011)	▪ Self-reported height and weight	▪ Self-reported data could lead to biased estimates of overweight and obesity ▪ Only available for broad grouping of local-level geographic units, although some health units have paid for an oversample to allow for local-level reporting
School Health Action Planning and Evaluation System Ontario (SHAPES), University of Waterloo (2005/2006)	Youth in grades 5 to 10	▪ Self-reported height and weight	▪ Self-reported data could lead to biased estimates of overweight and obesity ▪ Does not provide representative data at the provincial or local level ▪ Not currently being collected in an ongoing manner
COMPASS Study (using SHAPES), University of Waterloo (2012–2015)	Cohort of youth in grade 9 followed to grade 12	▪ Self-reported height and weight	▪ Self-reported data could lead to biased estimates of overweight and obesity ▪ Does not provide representative data at the provincial or local level ▪ Not currently being collected in an ongoing manner
Aboriginal Peoples Survey (APS), Statistics Canada (2001, 2006)	First Nations, Métis or Inuit (FNIM) children aged 6 to 17 (approximate sample of 9,160 in Canada in 2006)	▪ Parent-reported height and weight (aged 6 to 14), self-reported height and weight (aged 15 to 17)	▪ Self-reported and/or parent-reported data could lead to biased estimates of overweight and obesity ▪ No estimates at provincial and local level ▪ Height and weight not collected in 2012 APS

Table 3.5: Data Sources for Monitoring Overweight and Obesity in Children and Youth – Cont'd

Survey	Population	Measures	Limitations
Regional Health Survey (RHS), First Nations Information Governance Centre (FNIGC) (2002–2003, 2008–2010, 2 other surveys by 2016)	First Nations children aged 0 to 17 (sample of 11,640 in 2002–2003 in Canada)	▪ Parent-reported height and weight (aged 0 to 11), self-reported height and weight (aged 12 to 17)	▪ Self-reported and/or parent-reported data could lead to biased estimates of overweight and obesity ▪ Provincial level data not readily available; as of June 2012, the 2002–2003 regional specific report for Ontario has not been posted on the RHS website

In addition to using these available data sources, a number of existing surveys or approaches could potentially be augmented to collect measured height and weight, which are known to provide more accurate estimates of overweight and obesity in children and youth. Table 3.6 summarizes some of these options, which include using existing surveys with funding for additional sample size and exploring the use of primary care electronic medical/health record (EMR/EHR) data.

Table 3.6: Selected Approaches for Augmentation of Existing Surveys and Tools

Option	Opportunity details	Additional challenges and gaps	Relative cost
Fund an increased sample for the 2015 Canadian Community Health Survey (CCHS) Nutrition Module	Statistics Canada is currently undergoing stakeholder consultations with provincial representatives to confirm that anthropometric measures (height and weight) will be included as part of the survey; additional sample may be needed to permit provincial estimates of obesity in children	Would only allow for a one-time comparison of measured height and weight in children in 2015 compared to levels in 2004; unlikely that it could be reported at local level	Likely moderate cost, although consultation with Statistics Canada would have to be carried out to determine specific costs associated with these options
Explore the possibility of using electronic medical/health record (EMR/EHR) data from primary care physicians	Leverage height and weight measured during well-baby/well-child screening or other encounters within the primary care system	Currently EMR/EHR data is not managed in a centralized manner in the province; data standards within EMR/EHR software applications are not in place across the province; inconsistencies in height and weight collection	Moderate to high cost as IT infrastructure/processes would need to be in place to collect the data
Fund an increased sample for the Canadian Health Measures Survey (CHMS)	Measured height and weight collected as part of this survey	Capacity issues within Statistics Canada may not allow for oversampling; could not be reported at local level	Very high cost, as multiple physical measures being collected at mobile examination centres are done as part of this survey
Support the creation of a new, comprehensive surveillance system	This would build on the previous pilot efforts in 2010, and be coupled with an intervention program aimed at promoting healthy eating and lifestyle choices among those measured; could be modelled on existing collection protocols	Public health units could contribute to the collection and development of such a system; however, their participation may require incremental resources; PHUs would need to harmonize their protocols for collecting measures of overweight and obesity; designated organization for coordinated central analysis required for provincial utility	Depending on the approach, could range from moderate cost to very high cost

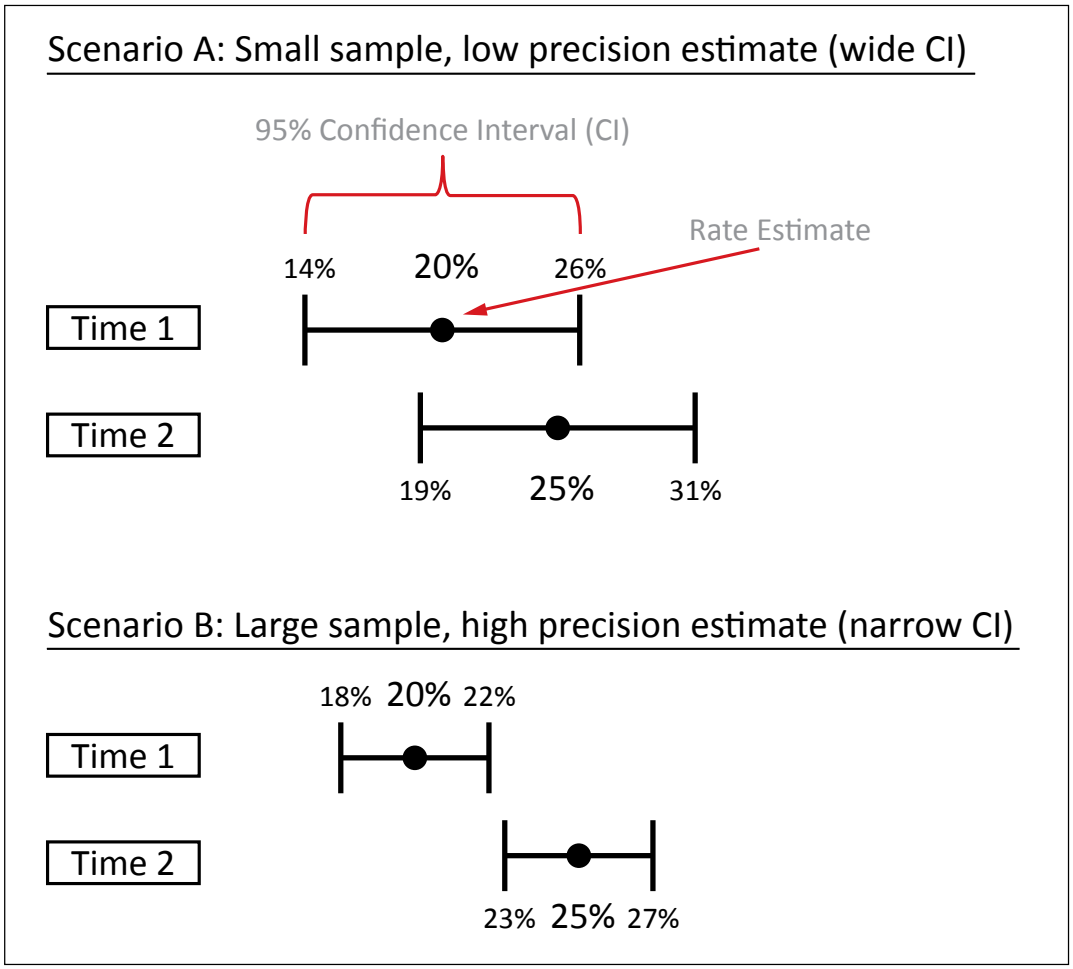
Precision of Rates from Survey Data

Overweight and obesity rates that are based on a population sample (rather than the entire population) are actually estimates or "best guesses" of the true underlying rate in the population. This is why it is important to understand how the sampling approach can affect the ability to measure change in the population. Rates of overweight and obesity in Ontario's children and youth are almost entirely based on collecting data from a sample of children from a survey in order to estimate what is happening in the population that the sample represents.

For any rate that comes from a sample, a confidence interval (CI) can be calculated, which gives a range of values in which the true value lies. For example, in the 2007–2009 CHMS, 8.6% of children and youth aged 6 to 17 in Canada were obese, and the 95% CI was 5.9% to 11.3% (64). The width (e.g., ± 2.7%) of the confidence interval indicates the precision of the estimate. The 2009 OSDUHS self-reported rate of obesity in Ontario youth in grades 9 to 12 was 7.1%, with a narrower 95% CI of 6.4% to 7.9% (65). The key factor that influences the narrower confidence interval around the OSDUHS obesity estimates is the sample size. The larger the sample, the more precise the estimate (i.e., the CI is narrower). Over 9,000 youth in Ontario are included in the OSDUHS estimate, compared to the just over 1,600 children and youth in Canada included in the CHMS. Another survey used to estimate rates of youth overweight and obesity, the CCHS, includes about 1,800 Ontario youth aged 12 to 17.

To measure a reduction in childhood obesity over time, the estimate must be precise enough to allow for the detection of a statistically significant difference in the rates (Figure 3.1). This figure shows two scenarios of population estimates at two different periods in time. In scenario B, a much larger sample results in more precise estimates with narrower confidence intervals. When dealing with imprecise estimates, any noted change may be due to chance and not a "true" change in the rate.

Figure 3.1: Effect of Sample Size on Precision of Overweight and Obesity Estimates



References

(1) Ontario. Ministry of Health and Long-Term Care. Ontario public health standards 2008. Toronto, ON: Queen's Printer for Ontario; 2008 [cited 2013 Jun 26]. Available from: http://www.health.gov.on.ca/en/pro/programs/publichealth/oph_standards/docs/ophs_2008.pdf

(2) Council of Ontario Medical Officers of Health of the Association Local Public Health Agencies. Childhood obesity surveillance proposal. Toronto, ON: Queen's Printer for Ontario; 2008 [cited 2013 Jun 26]. Available from: http://c.ymcdn.com/sites/www.alphaweb.org/resource/collection/C9DE3C10-BC69-4A49-9A9B-B5F146B34B38/COMOH_ChildObesity_Surveillance_Proposal_2008.pdf

(3) Swinburn B, Bell C, King L, Magarey A, O'Brien K, Waters E, et al. Obesity prevention programs demand high-quality evaluations. Aust N Z J Public Health. 2007;31(4):305-7.

(4) Public Health Agency of Canada. Actions taken and future directions 2011: curbing childhood obesity: a federal, provincial and territorial framework for action to promote healthy weights. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2011 [cited 2013 Jun 26]. Available from: http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/framework-cadre/2011/hw-os-2011-eng.php

(5) Australian Government Department of Health and Ageing. National monitoring in public health nutrition. Canberra: Commonwealth of Australia; 2012 [cited 2012 Jun 22]. Available from: http://www.health.gov.au/nutritionmonitoring

(6) National Board of Health, Center for Health Promotion and Prevention. National action plan against obesity: recommendations and perspectives (Short version). National Board of Health, Center for Health Promotion and Prevention; 2003. Available from: http://www.sst.dk/publ/publ2003/National_action_plan.pdf

(7) Health and Social Care Information Centre [homepage on the Internet]. West Yorkshire EN: Health and Social Care Information Centre; 2011. National child measurement programme: England: 2010/11 school year. 2011 [cited 2012 Jun 22]. Available from: http://www.ic.nhs.uk/ncmp

(8) European Public Health Alliance [homepage on the Internet]. Brussels, Belgium: European Public Health Alliance; 2008. EPODE: together let's prevent childhood obesity. 2008 [cited 2012 Jun 22]. Available from: http://www.epha.org/a/3149

(9) Centers for Disease Control and Prevention [homepage on the Internet]. Atlanta, GA: Centers for Disease Control and Prevention; 2012. National health and nutrition examination survey. 2013 Jun 25 [cited 2012 Jun 22]. Available from: http://www.cdc.gov/nchs/nhanes.htm

(10) World Health Organization Regional Office for Europe [homepage on the Internet]. Copenhagen, DK: WHO Regional Office for Europe; 2013. WHO European Childhood Obesity Surveillance Initiative (COSI). 2013 [cited 2012 Jun 22]. Available from: http://www.euro.who.int/en/what-we-do/health-topics/disease-prevention/nutrition/activities/monitoring-and-surveillance/who-european-childhood-obesity-surveillance-initiative-cosi

(11) Eastern Ontario Health Unit. Youth risk behaviour survey: executive summary. Cornwall, ON: EOHU; 2011 [cited 2012 Jun 22]. Available from: http://www.eohu.ca/_files/reports/YRBS_2011_ex_sum_e.pdf

(12) Halton District School Board. Halton youth survey: February 2 to March 12, 2010. Burlington, ON: Halton District School Board; 2010 [cited 2012 Jun 22]. Available from: http://www.hdsb.ca/PARENTINFO/Pages/HaltonYouthSurvey2010.aspx

(13) He M, Beynon C. Prevalence of overweight and obesity in school-aged children. Can J Diet Pract Res. 2006;67(3):125-9.

(14) Reading K, Carr D. What about our children? Overweight and obesity in Oxford County preschoolers. Woodstock, ON: Oxford County; 2011 [cited 2012 Jun 22]. Available from: http://www.oxfordcounty.ca/Portals/15/Documents/Public%20Health/Healthy%20You/Nutrition/ChildhoodObesityReport-lowRes_WEB.pdf

(15) Peel Public Health, Region of Peel [homepage on the Internet]. Brampton, ON: Region of Peel; 2011. School health assessment survey. 2011 [cited 2012 Jun 22]. Available from: http://www.peelregion.ca/health/assessment/school2004.htm

(16) Hanning R, Toews J. Food and physical activity behaviours of grade 6 students in Waterloo region. Waterloo, ON: University of Waterloo; 2007 [cited 2012 Jun 22]. Available from: http://chd.region.waterloo.on.ca/en/researchResourcesPublications/resources/Grade6lifestyle_report.pdf

(17) Toronto Public Health, City of Toronto [homepage on the Internet]. Toronto, ON: City of Toronto; 2013. Toronto Public Health Student Survey. 2011 [cited 2013 Aug 30]. Available from: http://www.toronto.ca/health/healthyschools/student_survey.htm

(18) Barlow SE, Dietz WH. Obesity evaluation and treatment: Expert Committee recommendations. The Maternal and Child Health Bureau, Health Resources and Services Administration and the Department of Health and Human Services. Pediatrics. 1998;102(3):E29.

(19) Himes JH, Dietz WH. Guidelines for overweight in adolescent preventive services: recommendations from an expert committee. The Expert Committee on Clinical Guidelines for Overweight in Adolescent Preventive Services. Am J Clin Nutr. 1994;59(2):307-16.

(20) Krebs NF, Himes JH, Jacobson D, Nicklas TA, Guilday P, Styne D. Assessment of child and adolescent overweight and obesity. Pediatrics. 2007;120 Suppl 4:S193-228.

(21) Himes JH. Challenges of accurately measuring and using BMI and other indicators of obesity in children. Pediatrics. 2009;124 Suppl 1:S3-22.

(22) Bray GA, DeLany JP, Volaufova J, Harsha DW, Champagne C. Prediction of body fat in 12-y-old African American and white children: evaluation of methods. Am J Clin Nutr. 2002 [cited 2013 Jun 26];76(5):980-990. Available from: http://ajcn.nutrition.org/content/76/5/980.full.pdf+html

(23) Schaefer F, Georgi M, Wuhl E, Scharer K. Body mass index and percentage fat mass in healthy German schoolchildren and adolescents. Int J Obes Relat Metab Disord. 1998;22(5):461-9.

(24) Freedman DS, Wang J, Thornton JC, Mei Z, Sopher AB, Pierson RN,Jr, et al. Classification of body fatness by body mass index-for-age categories among children. Arch Pediatr Adolesc Med. 2009 [cited 2013 Jun 26];163(9):805-11. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2846460/pdf/nihms173460.pdf

(25) Freedman DS, Wang J, Maynard LM, Thornton JC, Mei Z, Pierson RN, et al. Relation of BMI to fat and fat-free mass among children and adolescents. Int J Obes (Lond). 2005; Jan;29(1):1-8.

(26) Kuczmarski RJ, Ogden CL, Guo SS, Grummer-Strawn LM, Flegal KM, Mei Z, et al. 2000 CDC Growth Charts for the United States: methods and development. Vital Health Stat 11. 2002;(246):1-190.

(27) Cole TJ, Bellizzi MC, Flegal KM, Dietz WH. Establishing a standard definition for child overweight and obesity worldwide: international survey. BMJ. 2000 [cited 2013 Jun 26];320(7244):1240-1243. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC27365/pdf/1240.pdf

(28) de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007;85(9):660-667. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2636412/pdf/07-043497.pdf

(29) de Onis M, Garza C, Onyango AW, Borghi E. Comparison of the WHO child growth standards and the CDC 2000 growth charts. J Nutr. 2007 [cited 2013 Jun 26];137(1):144-8. Available from: http://jn.nutrition.org/content/137/1/144.full.pdf+html

(30) Shields M, Tremblay MS. Canadian childhood obesity estimates based on WHO, IOTF and CDC cut-points. Int J Pediatr Obes. 2010;5(3):265-273.

(31) WHO Expert Committee on Physical Status: the Use and Interpretation of Anthropometry. Physical status: the use and interpretation of anthropometry: report of a WHO Expert Committee. World Health Organ Tech Rep Ser. 1995;854:1-452.

(32) Shields M. Overweight and obesity among children and youth. Health Rep. 2006 [cited 2013 Jun 26];17(3):27-42. Available from: http://www.statcan.gc.ca/pub/82-003-x/2005003/article/9277-eng.pdf

(33) Public Health Agency of Canada; Canadian Institute for Health Information. Obesity in Canada. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2011.

(34) Shields M, Gorber SC, Janssen I, Tremblay MS. Obesity estimates for children based on parent-reported versus direct measures. Health Rep. 2011 [cited 2013 Jun 26];22(3):47-58. Available from: http://www.statcan.gc.ca/pub/82-003-x/2011003/article/11534-eng.pdf

(35) Harrison GG, Buskirk ER, Carter JEL, et al. Skinfold thicknesses and measurement technique. In: Lohman TG, Roche AF, Martorell R, eds. Anthropometric standardization reference manual. Champaign, IL: Human Kinetics Books; 1988. p. 55–70.

(36) Himes J. Subcutaneous fat thickness as an indicator of nutritional status. In: Green LS, Johnston FE, eds. Social and biological predictors of nutritional status, physical growth, and neurological development. New York, NY: Academic Press; 1980. p. 9 –32.

(37) Norgan NG. Anthropometric assessment of body fat and fatness. In: Himes JH, ed. Anthropometric assessment of nutritional status. New York, NY: Wiley-Liss; 1991. p. 197–212.

(38) Sarria A, Moreno LA, Garcia-Llop LA, Fleta J, Morellon MP, Bueno M. Body mass index, triceps skinfold and waist circumference in screening for adiposity in male children and adolescents. Acta Paediatr. 2001;90(4):387-92.

(39) Bedogni G, Iughetti L, Ferrari M, Malavolti M, Poli M, Bernasconi S, et al. Sensitivity and specificity of body mass index and skinfold thicknesses in detecting excess adiposity in children aged 8-12 years. Ann Hum Biol. 2003;30(2):132-9.

(40) Ulijaszek SJ, Kerr DA. Anthropometric measurement error and the assessment of nutritional status. Br J Nutr. 1999;82(3):165-77.

(41) Himes JH. Challenges of accurately measuring and using BMI and other indicators of obesity in children. Pediatrics. 2009;124 Suppl 1:S3-22.

(42) Katzmarzyk PT, Srinivasan SR, Chen W, Malina RM, Bouchard C, Berenson GS. Body mass index, waist circumference, and clustering of cardiovascular disease risk factors in a biracial sample of children and adolescents. Pediatrics. 2004 [cited 2013 Jun 26];114(2):e198-205. Available from: http://pediatrics.aappublications.org/content/114/2/e198.full.pdf+html

(43) Lee S, Bacha F, Gungor N, Arslanian SA. Waist circumference is an independent predictor of insulin resistance in black and white youths. J Pediatr. 2006;148(2):188-94.

(44) Maffeis C, Pietrobelli A, Grezzani A, Provera S, Tato L. Waist circumference and cardiovascular risk factors in prepubertal children. Obes Res. 2001;9(3):179-87.

(45) Savva SC, Tornaritis M, Savva ME, Kourides Y, Panagi A, Silikiotou N, et al. Waist circumference and waist-to-height ratio are better predictors of cardiovascular disease risk factors in children than body mass index. Int J Obes Relat Metab Disord. 2000;24(11):1453-8.

(46) Nafiu OO, Burke C, Lee J, Voepel-Lewis T, Malviya S, Tremper KK. Neck circumference as a screening measure for identifying children with high body mass index. Pediatrics. 2010 [cited 2013 Jun 26];126(2):e306-10. Available from: http://pediatrics.aappublications.org/content/126/2/e306.full.pdf+html

(47) Hatipoglu N, Mazicioglu MM, Kurtoglu S, Kendirci M. Neck circumference: an additional tool of screening overweight and obesity in childhood. Eur J Pediatr. 2010;169(6):733-9.

(48) Kyle UG, Bosaeus I, De Lorenzo AD, Deurenberg P, Elia M, Gomez JM, et al. Bioelectrical impedance analysis--part I: review of principles and methods. Clin Nutr. 2004;23(5):1226-1243.

(49) Helba M, Binkovitz LA. Pediatric body composition analysis with dual-energy X-ray absorptiometry. Pediatr Radiol. 2009;39(7):647-56.

(50) Fogelholm M, van Marken Lichtenbelt W. Comparison of body composition methods: a literature analysis. Eur J Clin Nutr. 1997;51(8):495-503.

(51) Reilly JJ. Assessment of childhood obesity: national reference data or international approach? Obes Res. 2002;10(8):838-40.

(52) Neovius M, Linne Y, Barkeling B, Rossner S. Discrepancies between classification systems of childhood obesity. Obes Rev. 2004;5(2):105-114.

(53) He M, Li ET, Harris S, Huff MW, Yau CY, Anderson GH. Canadian global village reality: anthropometric surrogate cutoffs and metabolic abnormalities among Canadians of East Asian, South Asian, and European descent. Can Fam Physician. 2010 [cited 2013 Jun 26];56(5):e174-82. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/pmid/20463258/

(54) Razak F, Anand SS, Shannon H, Vuksan V, Davis B, Jacobs R, et al. Defining obesity cut points in a multiethnic population. Circulation. 2007 [cited 2013 Jun 26];115(16):2111-8. Available from: http://circ.ahajournals.org/content/115/16/2111.full.pdf+html

(55) Flegal KM, Ogden CL, Yanovski JA, Freedman DS, Shepherd JA, Graubard BI, et al. High adiposity and high body mass index-for-age in US children and adolescents overall and by race-ethnic group. Am J Clin Nutr. 2010 [cited 2013 Jun 26];91(4):1020-6. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2844683/pdf/ajcn9141020.pdf

(56) Dietitians of Canada; Canadian Paediatric Society; College of Family Physicians of Canada; Community Health Nurses of Canada; Secker D. Promoting optimal monitoring of child growth in Canada: using the new WHO growth charts. Can J Diet Pract Res. 2010;71(1):e1-3.

(57) Scheier LM. Potential problems with school health report cards. J Am Diet Assoc. 2004;104(4):525-527.

(58) Hayden-Wade HA, Stein RI, Ghaderi A, Saelens BE, Zabinski MF, Wilfley DE. Prevalence, characteristics, and correlates of teasing experiences among overweight children vs. non-overweight peers. Obes Res. 2005;13(8):1381-92.

(59) Davison KK, Markey CN, Birch LL. A longitudinal examination of patterns in girls' weight concerns and body dissatisfaction from ages 5 to 9 years. Int J Eat Disord. 2003 [cited 2013 Jun 26];33(3):320-32. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2548285/pdf/nihms62039.pdf

(60) Ikeda JP, Crawford PB, Woodward-Lopez G. BMI screening in schools: helpful or harmful. Health Educ Res. 2006 [cited 2012 Jun 26];21(6):761-9. Available from: http://her.oxfordjournals.org/content/21/6/761.full.pdf+html

(61) Nihiser AJ, Lee SM, Wechsler H, McKenna M, Odom E, Reinold C, et al. BMI measurement in schools. Pediatrics. 2009 [cited 2013 Jun 26];124 Suppl 1:S89-97. Available from: http://pediatrics.aappublications.org/content/124/Supplement_1/S89.full.pdf+html

(62) Conrey EJ, Hade EM, Norton A, Scarpitti H. Methods for a survey of overweight and obesity coordinated with oral health surveillance among Ohio third-grade students. Prev Chronic Dis. 2009;6(1):A08.

(63) Pomietto M, Docter AD, Van Borkulo N, Alfonsi L, Krieger J, Liu LL. Small steps to health: building sustainable partnerships in pediatric obesity care. Pediatrics 2009 [cited 2013 Jun 26];123 Suppl 5:S308-16. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2644599/pdf/PCD61A08.pdf

(64) Statistics Canada. Canadian health measures survey: cycle 1 data tables 2007 to 2009. Statistics Canada Catalogue no. 82-623-X. Ottawa, ON: Minister of Industry; 2009 [cited 2013 Jun 26]. Available from: http://www.statcan.gc.ca/pub/82-623-x/82-623-x2010002-eng.pdf

(65) Paglia-Boak A, Mann R, Adlaf E, Beitchman J, Wolfe D, Rehm J. The mental health and well-being of Ontario students, 1991-2009: detailed OSDUHS findings. Toronto, ON: Centre for Addiction and Mental Health; 2010.

Part B: Effectiveness of Interventions for Prevention and Treatment

This part of the report provides a summary of the evidence assessing the effectiveness of interventions to prevent and treat overweight and obesity in children and youth. Given Ontario's focus on reducing childhood obesity, effectiveness was determined by changes in anthropometric outcomes (e.g., changes in weight, BMI, waist circumference, prevalence of overweight or obesity). The cost-effectiveness of such interventions was also addressed through an additional review of the literature.

The Evidence Review Framework presented in Chapter 1 (Figure 1.1) was used to group interventions and guide the structure of each section listed above. Wherever possible, interventions were first categorized by their macro-level environment (i.e., school, food and beverage, physical activity, health care and message), and then by setting (i.e., preschool, school, after-school, community, home, health care and work). The health care and work environment was abbreviated to the health care environment when there were no work-based interventions.

4. Prevention of Overweight and Obesity in Children and Youth: A Review of Reviews of Effectiveness of Interventions

Summary

This Chapter reviews the scientific literature assessing the effectiveness of interventions to prevent obesity in children and youth under 19 years, where effectiveness was determined by changes in direct or self-reported anthropometric measures (e.g., change in weight, BMI, waist circumference). The prevention interventions assessed in this review targeted the general population of children and youth unselected by weight status (i.e., populations comprised of children and youth with healthy weights, as well as those who were already overweight or obese). Reviews with studies that focused solely on interventions to reduce weight in overweight or obese children and youth were considered to assess treatment interventions and are, therefore, summarized in Chapter 5. A total of seven meta-analyses, two reviews of reviews, 22 systematic reviews and nine literature reviews were synthesized.

Overall, the obesity prevention interventions that were reviewed appear to have a modest effect on anthropometric outcomes, particularly among children aged six to 12. However, from a public health perspective what appears as a small effect on the individual level may be important at the population level. The majority of interventions were set primarily within the school environment and targeted physical activity and diet. Home-, community- or Internet-based activities were often included as components of these school-based interventions. There was some evidence of effect for interventions conducted within the home and community, especially for children under five years of age.

Results from the included reviews suggested that interventions were more likely to be effective if they:

- Targeted both physical activity and healthy eating (1-5);
- Involved parents (1,2,4-11);
- Were designed to be culturally sensitive (4,5,8,12,13);
- Had effective staff training and sustainability (4,5);
- Used participatory activities and training in behaviour techniques (e.g., self-monitoring) or coping skills (5);
- Were done in collaboration with community programs or facilities (14);
- Increased sessions of physical activity throughout the school week (2,5);
- Modified the food environment of schools to improve nutritional quality of school foods (2,5);
- Were set within environments and cultures that supported healthy eating and physical activity, and when they combined education with modifications to the school environment (2,15);
- Were universal (e.g., did not select children or youth based on weight or risk factors for obesity) (1);
- Were delivered by teachers who were supported by or worked in collaboration with specialists (1,2);
- Were longer in duration, rather than short term (1,6,7,14,16);
- Were integrated into the school curriculum (16-18).

Limitations of this synthesis are that all reviews published in languages other than English and before January 2009 were excluded; nevertheless, it was felt that the primary literature was well represented through this review of reviews. In addition, the search was limited to meta-analyses and systematic reviews, which tend to focus on interventions amenable to experimental trials, such as short-term programmatic interventions in the school setting. Furthermore, there was considerable heterogeneity within reviews — that is, studies varied in terms of the populations studied, interventions employed (e.g., their focus and content) and outcomes measured. Such heterogeneity made it challenging to summarize and synthesize results across all reviews to identify key components of effective interventions.

A number of gaps in the literature on obesity prevention in children and youth were identified. Within published reviews, there was little or no information on how to effectively address risk factors

associated with urban, rural and remote location, the built environment, socioeconomic status or other structural barriers to health. Additionally, most of the studies concerning minority children and youth were conducted in the U.S. and may not be applicable to Ontario's population. Finally, few reviews looked at or were able to assess the potential of inadvertent or adverse outcomes of weight-focused interventions.

Introduction

The Institute of Medicine (IOM) describes obesity prevention for children and youth as "maintaining a healthy weight trajectory and preventing excess weight gain while growing, developing and maturing," with the goal of preventing obesity and associated negative health consequences in childhood, but also through the life course into adulthood (19). As shown in Part 1 of this report, there are a variety of pathways by which to intervene in an effort to prevent children from becoming overweight/obese. It has been suggested that given these complex pathways, a suite of interventions will be needed to reverse childhood obesity trends, and these interventions should not only address individual factors but should target all five intersecting macro-level environments and social norms (19). However, there is no consensus on the most effective interventions nor a clear understanding of the necessary components for successful interventions. Thus, the purpose of this review of reviews was to determine the effectiveness of interventions to prevent obesity in children and youth, with anthropometric measures as the primary outcome.

Methods

Literature Search Strategy

A librarian-assisted literature search of multiple electronic databases and grey literature sources was conducted in March/April 2012. The search of electronic databases combined the following four concepts: child, obesity, effectiveness and interventions that focused on prevention. Given the limited amount of time available for the completion of this review, the scope was limited to secondary research articles (i.e., summary of existing research), published from January 2009 to March 2012. However, a Cochrane Review on interventions for the prevention of childhood obesity was recently published (December 2011), and summarized all primary research on the effectiveness of childhood obesity prevention interventions published prior to March 2010 (2). The Cochrane Collaboration is considered to be an authority on systematic reviews, due to its rigorous and standardized methodology. It was, therefore, felt that despite the relatively short time frame of the literature search, the literature would be adequately represented. A detailed description of the literature search strategy is provided in Appendix 4.

Study Selection

To be included in this report, articles had to summarize existing research on the effectiveness of interventions for the prevention of childhood overweight or obesity. At least one study in each review had to report an outcome of either a direct or self-reported anthropometric measure (e.g., body mass index, BMI z-score, weight, waist circumference, hip circumference, prevalence of overweight or obesity). The target population of at least one study within the reviews had to be children and youth 19 years of age and younger. A public health approach to prevention was taken where reviews were not excluded if the studies they summarized targeted populations comprised of children and youth with healthy weights, and children and youth who were already overweight or obese (i.e., studies were unselected by weight status). However, reviews with studies that focused solely on reducing weight in overweight or obese children and youth were considered to assess treatment interventions, the focus of Chapter 5 in this report, and were, therefore, excluded. Finally, articles had to be published in English and describe research in countries comparable to Canada (i.e., developed countries such as the U.S., the U.K. and Europe).

Two reviewers independently screened titles and abstracts against inclusion and exclusion criteria. Results from these independent screens were compared. Any discrepancies between the two reviewers were resolved by consensus.

Quality Assessment and Data Extraction

The quality of the secondary research articles included in this report was assessed independently by two reviewers using A Measurement Tool to Assess Systematic Reviews (AMSTAR), a

validated measurement tool created to assess the methodological quality of systematic reviews (20). AMSTAR ratings can range from 1 to 11, with 11 denoting the highest quality. AMSTAR ratings for each secondary research article are shown in Appendix 4.

For data extraction purposes, a standardized table was created to summarize the following elements of each article: the reference, type of study, study objective, population (age, socioeconomic status, ethnicity and weight status), number and types of studies included in the review, types of interventions, setting(s), primary and other outcomes, and comments on study limitations, cost-effectiveness, and feasibility or further research requirements. The extracted data for each review is provided in Appendix 5.

Effectiveness results are organized by the macro-level environment they target (i.e., food and beverage, physical activity, school, health care, and message environments) (19) and intervention type (i.e., policy and environmental, social and behavioural, or clinical) (21). Where available, interventions are also categorized by setting and effectiveness is distinguished by age group. It must be noted that many of the interventions consisted of multiple components (e.g., diet, physical activity, behaviour change and parental involvement) and were delivered in a variety of settings (e.g., school, home and community). If an intervention was delivered primarily in a school environment with some focus on other settings/environments (e.g., the home), the intervention was primarily described under the school environment, but may be additionally mentioned elsewhere if results were pertinent. Finally, key factors for success are highlighted.

Results

Results of the Literature Search

As shown in Table 4.1 and Figure 4.1, the search of electronic databases identified a total of 838 titles relating to the effectiveness of interventions for the prevention of obesity in children and youth. From the 838 potentially relevant abstracts, 252 abstracts were determined to be eligible for screening against inclusion and exclusion criteria. After examination by two independent reviewers, 40 articles were found to meet the study inclusion criteria and were synthesized in this report, including the previously mentioned Cochrane Review by Waters et al. published in 2011 (2).

Table 4.1: Electronic Database Search Result

Sources	No. of titles
MEDLINE (Ovid)	324
EMBASE (Ovid)	49
Database of Abstracts of Reviews of Effects (DARE), NHS Economic Evaluation Database, and Health Technology Assessments (EBSCO)	84
PsychINFO (Ovid)	116
CINAHL (EBSCO)	191
Cochrane Database of Systematic Reviews (EBSCO)	32
Campbell Collaborative	3
Clinical Preventive Services	N/A
Guide to Community Preventive Services	N/A
Effective Public Health Practice Project	N/A
NICE Guidelines	N/A
Healthevidence.ca	39
Hand-searched	N/A
TOTAL	838

Figure 4.1: Flow Diagram of Study Selection Process

Study Characteristics

Characteristics of the 40 secondary research articles are shown in Table 4.2. All reviews contained at least one study that reported anthropometric measures as outcomes, but different measures were used across studies, with BMI and BMI z-score being among the most commonly reported. The 40 secondary research articles included seven meta-analyses (1,2,22-25), 22 systematic reviews (3,6,9,13-15,17,26-38) and two reviews of reviews (11,39). The remaining nine articles were classified broadly as literature reviews, despite the utilization of a comprehensive search strategy, their methods were not described as systematic (5,7,10,12,18,40-43). One literature review reported results of a previous meta-analysis (5). Of the 29 literature and systematic reviews, one-third (10/29) reported anthropometric outcomes in all included studies, while the remainder reported anthropometric outcomes in some studies only.

The quality of included studies was generally not high. Out of a total quality score of 11, articles ranged from a low of one to a high of nine. Of the 40 articles assessed, 14 met one to three of the AMSTAR criteria, 13 met four to six, and 13 met seven to nine. The most common methodological issues were lack of a comprehensive literature search, not including a list of excluded studies, not including grey literature, not including non-English publications, not reporting conflict of interest and failing to assess the likelihood of bias. Agreement between the two independent reviewers on AMSTAR ratings was 94%.

The majority of reviews focused on children and youth in the school setting, and included a range of interventions primarily targeting physical activity and nutrition. Home- or community-based activities were often included as components of school-based interventions. Some reviews also focused on the use of computer or Internet-based interventions. Additionally, two reviews focused primarily on parenting or family systems, although parental involvement was often included as an intervention component. While young children aged 0 to 5 years were often included in reviews, seven systematic reviews and one meta-analysis focused exclusively on this age group. Only one review focused exclusively on youth.

Table 4.2: Study Characteristics

Review	Study type - AMSTAR rating	Age	Number of studies with anthropometric outcomes/total number of studies: study type	Range of years of individual studies included within reviews
An, 2009 (28)	Systematic review 5/11	8-18	8/8: Randomized control trials (RCTs); 4 relevant to prevention	2003–2008
Ayliffe, 2010 (3)	Systematic review 2/11	12-18	Not reported/41: No restriction on study design 63 studies total; 41 relevant to prevention	1997–2009
Bond, 2011 (8)	Systematic review 5/11	<5	7/7 articles reporting on 4 RCTs	1998–2006
Bond, 2009 (4)	Systematic review 7/11	<5	22/22: Systematic reviews, meta-analyses & RCTs	1998–2006
Branscum, 2011 (6)	Systematic review 2/11	3-12	8/9: RCTs and quasi-experimental or pilot	2000–2010
Brown, 2009 (17)	Systematic review 3/11	5-18	38/38: RCTs and controlled trials	1993–2007
Ciampa, 2010 (29)	Systematic review 7/11	<2	5/12 articles describing 10 studies: RCTs, pre/post, quasi-experimental, cohort	1978–2008
Cook-Cottone, 2009 (1)	Meta-analysis 2/11	Preschool -12th grade	40/40: RCTs and controlled trials	1997–2008
De Bourdeauhjij, 2011 (15)	Systematic review 7/11	6-18	9/11 studies described in 27 articles: RCTS, nonrandomized controlled	1991–2007
Dobbins, 2009 (14)	Systematic review 7/11	6-18	14/26: RCTs	1987–2006

Table 4.2: Study Characteristics – Cont'd

Review	Study type - AMSTAR rating	Age	Number of studies with anthropometric outcomes/total number of studies: study type	Range of years of individual studies included within reviews
D'Onise, 2010 (30)	Systematic review 7/11	3-4	2/37: trials and cohort studies	2007–2008
Froschl, 2009 (31)	Systematic review 1/11	Not specified	10/10 studies of 7 interventions: RCTs	Not available
Gerards, 2011 (32)	Systematic review 4/11	0-18	7/7: RCTS and pre/post	1975–2008
Golley, 2011 (9)	Systematic review 7/11	1-18	6/17: controlled trials and pre/post	1998–2008
Gonzalez-Suarez, 2009 (16)	Meta-analysis 4/11	School age	19/19: RCTs and controlled trials	1995–2007
Hamel, 2011 (33)	Systematic review 6/11	8-18	5/14: RCTs, quasi-experimental, repeated measure, pre/post	1999–2009
Harris, 2009 (22)	Systematic review and meta-analysis 8/11	5-18	Systematic review - 15/18 studies reported in 23 publication; Meta-analysis - 15/15 studies: RCTs, controlled studies	1993–2008
Hesketh, 2010 (34)	Systematic review 6/11	0-5	3/23: RCTs, non-randomized controlled trials, pre/post	1997–2008
Ickes and Sharma, 2011 (40)	Literature review 3/11	5-17	16/18: RCTs, experimental, secondary data analysis, single group repeated measure, pre/post; 13 prevention	2005–2010
Kanekar, 2009 (23)	Meta-analysis 7/11	School age	5/5: Not described	2000–2005
Katz, 2009 (5)	Literature review reporting meta-analysis results 6/11	3-18	For systematic review 19 studies described in 21 papers, for meta-analysis 12/12: RCTs, non-randomized controlled trials	1980–2004
Kesten, 2011 (35)	Systematic review 3/11	7-11	26/30: RCTs, controlled trial, cohort pre/post	1995–2010
Kitzman-Ulrich, 2010 (13)	Systematic review 2/11	Elementary to late adolescence	25/25 publications describing 21 trials: RCTs 46 studies total; 25 relevant to prevention	1981–2008
Larson, 2011 (41)	Literature review 3/11	2-5	5/18: Observational	2001–2010
Lytle, 2009 (39)	Review of reviews 5/11	0-18	9/9 reviews: RCTs, controlled trials, pre/post	2000–2006
Mayer, 2009 (42)	Literature review 1/11	Preschool to university	3/12: RCTs and pre/post	2001–2007
Monasta, 2011 (36)	Systematic review 7/11	< 5	7/7: RCTs	1997–2009
Nguyen, 2011 (27)	Systematic review 8/11	0-18	15/21 studies described in 24 articles: RCTs, non-randomized controlled, quasi-experimental, pre/post and feasibility	1998–2008
Reichert, 2009 (26)	Systematic review 6/11	6-19	24/24: observation, experimental and quasi-experimental	1997–2007
Roseman, 2011 (18)	Literature review 2/11	4-17	8/26: RCTs, non-randomized controlled and pre/post	2000–2008

Table 4.2: Study Characteristics – Cont'd

Review	Study type - AMSTAR rating	Age	Number of studies with anthropometric outcomes/total number of studies: study type	Range of years of individual studies included within reviews
Safron, 2011 (11)	Review of reviews 4/11	5-19	17/17: systematic reviews	2001–2009
Seo and Sa, 2010 (24)	Meta-analysis 6/11	6-19	40/40: RCTs, pre/post, quasi-experimental and non-randomized controlled	1999–2007
Standiford Brown, 2009 (43)	Literature review 2/11	9-19	3/14: experimental and quasi-experimental	1996–2006
Stevens, 2010 (10)	Literature review 2/11	10-14	4/8: RCTs, pre/post, quasi-experimental and longitudinal	1997–2007
Van Cauwenberghe, 2010 (37)	Systematic review 7/11	7-18	7/42: RCTs, observational and experimental	1991–2008
Wahi, 2011 (25)	Systematic review and meta-analysis 8/11	<18	For systematic review 13/13: RCTs	1995–2012
Waters, 2011 (2)	Systematic review and meta-analysis 9/11	0-18	For systematic review 40/55, for meta-analysis 37/37: RCTs and controlled trials	1993–2009
Wilks, 2011 (38)	Systematic review 4/11	3-19	3/4 interventions: controlled trials	2000–2007
Wilson, 2009 (12)	Literature review 2/11	0-18	8/8: RCTs, quasi-experimental and not described	1990–2007
Zenzen, 2009 (7)	Literature review 4/11	4-18	9/16: quasi-experimental and individual experimental	2001–2006

Evidence of Effectiveness

Of the 40 included studies, seven were meta-analysis and one literature review reported the results of a previous meta-analysis. The anthropometric outcome measures of these analyses varied; however, the majority of studies assessed standardized mean change in BMI as their primary outcome. Four studies found a significant reduction in an anthropometric outcome and four found a non-significant reduction of an anthropometric outcome. Descriptions of these analyses, along with their primary measurement outcome and findings, are described in Table 4.3. As demonstrated in the Table, findings from the pooled/combined analyses suggest an overall decrease in anthropometric outcomes as a result of the studied interventions.

Table 4.3: Summary of Meta-Analyses Analyses

Review and intervention description	Number of studies	Outcome measure	Results
Waters, 2011 (2) Physical activity and/or diet interventions in schools & other settings	37	Standardized mean change in BMI (kg/m^2)	Significant reduction (-0.15, 95% CI: -0.21, -0.09)
Cook-Cottone, 2009 (1) School-based physical activity and/or diet interventions	40	Effect size (Cohen's *d*)*	Significant effect (*d* = .05, 95% CI 0.04, 0.06)

Table 4.3: Summary of Meta-Analyses Analyses – Cont'd

Review and intervention description	Number of studies	Outcome measure	Results
Seo, 2010 (24) Weight-related interventions among U.S. minority children 6-19 yrs.	40	Effect size (Cohen's *d*) on weight measure used in study	Non-significant reduction One component interventions: (*d* = 0.07, 90% CI: -0.16, 0.43) Two component interventions: (*d* = 0.08, 90% CI: -0.08, 0.55) Three component interventions: (*d* = 0.33, 90% CI: -0.02, 0.67)
Gonzalez-Suarez, 2009 (16) School-based physical activity and/or diet interventions	19	Odds ratio (OR) of being overweight/ obese; Standardized mean change in BMI (kg/m^2)	Significant reduction in odds (OR=0.74); No significant change in BMI (-0.62, 95% CI -1.39, 0.14)
Harris, 2009 (22) School-based physical activity interventions	15	Standardized mean change in BMI (kg/m^2)	Non-significant reduction (-0.05, 95% CI -0.19, 0.20)
Katz, 2009 (5) School-based physical activity and/or diet interventions	13	Standardized mean change in BMI (kg/m^2)	Significant reduction (-0.29, 95% CI -0.45, 0.14)
Wahi, 2011 (25) Interventions to reduce screen time	6	Standardized mean change in BMI (kg/m^2)	Non-significant reduction (-0.10, 95% CI -0.28, 0.09)
Kanekar, 2009 (23) School-based physical activity and/or diet interventions	5	Standardized mean change in BMI (kg/m^2)	Non-significant reduction (-0.06, 95% CI -0.29, 0.16)

*Reported as statistic r in the review, but the given formula was consistent with the calculation for Cohen's d.

Five studies reported pooled results for interventions in the school environment, and all showed a reduction in anthropometric outcomes in the intervention groups compared to the control (1,5,16,22,23). But in two studies, these groups were not statistically different from one another (22,23). Wahi et al. (25) assessed the pooled effect of interventions focusing on screen-time reduction, but the overall reported reduction in BMI was not statistically significant. Of note, four of the five interventions in this meta-analysis did not include any additional intervention components (i.e., targeting physical activity or healthy eating).

Of the seven meta-analyses, two conducted sub-group analysis by age group (1,2). Waters et al.'s recent (2011) Cochrane Collaboration systematic review and meta-analysis of interventions to prevent or reduce obesity in school-aged children included interventions of more than 12 weeks duration that were conducted in a variety of settings, and addressed nutrition, physical activity or a combination of the two. This review is considered robust based on Cochrane methodology, as evidenced by a high AMSTAR rating. Waters et al. found a small but both statistically and clinically significant reduction in BMI for children ages 0 to 18 years (Standardized Mean Difference [SMD]: -0.15, 95% CI: -0.21, -0.09) (2). Sub-group analysis by age demonstrated a statistically significant effect for children 6 to 12 (i.e., elementary and middle-school aged) (SMD: -0.15, 95% CI: -0.23, -0.08) and a trend toward a positive intervention effect for children 0 to 5 years (SMD: -0.26, 95% CI: -0.53, 0.00). For youth ages 13 to 18 years, although the result was not statistically significant, heterogeneity and the small number of studies included were considered limitations (SMD: -0.09, 95% CI: -0.20, 0.03) (2).

In a review of school-based interventions, Cook-Cottone et al. reported a small but significant effect of interventions on weight outcomes for elementary schoolchildren (Cohen's *d* (*d*): 0.06, 95% CI: 0.05, 0.07) and a smaller, but still statistically significant, effect for interventions conducted in middle-school populations (*d*: 0.02, 95% CI: 0.00, 0.04) (1). When data from five

studies of interventions among secondary-school-aged youth were pooled, there was no significant effect, but the effect magnitude was in the range of the effect for younger ages (*d*: 0.04, 95% CI: -0.03, 0.12).

Evidence of Effectiveness by Macro-Level Environment

SCHOOL ENVIRONMENTS

Policy and Environmental Interventions

Preschool/child care settings

No anthropometric outcomes were reported for the few policy and environmental interventions set in preschool or child care, and no reviews focused specifically on this type of intervention. Despite this, based on a review of 18 interventions focused on curricular, educational and environmental changes in the child care setting (including improvements in classroom policies, food services practices and playground environments), Larson et al. (41) suggested that child care policies and regulations had a role to play in childhood obesity prevention.

School settings

Policy and environmental interventions within school settings were captured by many reviews (1,2,5,14, 16-18,22,24,35,37,40,42,43); however, the majority of reviews summarized the results of only a handful of individual studies. Only one of these reviews set out to specifically look at environmental interventions; in this case, the focus was on the food environment, although most of the studies occurred within schools (42). All three school-based studies that reported anthropometric outcomes were shown to have some effect (42). Two of these studies implemented changes to both the physical activity and school food and beverage environments through cafeteria changes, and increases in physical activity time, equipment availability, activities and supervision. The third effective intervention targeted environmental changes within the before-, during-, after-school, home and community environments (18,42).

The most prominent interventions were modifications to the school food environment, modifications to the classroom curriculum and increased time for physical activity during the school day (16). The overall evidence for these interventions was inconclusive, as many studies did not provide anthropometric measurement, and when they did the results were often mixed (i.e., effect demonstrated in only one sex) (17,37,40). The majority of these interventions targeted both the food and beverage environment and the physical activity environment. Common policy interventions within the school environment were the use of school nutrition policies (37), and, while these are difficult to evaluate, some promising findings were reported with a single study reporting a lower odds of incidence of overweight and obesity among intervention schools (18).

Social and Behavioural Interventions

Preschool/child care settings

Within the educational environment, few reviews focused specifically on interventions in the preschool/child care setting (30,34,41). D'Onise et al. conducted a broad review of a number of child health issues and interventions, of which two studies reported anthropometric outcomes (30). Both studies were cohort studies of Head Start, a U.S. federally funded program for at-risk minority, preschool-aged children delivered in child care or preschool settings. The authors reported that, at follow-up, both studies found a statistically significant difference in the weights of children who participated in the Head Start program, compared to a cohort of children who had not.

Several reviews reported the effectiveness of the U.S.-based preschool intervention called Hip Hop to Health Jr., one of the few interventions to show an effect on weight-based outcomes (4,8,34,41). However, this intervention, targeting 3- to 5-year-olds enrolled in Head Start programs in Chicago, has only proven to be effective among African-American preschoolers and did not show an effect with Latino preschoolers, suggesting the need for careful adaption when delivering interventions. Monasta, who reviewed similar studies, concluded that no single or combined intervention has been able to prove an effect in reducing overweight and obesity or in limiting weight gain in preschool children (36). Specifically, it was felt that the limited effects of Hip Hop to Health Jr. could not be applied to the general population. In the meta-analysis by Waters et al., evidence suggested that interventions occurring within education-type settings appeared to be less effective than those in home or health care settings for children aged 0 to 5 years (2). In addition to reporting on weight-status outcomes, some reviews also reported beneficial effects on risk behaviours or parental knowledge (34,36).

School settings

School-based interventions for the prevention of childhood obesity are a frequent focus of research investigations. It was suggested by one review that school provides an ideal setting for obesity prevention, given the amount of time children and youth spend there (3). In the Cochrane Review conducted by Waters et al., 35 of the 49 reviewed studies represented interventions conducted exclusively in the school setting, compared to eight in non-educational settings (e.g., the home or community) and another six that were conducted in both (2). Interventions in the educational setting had a statistically significant effect on BMI (SMD: -0.14, 95% CI: -0.21, -0.08), whereas those conducted in the non-educational setting did not (SMD: -0.28, 95% CI: -0.72, 0.16). For the six studies conducted in combined educational and non-educational setting, there was no evidence of effect (SMD: -0.09, 95% CI: -0.20, 0.02) (2).

Interventions in the school environment were the exclusive focus of five other meta-analyses (1,5,16,22,23). Of these meta-analyses, one reported a small but significant effect for elementary and middle school-aged children, but no significant effect for secondary school-aged students (1). The remaining four meta-analyses combined results for elementary, middle and secondary school-aged children and youth. Katz reported a significant reduction in BMI of school-based interventions focusing on both nutrition and physical activity (5). There was some weak evidence to show that interventions involving just nutrition had a similar magnitude of effect as those focusing on nutrition and physical activity, but that interventions focusing only on physical activity did not show an effect on BMI reduction.

One study reported that school-based interventions led to a significant reduction in the odds of being overweight or obese, but a significant reduction in BMI was only observed in programs that were implemented for more than one year (16). In contrast, Harris et al.'s analysis of physical activity interventions (22) and Kanekar and Sharma's review of interventions addressing physical activity, sedentary behaviour reduction and/or diet found no evidence of effectiveness on anthropometric outcomes (23).

In addition to the meta-analyses, nine articles were identified that specifically addressed interventions in the school setting (6,7,14,15,17,18,31,37). Of these reviews, three met seven of the 11 AMSTAR criteria (14,15,37). All three reported mixed or inconclusive evidence for the effectiveness of school-based interventions. Dobbins et al. (14) report there is evidence that school-based interventions focusing only on physical activity are not effective at reducing BMI, although they are effective at increasing the duration of physical activity.

The remaining six reviews met five or fewer of the AMSTAR criteria (6,7,17,18,31). Of these, four reported limited or mixed evidence of effectiveness (7,17,18,31). More positive results were reported in Branscum and Sharma's review of school and school/home interventions targeting Hispanic children (6). In this review, participants ranged from 3 to 12 years; there was a tendency for interventions targeting children at the older end of the age range to be more effective. Lytle et al. (39) summarized reviews on school-based prevention interventions and reported that there is inconclusive evidence regarding effective childhood obesity prevention interventions, as most articles had no statistical differences between control and intervention groups.

The mixed findings for school-based programs reflect in part the heterogeneity of the interventions conducted in this setting. Within reviews, interventions varied significantly in the behaviours targeted (physical activity, sedentary behaviour reduction and/or diet), study populations (age, ethnicity and weight status), level of parental involvement, duration and study outcomes.

HEALTH CARE ENVIRONMENTS

Clinical Interventions

No meta-analyses or systematic reviews focused specifically on obesity prevention interventions for children and youth in health care environments. However, three meta-analyses (2,24,25) and six systematic reviews contained at least some studies with interventions based in health care.

In two of the meta-analyses, the numbers of health care-based studies included were small (2,25). In the study by Waters et al., it was noted that interventions conducted in the health care setting may be effective for children 0 to 5 years of age (2). In Seo and Sa's meta-analysis, 16 of 40 trials were conducted in clinical settings (24). They estimated that clinic-based controlled trials had a greater effect size (d=0.35, which represents a medium effect) than school-based trials (d=0.08, a small effect). However, they pointed out that these findings may reflect differences in the

study populations (clinic-based interventions tended to recruit overweight or obese children, which increased the likelihood of seeing larger effects) and nature of the interventions (clinic programs combined multiple components, which was associated with larger effect sizes) (24). Clinic-based trials targeting overweight and obese children are discussed in detail in Chapter 5.

Of reviews that included studies conducted in health care settings, three focused on children under the age of five (29,34,36), one included pre-adolescent children ages 10 to 14 (10), and one included a broad range of ages (9). The numbers of health care-based studies within reviews were small, and information on outcomes was also limited. Most reviews report inconclusive evidence of effectiveness of health care childhood obesity prevention interventions on anthropometric outcomes. One review focused on interventions targeting parents to improve children's weight status primarily using behaviour change techniques (e.g., social cognitive therapy, behavioural skill maintenance, parent support sessions) (9), and three of eight interventions that reported weight-based outcomes showed a significant reduction. In another article, no anthropometric outcomes were given for health care-based interventions (10).

THE ENERGY BALANCE

Physical Activity and Sedentary Behaviours

Physical activity and sedentary behaviours were the target of several articles, and the majority of studies reported little to no effect of these single-component interventions on anthropometric outcomes (14,26,33,38,43). Two studies report evidence that school-based interventions focused only on physical activity are not effective at reducing BMI, although they are effective at increasing the duration of physical activity and provide other beneficial health effects (14,22). Wilks et al. also found that interventions focused only on physical activity did not show an effect (38). A meta-analysis of screen-time reduction interventions did not demonstrate effectiveness as measured by BMI reduction in children, but there was some promise in the preschool age group with a reduction in the number of hours watched per week (25).

Conversely, some evidence of effectiveness was shown for the few interventions that target physical activity in adolescent girls (43). Hamel et al. reported that five of 14 studies on the use of computer- and web-based interventions to increase physical activity had anthropometric outcomes, and three reported small but significant decreases in either BMI or mean body fat (33). Reichert et al. found that physical activity had an inverse association with BMI and other weight-related outcomes, but interventions were generally multi-component so it was not possible to assess the effect due to changes in the physical activity (26). In this study, stronger effects were shown for children who were already overweight or obese. Finally, Safron et al. suggest from their review of reviews of school-based interventions that the physical activity component of interventions should target both a reduction of sedentary behaviours and an increase of physical activity (11).

Dietary Behaviours

Overall, Van Cauwenberghe et al. (37) report that the evidence of effectiveness on anthropometric outcomes for educational, environmental and multi-component interventions focused solely on nutrition was lacking or inconclusive. Two additional reviews set out to look at interventions that focus on food and nutrition (18,42). Both studies reported some evidence of the effectiveness of nutrition-focused interventions in the school setting to reduce anthropometric outcomes; however, effective interventions also had a component of physical activity, making it difficult to determine the effect of the dietary component.

Addressing Both Sides of Energy Balance

Evidence that interventions are more effective when they address a combination of diet and physical activity or sedentary behaviour was provided by two meta-analyses (1,24). Safron et al.'s review of reviews also suggested that multi-component interventions were characteristic of interventions that were effective in changing anthropometric outcomes (11). Multi-component interventions, especially those that target both the food and beverage environment and the physical activity environment, have also been cited as more likely to be effective in a number of systematic reviews (3,5,10). However, there is some evidence to suggest that intervention effectiveness is not influenced by the number of nutrition and activity behaviours that are targeted (9).

OTHER SETTINGS

Home and Community Settings

Waters et al. noted that interventions in non-educational settings, such as home and health care, may be effective for children under five years of age; however, these findings were based on a small number of studies and do not separate the effects of interventions in the home settings compared to health care settings (2). Other reviews found that interventions in the home and community tended to focus more on pre-adolescent children than youth and often involved parents, especially mothers (6,38,43). Some evidence of the effective reduction of weight-based outcomes has been shown for interventions set in the community (e.g., church) in minority populations (12). Most of the studies included within these reviews were small and without follow-up, and, as a result, it is difficult to determine whether effects were significant or lasting.

Computer or Internet-based Interventions

Three moderate-to-good-quality reviews looked at computer- or Internet-based interventions (27,28,33). Such interventions were typically delivered in conjunction with a community-, home- or school-based program, and addressed diet, physical activity or a combination of the two. Stevens' review (2010) also reported on two computer-tailored interventions delivered to improve physical activity and healthy eating, but physical activity and dietary outcomes were mixed, and no anthropometric outcomes were reported (10).

Of the three better-quality reviews, Nguyen et al. reported that one of three interventions conducted among children and three of 12 conducted among youth reported significant reductions in anthropometric outcomes (27). These studies primarily used interactive Internet sites or CD-ROM-based components, but most did not separately analyze the effects of the computer component from other components. Hamel et al. reported that five of 14 studies on the use of computer- and web-based interventions to increase physical activity had anthropometric outcomes, and three reported small but significant decreases in either BMI or mean body fat (33). An et al. looked at eight studies, of which four could be described as obesity prevention interventions (28). Of these four studies, only two reported a change in anthropometric outcomes between baseline and end of the intervention. In one study of 12- to 18-year olds, there was a reduction in the BMI z-score for the intervention group, while the other, a study of 7th and 8th graders, reported significant differences for girls but not for boys. Results appeared to persist over time, but also appeared dependent on parental involvement (28). Additionally, web-based behavioural interventions with interactive approaches, such as e-mail counselling and tailored messages, were found to be superior to interventions with only online health education.

These reviews suggest that results for computer- or Internet-based interventions are promising, but not definitively effective as stand-alone interventions. Most studies have used computer or Internet programs in conjunction with or as part of community- or school-based interventions. Computer-based interventions may be beneficial, because they are able to reach large audiences (33) and may help overcome social barriers to accessing obesity prevention and treatment activities as an alternative to going to a clinic (28).

KEY FACTORS

A variety of factors that may be imperative to the prevention of obesity in children and youth were identified with the reviews, and were often important independent of the macro-level environment or setting.

Intervention design:

As mentioned above, overall interventions are more effective when they address both physical activity and dietary behaviours. Furthermore, Seo et al. found that interventions with one or two components had less of an effect on anthropometric outcomes than interventions with three components (24). Components included physical activity, nutrition, sedentary behaviour, counselling and medication. Combining education and environmental interventions has also been shown to enhance effectiveness, with little to no evidence of effectiveness for education-only interventions (15,35,37). Ayliffe et al. (3) observe that interventions should be designed to be developmentally appropriate, and that strategies such as the use of peer leader and Internet-based interventions have promise for youth. It is also recognized that age and gender differences should be considered in intervention design (35). Another important consideration of intervention design mentioned in the reviews is the dose or frequency. For example, the increased frequency of an Internet intervention is considered important to its success (28).

Parental involvement:

Parental involvement was shown to increase the effect of interventions on anthropometric outcomes in Cook-Cottone et al.'s meta-analysis (1) and was also cited in Safron et al.'s umbrella review as a characteristic of successful interventions (11). In addition, two moderate-to-good-quality reviews (23,37) and four other reviews (1,11,13,16) suggested that parental involvement may contribute to the effectiveness of interventions among school-aged children. Kitzman-Ulrich et al. (13), showed there is some evidence that interventions with a family component (e.g., family homework assignments to promote healthy eating at home and parent meetings at school) led to significant reductions in BMI; however, studies did not generally assess the independent effect of the family component, and most did not attempt to change parenting style or family functioning. Parental involvement has also been reported to be important for web-based interventions (28) and interventions for children under five (4,8). Golley et al. (9) suggest that having a higher degree of parental involvement leads to more intervention success.

Seo and Sa looked at parenting style (24) and reported that interventions tended to have a larger effect if they addressed both physical activity and diet, involved parents and were culturally tailored (24). Gerards et al. reported on childhood obesity preventions interventions that targeted general parenting (32). This review looked at six RCTs and one pre/post-trial. Studies varied considerably in methods, study quality and outcome; however, four reported an association between parenting style and anthropometric outcomes (32). One review reported contradictory results, where it was found that there was a small reduction of effect in school-based interventions when it included parental engagement (5). These results should be interpreted with caution, as findings were based on five studies.

Vulnerable populations:

Waters et al. undertook an equity assessment of studies included in their review (2). Findings demonstrated that although most studies reported gender and/or race of participants, a much smaller number analyzed outcome data by these variables. Socioeconomic status and household education level were even less frequently reported and analyzed, making it challenging to assess the impact of interventions on health equity. However, Waters noted that many of the interventions were conducted in population groups already experiencing disadvantages and that none of the interventions appeared to have increased health inequities where this had been studied (2).

Although ethnicity was not subjected to pooled-effect size calculations in the meta-analysis conducted by Waters et al. (2), it was examined in Cook-Cottone's analysis. Results available in this review suggest that intervention effects were stronger in studies with predominantly Asian students than among interventions targeting African-American, Native American, Hispanic or Caucasian students; however, these results need to be further validated (1). In addition, five systematic reviews examined the literature on obesity interventions among ethnic minority children and youth. Three of these studies focused on American ethnic minorities (African-Americans, Hispanics and/or Native Americans) (6,24,40). Evidence of effectiveness was reported for reviews of mixed U.S. ethnic populations (12), Hispanic children (6) and African-American children (40).

Stevens' review of interventions among middle-school-aged children of ethnic minorities included studies from the U.S., Australia, Belgium and Chile (10). Interventions were multi-component and were delivered in a variety of settings (school, family, clinics and by computer). However, only school-based interventions appeared to be effective and none were specific to minority children only (10). Wilson et al. (12) report that there was limited research on implementing obesity interventions in minority populations. This review supported the use of intervention components, such as parent and family involvement, cultural tailoring, changes to the school environment, behaviour skill improvement, and addressing broader health behaviour and health care access issues, as means of obesity prevention.

In their analysis, Seo and Sa estimated that interventions that were culturally tailored had a larger effect size than those that were not (24). The importance of developing culturally appropriate interventions was noted frequently in the literature (4,5,8,12,13,35).

Intervention staff:

The importance of a well-trained, engaged and sustainable staff was another cross-cutting theme in the reviews. One review of school-based interventions discussed the issue of sustainability and suggested that school-based interventions should be integrated into the curriculum, because using non-school personnel

would not be feasible in the long term (17). Others have suggested that there must be effective training for intervention delivery (4,5) and interventions are more successful with a dedicated staff (6).

Theoretical frameworks:

Review authors frequently note that theoretical frameworks or models should be used during the planning and implementation stages of interventions (7,33,42), and some authors have suggested that interventions are more successful if they are based in theory (6,9). In the review by Zenzen et al. (7), a variety of theoretical frameworks were applied in half of the school-based studies they summarized (i.e., Social Cognitive Theory, Transtheoretical Model, Health Promotion Model and Theory of Planned Behaviour). However, they did not measure how the use of the frameworks modified effectiveness results. One review of reviews reported that a comparison of reviews that investigated the role of psychological theory suggests psychological theory and cognitive mediators may have only a marginal role (11).

Other Outcomes

DIET AND PHYSICAL ACTIVITY OUTCOMES

In addition to assessing anthropometric outcomes, many of the studies evaluated within the reviews also assessed other outcomes, such as dietary improvements, increased physical activity and decreased sedentary behaviour. Some of the most common findings are discussed, but as it was not the primary focus of this review this discussion should not be considered definitive.

In the study by Waters et al., it was noted that for all age groups considered, only modest changes in diet, physical activity and sedentary behaviour were reported (2). Similarly, in their review of reviews, Safron et al. (11) reported that just over half (57.3%) of interventions per review that evaluated changes in physical activity in children and youth resulted in increases in physical activity or reductions in sedentary behaviour. However, it is not clear whether increases in physical activity were sufficient by themselves to improve anthropometric outcomes. For example, at least two other reviews, one on school- and community-based physical activity programs (38), and another on active school commuting (44), showed that programs were beneficial in increasing physical activity, but had no impact on anthropometric outcomes. Similar findings were noted with respect to dietary behaviours. For example, Safron et al. reported that 96% of interventions showed evidence of effect on dietary behaviours (11). However, a variety of different outcome measures were used (e.g., fruit and vegetable consumption, dietary fat consumption, calcium consumption) and the extent to which the dietary changes affected anthropometric outcomes was unclear. Two other systematic reviews reported that school-based interventions could increase physical activity and/or nutrition knowledge, but had less conclusive evidence of the effect on anthropometric outcomes (15,37).

These results suggest there is evidence that interventions can have a positive effect on dietary and physical activity behaviours. However, it is not clear how changes in these behaviours will effect anthropometric outcomes in the future or if these behaviour changes are sustainable.

ADVERSE EFFECTS

Few articles (2,14,27) discussed the potential for unintentional or adverse effects from obesity prevention interventions, such as stigmatization. Waters et al. (2) noted that there was no evidence of adverse effects, such as unhealthy dieting practices, increased prevalence of underweight or body image sensitivities, reported among the few studies that measured adverse outcomes of obesity prevention activities.

Discussion

Forty articles were included in this review. Despite considerable heterogeneity, many reviews found that interventions produced small to moderate changes in anthropometric outcomes. However, from a public health perspective, what appears to be a small effect may be important at the population level (2). Effective interventions tended to be multi-component in nature, addressing both physical activity and nutrition, included parents and were collaborative. The most recent and comprehensive review found an overall significant effect of a 0.15 mg/m2 (95% CI: -0.21 to -0.09) reduction in BMI among children in the intervention group (2).The review's authors suggest these results indicate that childhood obesity prevention research should move past trials and toward understanding how these effective intervention components can be implemented within health, education, community and child care settings.

Additionally, several authors have discussed the need to take a broad and inclusive approach to the evidence considered, rather than being limited only to experimental evidence (45-47).

It also should be noted that few studies were found in this review that addressed the effect of policy or environmental interventions. Only one systematic review focused specifically on policy and/or environmental initiatives to prevent obesity in children (41). Studies that focus on policy and environmental changes often look at ecological associations or more proximal outcomes, such as changes to physical activity or dietary behaviours, which may be one reason why these studies were not captured in our search. Further, systematic reviews privilege randomized control trials, and these methods are not conducive to the assessment of policy and environmental changes. However, drawing on lessons learned from other complex population health interventions, policy and environmental interventions may be important components of obesity prevention.

Across the 40 reviews, some intervention components were repetitively identified as contributing to successful, effective interventions. While the majority of these relate to weight-based outcomes, authors often extrapolated results that were effective in changing risk behaviours to weight-based outcomes. Results from included reviews suggested that interventions were more likely to be effective if they:

- Targeted both physical activity and healthy eating (1-5);
- Involved parents (1,2,4-11);
- Were designed to be culturally sensitive (4,5,8,12,13);
- Had effective staff training and sustainability (4,5);
- Used participatory activities and training in behaviour techniques (e.g., self-monitoring) or coping skills(5);
- Were done in collaboration with community programs or facilities (14);
- Increased sessions of physical activity throughout the school week (2,5);
- Modified the food environment of schools to improve nutritional quality of school foods (2,5);
- Were set within environments and cultures that supported healthy eating and physical activity, and when they combined education with modifications to the school environment (2,15);
- Were universal (e.g., did not select children or youth based on weight or risk factors for obesity) (1);
- Were delivered by teachers who were supported by, or worked in collaboration with, specialists (1,2);
- Were longer in duration rather than short term (1,6,7,14,16);
- Were integrated into the school curriculum (16-18).

Limitations

There were several limitations to this review that must be noted. This review synthesized evidence from secondary research. While systematic reviews are an important source of information, they have a limited ability to provide all of the information needed for program planning, implementation and evaluation (52). Given the deeply contextual nature of population interventions, further targeted reviews will be required to capture more detailed implementation-relevant information.

In addition to the above-mentioned limitation, it must be mentioned that only those systematic reviews published in English from 2009 and onward were included. This was purposeful, based on the presence of a recent Cochrane Review and the limited time available to complete this synthesis. However, the included reviews consisted of individual studies dating back decades and some also included individual studies that were published in other languages. As well, there was heterogeneity in the focus, content, activities, delivery, outcome measures, duration and setting of studies within the included reviews. This heterogeneity made it difficult for authors to pool data (only a minority of the 40 reviews were able to pool data) or to identify which components of interventions contributed to effectiveness. Finally, according to the AMSTAR score, the quality of the included reviews was generally not high. The quality of the included reviews must be taken into consideration when interpreting the reported effectiveness, given that bias can be introduced when important methodological elements, such as comprehensive literature search, inclusion of grey literature, assessment of publication bias and conflict of interest disclosure, are not included in the systematic review protocol. Lastly, the focus on measured anthropometric outcomes, rather than behavioural outcomes such as physical activity and healthy eating, also limited the results of this review.

Research Gaps

The review identified a number of key gaps in the literature. There is, for example, little or no information on how to address risk factors associated with urban, rural and remote location or socioeconomic status. No reviews focused on obesity prevention among rural children or youth. Even reviews focusing on ethnic minorities did not discuss socioeconomic issues and their potential impact on outcomes.

Though many of the school-based interventions included strategies to modify the school environment, few mentioned the potential influence of neighbourhoods or the built environment on modifiable risk factors (10,44). There was also a lack of information regarding early-life or prenatal interventions. One review included a study on breastfeeding promotion by clinicians, but none of the other reviews looked at factors or interventions during early life and development. Intervening during this period will be critical to the advancement of obesity prevention during childhood. Parental involvement was also cited by many studies as an important enabler of obesity prevention, but few reviews focused on studies that addressed parenting styles (13,32). Additionally, only one review (41) looked at the potential to use child care policies and regulation to improve the health of preschool-aged children. Although a large body of research on obesity prevention among U.S. minority children and youth exists, it does not reflect the ethnic diversity of Ontario. Therefore, the extent to which results can be generalized is unclear, and there is a need for research among populations that are more reflective of the ethnic diversity and socioeconomic environments across the province, particularly for First Nations, Inuit and Métis populations.

Conclusions

Overall, the obesity prevention interventions summarized in the reviews appear to have a modest beneficial effect on anthropometric outcomes, particularly among children aged six to 12. The majority of interventions were set primarily within educational settings, and targeted physical activity and diet. Home-, community- or Internet-based activities were often included as components of these school-based interventions. There was some evidence of effect of interventions conducted within the home and community, especially for children under five years of age, and health care environments. Results revealed that the most effective interventions tended to be those that were multi-component in nature, addressing both diet and physical activity, included educational and environmental components, and an element of parental involvement.

References

(1) Cook-Cottone C, Casey CM, Feeley TH. A meta-analytic review of obesity prevention in the schools: 1997-2008. Psychology in the Schools. 2009;46(8):695-719.

(2) Waters E, de Silva-Sanigorski A, Hall BJ, Brown T, Campbell KJ, Gao Y, et al. Interventions for preventing obesity in children. Cochrane Database Syst Rev. 2011;(12):CD001871.

(3) Ayliffe B, Glanville NT. Achieving healthy body weight in teenagers: evidence-based practice guidelines for community nutrition interventions. Can J Diet Pract Res. 2010;71(4):e78-86.

(4) Bond M, Wyatt K, Lloyd J, Welch K, Taylor R. Systematic review of the effectiveness and cost-effectiveness of weight management schemes for the under fives: a short report. Health Technol Assess. 2009;13(61):1-75, iii.

(5) Katz DL. School-based interventions for health promotion and weight control: not just waiting on the world to change. Annu Rev Public Health. 2009;30:253-272.

(6) Branscum P, Sharma M. A systematic analysis of childhood obesity prevention interventions targeting Hispanic children: lessons learned from the previous decade. Obes Rev. 2011;12(5):e151-8.

(7) Zenzen W, Kridli S. Integrative review of school-based childhood obesity prevention programs. J Pediatr Health Care. 2009;23(4):242-58.

(8) Bond M, Wyatt K, Lloyd J, Taylor R. Systematic review of the effectiveness of weight management schemes for the under fives. Obes Rev. 2011;12(4):242-253.

(9) Golley RK, Hendrie GA, Slater A, Corsini N. Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns - what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness? Obes Rev. 2011;12(2):114-30.

(10) Stevens CJ. Obesity prevention interventions for middle school-age children of ethnic minority: a review of the literature. J Spec Pediatr Nurs. 2010;15(3):233-43.

(11) Safron M, Cislak A, Gaspar T, Luszczynska A. Effects of school-based interventions targeting obesity-related behaviors and body weight change: a systematic umbrella review. Behav Med. 2011;37(1):15-25.

(12) Wilson DK. New perspectives on health disparities and obesity interventions in youth. J Pediatr Psychol. 2009 [cited 2013 Jun 26];34(3):231-44. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2722129/pdf/jsn137.pdf

(13) Kitzman-Ulrich H, Wilson DK, St George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clin Child Fam Psychol Rev. 2010 [cited 2013 Jun 26];13(3):231-53. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3293190/pdf/nihms357806.pdf

(14) Dobbins M, De Corby K, Robeson P, Husson H, Tirilis D. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6-18. Cochrane Database Syst Rev. 2009;(1):CD007651.

(15) De Bourdeaudhuij I, Van Cauwenberghe E, Spittaels H, Oppert JM, Rostami C, Brug J, et al. School-based interventions promoting both physical activity and healthy eating in Europe: a systematic review within the HOPE project. Obes Rev. 2011;12(3):205-16.

(16) Gonzalez-Suarez C, Worley A, Grimmer-Somers K, Dones V. School-based interventions on childhood obesity: a meta-analysis. Am J Prev Med. 2009;37(5):418-27.

(17) Brown T, Summerbell C. Systematic review of school-based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. Obes Rev. 2009;10(1):110-41.

(18) Roseman MG, Riddell MC, Haynes JN. A content analysis of kindergarten-12th grade school-based nutrition interventions: taking advantage of past learning. J Nutr Educ Behav. 2011;43(1):2-18.

(19) IOM (Institute of Medicine). Accelerating progress in obesity prevention: solving the weight of the nation. Washington, DC: National Academies Press; 2012 [cited 2013 Jun 26]. Available from: http://www.thecommunityguide.org/library/book/index.html

(20) Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, et al. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC Med Res Methodol. 2007 [cited 2013 Jun 26];7:10. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1810543/pdf/1471-2288-7-10.pdf

(21) Zaza S, Briss PA, Harris KW. The guide to community preventive services: what works to promote health? New York, NY: Oxford University Press; 2005 [cited 2013 Jun 26]. Available from: http://www.thecommunityguide.org/library/book/index.html

(22) Harris KC, Kuramoto LK, Schulzer M, Retallack JE. Effect of school-based physical activity interventions on body mass index in children: a meta-analysis. CMAJ. 2009 [cited 2013 Jun 26] ;180(7):719-726. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2659836/pdf/20090331s00019p719.pdf

(23) Kanekar A, Sharma M. Meta-analysis of school-based childhood obesity interventions in the U.K. and U.S. Int Q Community Health Educ. 2008;29(3):241-56.

(24) Seo DC, Sa J. A meta-analysis of obesity interventions among U.S. minority children. J Adolesc Health. 2010;46(4):309-23.

(25) Wahi G, Parkin PC, Beyene J, Uleryk EM, Birken CS. Effectiveness of interventions aimed at reducing screen time in children: a systematic review and meta-analysis of randomized controlled trials. Arch Pediatr Adolesc Med. 2011;165(11):979-86.

(26) Reichert FF, Baptista Menezes AM, Wells JC, Carvalho Dumith S, Hallal PC. Physical activity as a predictor of adolescent body fatness: a systematic review. Sports Med. 2009;39(4):279-94.

(27) Nguyen B, Kornman KP, Baur LA. A review of electronic interventions for prevention and treatment of overweight and obesity in young people. Obes Rev. 2011;12(5):e298-314.

(28) An JY, Hayman LL, Park YS, Dusaj TK, Ayres CG. Web-based weight management programs for children and adolescents: a systematic review of randomized controlled trial studies. ANS Adv Nurs Sci. 2009;32(3):222-40.

(29) Ciampa PJ, Kumar D, Barkin SL, Sanders LM, Yin HS, Perrin EM, et al. Interventions aimed at decreasing obesity in children younger than 2 years: a systematic review. Arch Pediatr Adolesc Med. 2010;164(12):1098-1104.

(30) D'Onise K, Lynch JW, Sawyer MG, McDermott RA. Can preschool improve child health outcomes? a systematic review. Soc Sci Med. 2010;70(9):1423-40.

(31) Froschl B, Wirl C, Haas S. Overweight prevention in adolescents and children (behavioural and environmental prevention). GMS Health Technol Assess. 2009 [cited 2013 Jun 26];5(1-10). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3011287/pdf/HTA-05-05.pdf

(32) Gerards SM, Sleddens EF, Dagnelie PC, de Vries NK, Kremers SP. Interventions addressing general parenting to prevent or treat childhood obesity. Int J Pediatr Obes. 2011;6(2-2):e28-45.

(33) Hamel LM, Robbins LB, Wilbur J. Computer- and web-based interventions to increase preadolescent and adolescent physical activity: a systematic review. J Adv Nurs. 2011;67(2):251-68.

(34) Hesketh KD, Campbell KJ. Interventions to prevent obesity in 0-5 year olds: an updated systematic review of the literature. Obesity (Silver Spring). 2010;18(Suppl 1):S27-35.

(35) Kesten JM, Griffiths PL, Cameron N. A systematic review to determine the effectiveness of interventions designed to prevent overweight and obesity in pre-adolescent girls. Obes Rev. 2011;12(12):997-1021.

(36) Monasta L, Batty GD, Macaluso A, Ronfani L, Lutje V, Bavcar A, et al. Interventions for the prevention of overweight and obesity in preschool children: a systematic review of randomized controlled trials. Obes Rev. 2011;12(5):e107-18.

(37) Van Cauwenberghe E, Maes L, Spittaels H, van Lenthe FJ, Brug J, Oppert JM, et al. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. Br J Nutr. 2010;103(6):781-97.

(38) Wilks DC, Besson H, Lindroos AK, Ekelund U. Objectively measured physical activity and obesity prevention in children, adolescents and adults: a systematic review of prospective studies. Obes Rev. 2011;12(5):e119-29.

(39) Lytle LA, Heart MO. Examining the state of the science of prevention of childhood obesity. Curr Nutr Food Sci. 2009;5(2):134-48.

(40) Ickes MJ, Sharma M. A review of childhood obesity prevention interventions targeting African American children. Vulnerable Child Youth Stud. 2011;6(1):103-123.

(41) Larson N, Ward DS, Neelon SB, Story M. What role can child-care settings play in obesity prevention? a review of the evidence and call for research efforts. J Am Diet Assoc. 2011;111(9):1343-62.

(42) Mayer K. Childhood obesity prevention: focusing on the community food environment. Fam Community Health. 2009;32(3):257-70.

(43) Standiford Brown A. Promoting physical activity amongst adolescent girls. Issues Compr Pediatr Nurs. 2009;32(2):49-64.

(44) Faulkner GE, Buliung RN, Flora PK, Fusco C. Active school transport, physical activity levels and body weight of children and youth: a systematic review. Prev Med. 2009;48(1):3-8.

(45) Puddy RW, Wilkins N. Understanding evidence - part 1: best available research evidence. A guide to the continuum of evidence of effectiveness. Atlanta, GA: Centers for Disease Control and Prevention; 2011 [cited 2013 Jun 26]. Available from: http://www.cdc.gov/ViolencePrevention/pdf/Understanding_Evidence-a.pdf

(46) Swinburn B, Gill T, Kumanyika S. Obesity prevention: a proposed framework for translating evidence into action. Obes Rev. 2005;6(1):23-33.

(47) Wolfenden L, Wiggers J, Tursan d'Espaignet E, Bell AC. How useful are systematic reviews of child obesity interventions? Obes Rev. 2010;11(2):159-165.

5. Treatment Approaches for Overweight and Obese Children and Youth: A Review of Reviews on the Effectiveness of Interventions

Summary

Prevention efforts, such as those discussed in Chapter 4, are important to ensure that children and youth who are not presently overweight or obese do not become overweight or obese. Treatment efforts are also important to help children and youth who are overweight or obese manage their weight. Identifying effective treatment approaches to support weight management among overweight and obese children and youth is an important element to improving chronic disease outcomes in Ontario and Canada. This chapter summarizes the results of a literature review to determine the effectiveness of treatment approaches designed to help children and youth under age 19 who are already overweight and obese reach a healthy weight. Effectiveness was determined by changes in anthropometric outcomes (e.g., change in weight, BMI, waist circumference). Three approaches to the treatment of overweight and obesity in children and youth were assessed within the 15 reviews, of which five were meta-analyses and 10 were systematic reviews.

Nine reviews assessed the effectiveness of lifestyle initiatives, which targeted behavioural modifications through diet, physical activity and behavourial therapy. The effectiveness of pharmaceutical approaches (sibutramine, orlistat and metformin) was assessed in four reviews. Surgical approaches, such as gastric bypass surgery, were assessed in one systematic review. The remaining review assessed the effectiveness of all three approaches in reducing overweight and obesity among children and youth. Results showed that lifestyle, pharmaceutical and surgical treatment approaches could result in decreases in anthropometric outcomes. Lifestyle approaches had better results when they combined several components, such as dietary and physical activity change, behavioural therapy and parental involvement. Although both pharmaceutical and surgical approaches also resulted in reductions in anthropometric measures, several adverse effects were reported with the use of pharmaceuticals, such as nausea, vomiting and gastrointestinal discomfort. In addition, revisional surgeries were frequently needed in those undergoing surgery.

Limitations of this synthesis are that all reviews published in languages other than English and prior to 2009 were excluded. Studies evaluated within the reviews had varying sample sizes, consisted mainly of Caucasian populations, and were heterogeneous in their reporting of outcomes and treatment protocols. Despite these limitations, the literature was concisely summarized with a high degree of methodological rigour.

Introduction

Although obesity preventive efforts are important, treatment efforts are also needed to help children and youth who are overweight or obese manage their weight and minimize complications. The purpose of this review of reviews was to determine the effectiveness of treatment approaches designed to help children and youth under 19 years who are already overweight or obese reach a healthy weight.

Methods

Literature Search Strategy

A librarian-assisted literature search of multiple electronic databases and grey literature sources was conducted in March/April 2012. The scope of the search included secondary research articles (i.e., systematic reviews and/or meta-analyses) published in English. The search of electronic databases combined the following four concepts: child, obesity, effectiveness and interventions that focused on treatment. Given the limited amount of time available for the completion of this review, the scope was

limited to secondary research articles (i.e., summary of existing research such as systematic reviews or meta-analyses), published from January 2009 to March 2012. However, a Cochrane Review on interventions for the treatment of childhood obesity was recently published (January 2009) and summarized all primary research on the effectiveness of childhood obesity treatment interventions published prior to May 2008 (1). A detailed description of the literature search strategy is provided in Appendix 4.

Study Selection

To be included in this report, articles had to summarize existing research on the effectiveness of interventions for the treatment of childhood overweight or obesity. At least one study in each review had to report an outcome of either a direct or self-reported anthropometric measure (e.g., BMI, BMI z-score, weight, waist circumference, hip circumference, prevalence of overweight or obesity). The target population of at least one study within the reviews had to be children and youth 19 years of age and younger. Additionally, as this synthesis was focused on treatment, at least one study within each review had to assess interventions that targeted populations of children and youth who were already overweight or obese, with an intention of reducing weight. Finally, articles had to be published in English and describe research in countries comparable to Canada (i.e., developed countries such as the U.S., the U.K. and Europe).

Two reviewers independently screened titles and abstracts against inclusion and exclusion criteria. Results from these independent screens were compared and any discrepancies between the two reviewers were resolved by consensus.

Quality Assessment and Data Extraction

The quality of the secondary research articles included in this report was assessed independently by two reviewers with AMSTAR, a validated measurement tool created to assess the methodological quality of systematic reviews (2). AMSTAR ratings can range from 1 to 11, with 11 denoting the highest quality. AMSTAR ratings for each secondary research article are shown in Appendix 4.

For data extraction purposes, a standardized table was created to summarize the following elements of each article: reference and review type, population (age, SES, ethnicity, sample size), study objectives, treatment approach, primary outcome (weight/BMI), study limitations and future research. The extracted data for each review is provided in Appendix 5.

The interventions found were categorized based on which macro-level environment their activities fall within (i.e., food and beverage, physical activity, school, health care, and message environments) (3) and intervention type (i.e., policy and environmental, social, and behavioural or clinical) (4), although not all environments and interventions types were represented in this literature. Finally, where applicable, interventions were categorized by the setting (i.e., micro-level environment) where they are conducted, and key factors for success were highlighted.

Results

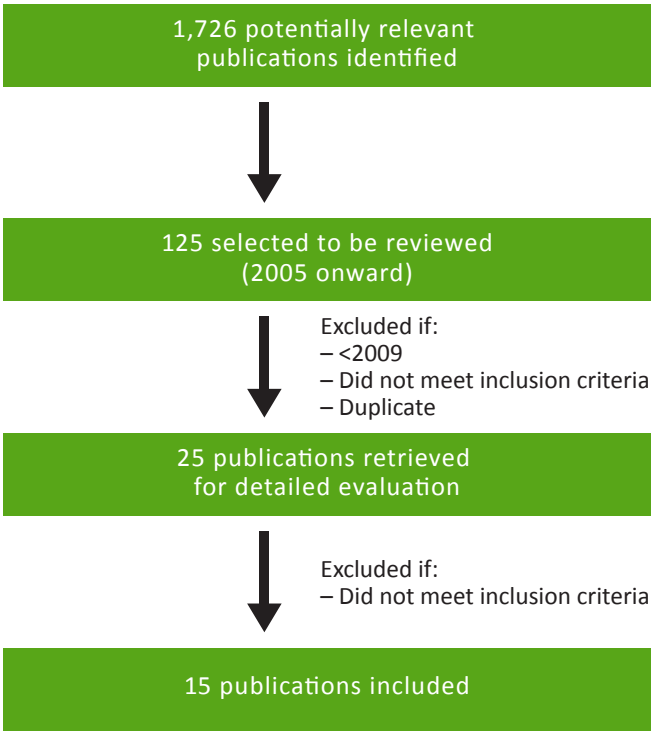
Results of the Literature Search

As shown in Table 5.1 and Figure 5.1, the search of electronic databases identified 1,726 articles. A total of 15 secondary research articles met all inclusion criteria and were synthesized in this review, including the Cochrane Review by Oude et al. published in 2009 (1).

Table 5.1: Electronic Database Search Results

Sources	No. of titles
MEDLINE (Ovid)	340
EMBASE (Ovid)	726
Database of Abstracts of Reviews of Effects (DARE), NHS Economic Evaluation Database, and Health Technology Assessments (EBSCO)	325
PsychINFO (Ovid)	69
CINAHL (EBSCO)	128
Cochrane Database of Systematic Reviews (EBSCO)	32
Campbell Collaborative	3
Clinical Preventive Services	1
Guide to Community Preventive Services	29
Effective Public Health Practice Project	16
NICE Guidelines	2
Healthevidence.ca	55
Hand-searched	N/A
TOTAL	**1,726**

Figure 5.1: Flow Diagram of Study Selection Process



Study Characteristics

Characteristics of the 15 secondary research articles on child and youth overweight and obesity treatment captured in this synthesis are shown in Table 5.2. Of these, 10 were systematic reviews and five were meta-analyses. The AMSTAR quality scores ranged from 2 to 11 out of maximum of 11 (one study was out of 10), with an average of 5. The most common methodological issues found in the reviews were not including a list of excluded articles (93% of reviews), not reporting conflict of interest information for both the articles included in the review and the review itself (93% of reviews), and not explicitly searching the grey literature and non-English publications (93% of reviews). The two reviewers applied the AMSTAR rating system with a high degree of agreement (kappa 0.74, 95% CI 0.64-0.85).

Table 5.2: Review Characteristics

Review	Study type - AMSTAR rating	Age	Number of studies with anthropometric outcomes/total number of studies: study type	Range of years of individual studies included within reviews
An, 2009 (5)	Systematic review 5/10	8-18	8/8: RCTs	2003–2008
Ayliffe and Glanville, 2010 (6)	Systematic review 2/11	0-18	63 articles total; Not reported/22 studies relevant to treatment: all study designs	1997–2009
Czernichow, 2010 (7)	Meta-analysis 7/11	10-18	8/8: RCTs	2003–2007
Garcia, 2011 (8)	Systematic review 6/11	12-18	9/9: RCTs	2003–2007
Ickes and Sharma, 2011 (9)	Systematic review 3/11	7-17	18 studies total; 7/8 studies relevant to treatment: 2 RCT, 1 stratified randomization, 2 experimental design, 3 unknown	2005–2010
Kelly and Kirschenbaum, 2011 (10)	Systematic review 2/11	8-18	22/22 studies: 1 randomized, 5 quasi-experimental and 16 prospective follow-up	1973–2009
Kitzmann, 2010 (11)	Meta-analysis 6/11	6-19	76/76; 40 between-group, treatment compared to a control, 36 alternate treatment involved parents: randomized and non-randomized	1965–2004
Kitzman-Ulrich, 2010 (12)	Meta-analysis 2/11	6-16	46 studies total; 21/21 studies relevant to treatment: 18 RCTs, 1 stratified random assignment, 1 controlled clinical study, 1 non-random treatment/control	1981–2008
Lambiase 2008 (13)	Systematic review 2/11	8-12	6/6: RCTs	1995–2006
Nguyen, 2011 (14)	Systematic review 7/11	6-12	24 studies total; 9 studies relevant to treatment: 7 RCTs, 1 quasi-experimental, 1 longitudinal	1998–2008
Oude, 2009 (1)	Systematic review and meta-analysis 11/11	3-21	64/64: RCTs	1985–2008
Padwal, 2011 (15)	Systematic review 6/11	14-18	1/1: RCT	2010
Park, 2009 (16)	Meta-analysis 3/11	6-19	5/5: double-blind RCTs (one crossover-trial)	2001–2008
Sargent, 2011 (17)	Systematic review 6/11	3-11	17/17 studies (in 22 papers): 10 RCTs and 7 non-random trials	1991–2007
Viner, 2010 (18)	Systematic review and meta-analysis 6/11	12-18	7/7: double-blind RCT, 5 open-label trial, 1 non-blinded trial	2003–2007

There were three main treatment approaches identified by the reviews: (1) lifestyle approaches targeting individual behavioural modifications, including diet and physical activity, often with a component of behavioural or other therapy; (2) pharmaceutical approaches; and (3) surgical approaches, such as gastric bypass. Only one of the reviews looked at all three treatment approaches (1). These treatment approaches were categorized and summarized by macro-level environment, with both pharmaceutical and surgical approaches falling within health care environments. The classification of lifestyle approaches was challenging, as most studies within reviews used a combination of methods, such as combining diet, physical activity and/or behavioural therapy. Therefore, lifestyle approaches were

categorized as belonging to the intersection of the food and beverage environment, physical activity environment and health care environment, although some specific interventions may in fact intervene in only one or two of these three environments. None of the interventions found for the treatment of child and youth overweight and obesity had a policy or environmental focus.

Evidence of Effectiveness by Macro-Level Environment

INTERSECTING ENVIRONMENTS

Social, Behavioural and Clinical Interventions

Lifestyle approaches

Nine reviews looked at lifestyle approaches (5,6,9-11,13,14,17,19). Of these, one review focused specifically on primary care initiatives (17), two on web-based initiatives (5,14) and one on immersion treatments (settings where participants remain in a controlled environment day and night) (10). The remainder focused on a variety of settings and approaches, and for the most part included both diet and physical activity components.

Within each systematic review, there was a great deal of heterogeneity among the studies. Specifically, variation was observed among the studies with regards to the types of initiatives or programs, comparison groups and outcomes reported. In fact, only two reviews focusing on lifestyle changes pooled results of included studies (1,11). Both meta-analyses reported significant decreases in the BMI of children and youth who underwent lifestyle treatment approaches (Table 5.3).

While some studies looked at children or youth only, many combined age groups. The sample size of children and youth varied greatly between studies (range: 10-3806), as did the length of treatment approaches (seven days to two years). Only one review targeted a specific population (Ikes, 2011 – African-American) (9).

Settings

Four reviews focused on lifestyle treatment approaches that were implemented in specific settings: primary care settings (17), Internet-based approaches (5,14) and immersion treatments (10).

Primary care: Lifestyle approaches to treat overweight and obese children can be done in a primary care setting or with the involvement of a primary health care professional. Primary care settings refer to physicians' offices, hospitals and clinics, or when the intervention is conducted by a primary health care professional (such as general practitioners, nurses, nutritionists and psychologists). Primary care professionals can provide individuals with the necessary encouragement, support and concrete information to effectively deliver obesity treatments to overweight and obese children and youth, while also informing and involving parents (20,21).

In the review conducted by Sargent et al. (17), studies looked at the effectiveness of treatment approaches in primary care settings (i.e., delivered by medical, nursing or allied health professionals, such as dietitians, exercise physiologists and counsellors). The approaches focused on children aged 3 to 11 years. Approaches varied in composition, and included motivation/support, counselling, education, physical activity sessions and/or dietary changes. Overall, Sargent found that approaches implemented in the primary care setting were successful at reducing the weight of overweight and obese children, but that success was more likely when the child had five or more contacts/visits with the health professional.

While primary care appears to be a promising setting for the treatment of overweight or obese children, no reviews included in this report assessed the effectiveness of primary care settings in youth. Thus, no conclusions can be made for the youth population from this review.

Internet-based: Reviews done by Nguyen et al. (14) and An et al. (5) evaluated interactive electronic media approaches as a means of treating overweight and obese children and youth. Approaches included Internet-based cognitive behavioural programs, weight loss e-learning, counselling and/or nutrition education. Results in the youth population were mixed, thus it is difficult to decipher whether or not such approaches successfully led to the reduction of anthropometric outcome measures in overweight or obese youth. No evidence was found for this approach in children.

Immersion treatment: Immersion treatments involve placing overweight and obese children and youth in therapeutic and educational environments for extended periods of time, thereby removing them from obesogenic environments. These treatment approaches include settings where participants remain

in a controlled environment day and night, such as residential summer camps and inpatient care centres.

In the review by Kelly et al. (10), immersion treatments included several components, such as diet, physical activity, nutrition/culinary education, therapy/support and weekend family involvement. The duration of immersion treatments ranged from three weeks to 10 months, and were found to be effective in reducing anthropometric outcome measures of 8- to 18-year-old children and youth. Follow-up post-immersion treatments ranged from four months to 3.6 years, and weight-loss maintenance varied. For example, during the follow-up period, some studies reported weight gain while others reported continued weight loss.

Key factors

Some reviews included studies that focused on specific lifestyle treatment factors that may be important to the treatment of children and youth who are overweight or obese.

Multi-component approaches: Although some reviews singled out specific treatment settings and strategies, most of the studies included within the reviews looked at lifestyle treatment approaches that involved several components. It is difficult to tease apart which components are fundamental to effectiveness. Results from the reviews suggest that taking a multi-component approach to treatment may be a key to success. In other words, treatments that incorporate several components (e.g., diet, physical activity, cognitive behavioural therapy, family involvement) are more likely to result in reductions in anthropometric outcome measures in overweight or obese children and youth than are treatment approaches that include only one component (e.g., diet only). The importance of multi-component approaches was also found for the effectiveness of child and youth overweight and obesity preventions interventions in Chapter 4.

In their reviews, Kitzmann et al. (11) and Ayliffe et al. (6) reviewed studies that were multi-component in nature, and included nutrition education, dietary plans, physical education, peer facilitation, problem-solving and family involvement. The studies took place in a variety of settings, including schools, sports centres, churches, primary care settings, research centres and camps, and their duration varied greatly. Positive results (e.g., decreases in the anthropometric outcome) were found across treatment settings; as well, similar results were observed in both brief and longer-term programs. Furthermore, Oude et al. (1) reported better anthropometric outcomes in both children and youth in studies that included multiple components versus those that focused primarily on a single behaviour.

Parental involvement: Parental involvement appears to be a key component in the treatment, but results from the reviews suggest that parental involvement may be more effective for children than youth. Oude et al. (1) pooled the results of studies that looked at lifestyle treatment approaches in children. Among approaches that were geared toward changing thinking patterns and actions, especially in relation to dietary intake, physical activity, sedentary behaviours, and the family's food and physical environment, the main consistent component of effective studies was parental involvement. Results showed a decrease in the BMI of children participating in parent-focused behavioural groups compared to standard care groups. Similarly, in their review, Ayliffe et al. (6) also noted that treatment approaches tended to result in greater reductions in anthropometric outcomes when they included a family component.

In the review conducted by Kitzmann-Ulrich et al. (12), all obesity treatment initiatives included family involvement. Overall, the review indicated that including positive parenting styles, training in parenting skills and child-management strategies, family functioning variables, targeting parental behavioural change and utilizing parents as conduits for family-level change was promising. However, the authors noted that, given the multi-component approach of the included studies, it was unclear which components were most likely to effect change (e.g., parental involvement, dietary education and physical activity opportunities).

Behavioural therapy: Behavioural therapy is a type of lifestyle approach aimed at changing thinking patterns and actions, especially in relation to dietary intake, physical activity, sedentary behaviours, and the family's food and physical environment. Several reviews concluded that behavioural therapy was a key component to successful weight loss in overweight or obese children and youth. It is thought that including therapy components may lead to added success in obesity treatment, as these help to develop and reinforce key self-regulatory skills such as self-monitoring. Therapy can also reduce negative emotional states and improve psychosocial functioning.

Oude et al. (1) found treatments that included a behavioural therapy component among other components (e.g., dietary plan) were more successful at attaining reductions in anthropometric outcomes in both children and youth compared to those studies that did not include a behavioural therapy component. Similarly, Kelly et al. (10) found that greater reductions in anthropometric outcomes occurred when treatments included cognitive behavioural therapy. Kelly also mentioned that studies including this therapy component tended to have longer follow-up periods, which may also have contributed to the greater body composition changes observed.

Decreased sedentary behaviour: While most studies that included a physical activity component were geared toward increasing the physical activity of overweight or obese children and youth, Lambiase's (13) review suggested that reducing sedentary behaviours may also be effective in reducing anthropometric outcomes. Sedentary behaviours encompass a distinct class of behaviours (e.g., sitting, watching television, playing video games) that are characterized by little physical movement and low energy expenditure (22). The results from his review suggested that reinforcing decreased sedentary behaviour through various methods, such as TV turn-offs, TV weekly limits, accumulating pedometer steps for TV privileges and changes to the home environment, all result in increased activity/play and decreased anthropometric outcomes.

Table 5.3: Summary of Meta-Analyses on the Effect of Lifestyle and Pharmaceutical Treatment Approaches

Review	Pooled data	Outcome measured	Pooled results	
			Lifestyle	Pharmaceutical
Czernichow, 2010 (7)	Pooled mean BMI reduction compared to placebo	BMI	▪ N/A	Sibutramine: ▪ -2.28 (95% CI: -2.81 to -1.76) Orlistat: ▪ -1.67 (95% CI: -3.52 to 0.18) Sibutramine + orlistat: ▪ -1.89 (95% CI: -2.73 to -1.06)
Kitzmann, 2010 (11)	Pooled average effect size in treatment-control comparisons	Averaged effect sizes across included studies	Weighted least square average effect size: ▪ d=0.41 (95% CI: 0.26 to 0.55)	▪ N/A
Oude, 2009 (1) (Cochrane Review)	Pooled mean difference of BMI-SDS or absolute BMI of program or treatment compared to standard care or placebo	BMI-Standard Deviation Score (SDS) or absolute BMI	BMI-SDS: ▪ Under 12 years: -0.06 (95% CI:-0.12 to 0.01) ▪ Over 12 years: -0.14 (95% CI: -0.17 to -0.12)	Absolute BMI: Sibutramine: ▪ Over 12 years: -1.66 (95% CI: -1.89 to -1.43) Orlistat: ▪ Over 12 years: -0.76 (95% CI: -1.07 to -0.44)
Park, 2009 (16)	Pooled mean BMI reduction compared to placebo	BMI	N/A	Metformin: ▪ -1.42 (95% CI -0.83 to -2.02)
Viner, 2010 (18)	Pooled mean BMI reduction compared to placebo	BMI	N/A	Sibutramine : ▪ -2.20 (95% CI: -1.57 to -2.83) Orlistat: ▪ -0.83 (95% CI: -0.47 to -1.19)

HEALTH CARE ENVIRONMENT

Social and Behavioural Interventions

Social and behavioural interventions provided or recommended by care providers have been described in the intersecting environment above. In the health care environment, interventions described primarily as clinical often included a secondary social and behavioural component.

Clinical Interventions

Pharmaceutical approaches

Within the systematic reviews assessing the effectiveness of pharmaceutical approaches to treat obesity, no studies were conducted among children. Four reviews looked at the effectiveness of using pharmaceuticals for the treatment of overweight or obese youth (7,8,16,18). In these reviews involving

youth, three drugs were reviewed: sibutramine, orlistat and metformin. One review included studies assessing all three drugs (1), three reviews included studies of sibutramine and orlistat only (7,8,18), and one review included studies looking at metformin only (16). Both orlistat and metformin are currently approved for use in Canada, while sibutramine was removed from the market in 2010 after clinical trials showed an increased risk of heart attacks and strokes in recipients of this drug (23). Orlistat and metformin are generally prescribed for obesity and diabetes, respectively, and are not widely prescribed as obesity medications in children and youth.

All five reviews (four meta-analyses, one systematic review) concluded that pharmaceuticals effectively reduced anthropometric outcomes of overweight and obese youth (Table 5.3). Most of the studies within the reviews also included diet and physical activity components, and it is not possible to determine how much of the weight loss occurred as a direct result of the pharmaceutical treatment.

Surgical approaches

Gastric banding is a procedure whereby a band is placed around the upper part of the stomach, creating a small pouch that can hold only a small amount of food. The narrowed opening between the stomach pouch and the rest of the stomach controls how quickly food passes from the pouch to the lower part of the stomach. This procedure helps the patient eat less by limiting the amount of food that can be eaten at one time and increasing the time it takes for food to be digested. Other surgical procedures to treat obesity include sleeve gastrectomy and Roux-en-Y gastric bypass.

While surgical procedures to treat obesity are becoming routine in adults, their use in children and youth is not yet widely employed. Only two systematic reviews (1,15) set out to assess the effectiveness of surgical procedures in children and youth. Of these, one review found no studies that met its inclusion criteria (1), while the other included only one small study with 50 youth (15).

In their review, Padwal et al. (15) concluded that gastric banding was useful for the reduction of obesity in youth. The single study in this review revealed substantial weight reduction in those who underwent gastric banding and lifestyle modifications compared to those who pursued lifestyle modifications only.

Other Outcomes

DIET, PHYSICAL ACTIVITY AND CLINICAL OUTCOMES

In addition to assessing anthropometric outcomes, some of the included studies within the reviews also assessed other outcomes, such as psychological (e.g., anxiety) and clinical (e.g., cholesterol) factors. Although the evidence for these other outcomes was sparse, as this was not the primary focus of these summarized reviews, the most commonly report outcomes are discussed below.

Lifestyle Approaches

Some of the studies within the reviews found that lifestyle approaches to treatment resulted in positive psychosocial outcomes where participants reported decreases in depression, anxiety and eating disorder symptoms, and increases in self-esteem, quality of life and global well-being (1,9,10). An increase in healthy behaviours was also reported, including increases in healthy eating and physical activity, and decreases in sedentary behaviour. Decreases in caloric intake and reductions in the number of meals consumed in front of the TV were also reported (5,9,11-14,17). There was also limited evidence suggesting that lifestyle approaches to treatment helped improve blood pressure, LDL cholesterol, total cholesterol and fasting insulin (17).

Pharmaceutical Approaches

The use of sibutramine resulted in a small improvement in triglyceride and high-density lipoprotein (HDL) levels (7,18), and the use of metformin resulted in small reductions in fasting insulin (16).

Surgical Approaches

Gastric banding resulted in improvements in metabolic syndrome prevalence and insulin sensitivity (15).

ADVERSE EFFECTS

All treatment approaches have the potential for adverse effects. For example, classifying individual children and youth as overweight or obese can result in stigmatization (24,25); however, none of the reviews mentioned this. In addition, none of the reviews mentioned adverse effects associated with lifestyle treatment approaches.

Adverse effects to pharmaceutical treatment approaches contributed to the relatively high attrition rates (20%) reported within the studies. Rates of attrition were similar between drugs. The most common side effects of each of the three studied drugs are:

- *Orilstat*: Gastrointestinal complaints, fatty stools, oily spotting, increased defecation, cramps, abdominal pain, decrease in estradiol in girls, gallstones, renal abnormalities, headache, upper respiratory tract infections, nasopharyngitis (1,8,18).
- *Sibutramine*: Dry mouth, constipation, dizziness, insomnia, hypertension, tachycardia, increased pulse rate, increased blood pressure, abdominal pain, rash (1,8,18).
- *Metformin*: Gastrointestinal complaints, abdominal discomfort, diarrhea (1,16).

Finally, the main adverse effect associated with the reviewed surgical procedure was the need for revisional surgeries (i.e., additional surgeries to correct complications), with over a quarter of patients requiring these procedures.

Furthermore, there is a risk of future nutrient deficiencies as a result of this treatment approach (26).

Discussion

Although the systematic reviews discussed within this chapter included many individual studies, given the heterogeneity of approaches and outcomes the included reviews did not provide any definitive conclusions about the single most effective treatment for child and youth overweight and obesity. Most treatment interventions are clinically focused; however, many use social and behavioural techniques to change dietary and physical activity behaviours. Results from the reviews provided some evidence that lifestyle approaches to treat children and youth who are overweight/obese can be successful in various settings (e.g., primary care, immersion) and that they are more successful when they include multiple components (e.g., diet, physical activity, therapy). The reviews also revealed that both pharmaceutical and surgical approaches seem promising in terms of anthropometric outcomes; however, there is insufficient evidence regarding their long-term safety and effectiveness. While weight loss was reported in all pharmaceutical and surgical reviews, no long-term follow-ups were completed to assess possible long-term health consequences and safety of the approaches. Furthermore, given the limited follow-up, whether or not changes in adiposity were maintained after discontinuing drug treatment was not reported.

When choosing a course of action to reduce childhood obesity through treatment approaches, factors such as the potential population impact should be considered (27). Because treatment approaches generally target individuals rather than populations, the potential population impact tends to be low when compared to other prevention initiatives. In order to prevent complications of obesity in children and youth, treatment approaches play a complementary role. Swinburn et al. (27) provide an approach for considering the potential population impact of obesity-related interventions. This approach was applied in Table 5.4, where an assessment of the certainty of effectiveness and potential population impact of each of the three reviewed treatment approaches is presented. The certainty of effectiveness was judged by the quality of the evidence and the strength of the program logic (i.e., the rationale and described pathways of effect based on theory and experience). Potential population impact accounted for efficacy (i.e., the impact of a treatment approach on important outcomes, including potential negative effects, quality of life and economic outcomes), reach (i.e., the absolute number, proportion and representativeness of individuals who are willing to participate) and uptake. The Table shows that lifestyle approaches for treating overweight/obese children and youth may have a moderate population impact, while also being moderately effective within the population of overweight/obese children and youth.

Table 5.4: Potential Population Impact

Certainty of effectiveness	Potential population impact within overweight/obese children and youth		
	Low	**Moderate**	**High**
High			
Moderate	▪ Pharmaceutical	▪ Lifestyle	
Low	▪ Surgical		

Limitations

This review has several limitations to note when interpreting the findings. First, only systematic reviews published in 2009 and onward were included; however, the included reviews consisted of individual studies published prior to 2009. Second, only reviews published in English were included, although some reviews included individual studies that were published in other languages. The individual reviews also had notable limitations. According to the AMSTAR score, the quality of the included reviews was generally not high (average score was 5 out of 11). The quality of the included reviews must be taken into consideration when interpreting the reported effectiveness, given that bias can be introduced when important methodological items, such as comprehensive literature search strategy, inclusion of grey literature, assessment of publication bias and conflict of interest disclosure, are not part of the systematic review protocol.

Additionally, the studies included within the reviews had a high degree of heterogeneity. In general, studies had varying sample sizes (range: 8-3806) and consisted mainly of Caucasian populations from developed nations, somewhat limiting the generalizability of findings to children and youth in Ontario, which has a diverse ethnic makeup. Studies also tended to be very heterogeneous, making direct comparisons of research results difficult. In addition, most of the studies revealed positive benefits (e.g., weight loss), which possibly reflects publication bias (i.e., null or negative studies were less likely to be published and, therefore, less likely to be included). There was also a large range in terms of follow-up duration (one week to two years) making it difficult to identify whether or not the observed weight changes were maintained after the treatment approach was completed. Finally, none of the studies examined the effectiveness of treatment approaches in preschool-aged children.

Conclusions

The systematic reviews that were synthesized in this chapter of the report highlight the true complexity of treating overweight or obese children and youth. Based on the potential population impact and the results of the included reviews, lifestyle approaches may be the preferred course of action for overweight and obese children and youth, especially those that include many components (e.g., diet, physical activity, behavioural therapy and parental involvement) and that offer continued support. Pharmaceutical and/or surgical approaches to treatment can also be effective. However, the long-term safety and effectiveness of such treatment approaches is not well studied, and several short-term adverse effects have been reported.

References

(1) Oude Luttikhuis H, Baur L, Jansen H, Shrewsbury VA, O'Malley C, Stolk RP, Summerbell CD. Interventions for treating obesity in children. Cochrane Database Syst Rev 2009;(1)(1):CD001872.

(2) Shea BJ, Grimshaw JM, Wells GA, Boers M, Andersson N, Hamel C, Porter AC, Tugwell P, Moher D, Bouter LM. Development of AMSTAR: a measurement tool to assess the methodological quality of systematic reviews. BMC Med Res Methodol 2007 [cited 2013 Jun 26];7:10. Available from: http://www.biomedcentral.com/1471-2288/7/10

(3) IOM (Institute of Medicine). Accelerating progress in obesity prevention: Solving the weight of the nation. Washington, DC: National Academies Press, 2012 [cited 2013 Jun 26]. p. 6. Available from: http://books.nap.edu/catalog.php?record_id=13275

(4) Zaza S, Briss PA, Harris KW. The guide to community preventive services: What works to promote health? New York, NY: Oxford University Press, Inc; 2005.

(5) An JY, Hayman LL, Park YS, Dusaj TK, Ayres CG. Web-based weight management programs for children and adolescents: a systematic review of randomized controlled trial studies. ANS Adv Nurs Sci 2009;32(3):222-240.

(6) Ayliffe B, Glanville NT. Achieving healthy body weight in teenagers: evidence-based practice guidelines for community nutrition interventions. Can J Diet Pract Res 2010;71(4):e78-86.

(7) Czernichow S, Lee CM, Barzi F, Greenfield JR, Baur LA, Chalmers J, Woodward M, Huxley RR. Efficacy of weight loss drugs on obesity and cardiovascular risk factors in obese adolescents: a meta-analysis of randomized controlled trials. Obes Rev 2010;11(2):150-158.

(8) Garcia Diaz E, Martin Folgueras T. Systematic review of the clinical efficacy of sibutramine and orlistat in weight loss, quality of life and its adverse effects in obese adolescents. Nutr Hosp 2011;26(3):451-457.

(9) Ickes MJ, Sharma M. A review of childhood obesity prevention interventions targeting African American children. Vulnerable Child Youth Stud 2011;6(1):103-123.

(10) Kelly KP, Kirschenbaum DS. Immersion treatment of childhood and adolescent obesity: the first review of a promising intervention. Obes Rev 2011 [cited 2013 Jun 26];12(1):37-49. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2009.00710.x/pdf

(11) Kitzmann KM, Dalton WT,3rd, Stanley CM, Beech BM, Reeves TP, Buscemi J, Egli CJ, Gamble HL, Midgett EL. Lifestyle interventions for youth who are overweight: a meta-analytic review. Health Psychol 2010;29(1):91-101.

(12) Kitzman-Ulrich H, Wilson DK, St George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clin Child Fam Psychol Rev 2010;13(3):231-253.

(13) Lambiase M. Treating pediatric overweight through reductions in sedentary behavior: a review of the literature. J Pediatr Health Care 2009;23(1):29-36.

(14) Nguyen B, Kornman KP, Baur LA. A review of electronic interventions for prevention and treatment of overweight and obesity in young people. Obes Rev 2011 [cited 2013 Jun 26];12(5):e298-314. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2010.00830.x/pdf

(15) Padwal R, Klarenbach S, Wiebe N, Hazel M, Birch D, Karmali S, Sharma AM, Manns B, Tonelli M. Bariatric surgery: a systematic review of the clinical and economic evidence. J Gen Intern Med 2011;26(10):1183-1194.

(16) Park MH, Kinra S, Ward KJ, White B, Viner RM. Metformin for obesity in children and adolescents: a systematic review. Diabetes Care 2009;32(9):1743-1745.

(17) Sargent GM, Pilotto LS, Baur LA. Components of primary care interventions to treat childhood overweight and obesity: a systematic review of effect. Obes Rev 2011 [cited 2013 Jun 26];12(5):e219-35. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2010.00777.x/pdf

(18) Viner RM, Hsia Y, Tomsic T, Wong IC. Efficacy and safety of anti-obesity drugs in children and adolescents: systematic review and meta-analysis. Obes Rev 2010;11(8):593-602.

(19) Kitzman-Ulrich H, Wilson DK, St George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clin Child Fam Psychol Rev 2010;13(3):231-253.

(20) Barlow SE, Dietz WH. Obesity evaluation and treatment: Expert committee recommendations. Pediatrics 1998;102(3):e29-e29.

(21) Perrin EM, Finkle JP, Benjamin JT. Obesity prevention and the primary care pediatrician's office. Curr Opin Pediatr 2007;19(3):354-361.

(22) Tremblay MS, Leblanc AG, Janssen I, Kho ME, Hicks A, Murumets K, Colley RC, Duggan M. Canadian sedentary behaviour guidelines for children and youth. Appl Physiol Nutr Metab 2011;36(1):59-64; 65-71.

(23) James WP, Caterson ID, Coutinho W, Finer N, Van Gaal LF, Maggioni AP, Torp-Pedersen C, Sharma AM, Shepherd GM, Rode RA, Renz CL, SCOUT Investigators. Effect of sibutramine on cardiovascular outcomes in overweight and obese subjects. N Engl J Med 2010 [cited 2013 Jun 26];363(10):905-917. Available from: http://www.nejm.org/doi/pdf/10.1056/NEJMoa1003114

(24) Puhl R. Weight stigmatization toward youth: a significant problem in need of societal solutions. Childhood Obesity 2011;7(5):359.

(25) Puhl R, Brownell KD. Ways of coping with obesity stigma: review and conceptual analysis. Eat Behav 2003;4(1):53-78.

(26) Shankar P, Boylan M, Sriram K. Micronutrient deficiencies after bariatric surgery. Nutrition 2010;26(11-12):1031.

(27) Swinburn B, Gill T, Kumanyika S. Obesity prevention: a proposed framework for translating evidence into action. Obes Rev 2005;6(1):23-33.

6. Cost-Effectiveness of Interventions to Prevent or Treat Obesity in Children and Youth: A Review

Summary

Childhood obesity is considered a major public health problem, and action is needed to reduce current obesity rates and prevent future cases. However, there is a scarcity of funds for public health interventions and, thus, the results of cost-effectiveness analyses are important to guide decision-making. Cost-effectiveness analysis is a form of economic evaluation in which the costs and health benefits of two interventions are compared (1). This section of the report summarizes the results of a literature search performed to determine the cost-effectiveness of interventions to prevent or treat child and youth overweight/obesity. The literature search yielded a total of 22 cost-effectiveness evaluations of obesity interventions that were conducted within four main environments: one in the message environment (2), ten in the school environment (3-10), two in the physical activity environment (11,12) and nine within the health care environment (13-19). Two additional studies assessed how much could be invested in childhood obesity interventions in general.

Results suggest that there are both prevention and treatment interventions that meet acceptable cost-effectiveness thresholds, and these interventions occur in a variety of settings:

- **Cost saving:** ban on TV advertising of high-fat/high-sugar foods (2), education to reduce TV viewing (3-5), education to reduce soda consumption (3-5), a multifaceted school-based peer-led program (3-5), a multifaceted school-based program with active physical education (3-5), family-based therapy with general practitioner (GP) follow-up (4-6) and group therapy (17)
- **Highly cost-effective:** three multifaceted school-based programs (CATCH (6), Planet Health (7) and a program without active physical education (3-5)), bariatric surgery (13), drug therapy (3-5) and a GP-mediated targeted intervention (LEAP) (14)
- **Cost-effective:** active transport education program (TravelSMART) (8) and physical activity-based Active After-School Community Program (12)
- **Not cost-effective:** active transport to school (Walking School Bus) (9)
- **More costly with no benefits:** two GP-mediated targeted interventions (LEAP (16) and LEAP2 (15))

Assessments of obesity interventions showed that, given the high costs of obesity-related diseases and probability of progression from childhood obesity to adulthood obesity, a large investment in childhood obesity prevention is cost-effective. The major limitation of included studies was the lack of conclusive evidence on the effectiveness of obesity interventions evaluated, which has led to inconclusive results on the cost-effectiveness of interventions, such as GP-mediated interventions. The results should be interpreted with caution, as there was often a high degree of uncertainty around the costs and effects of interventions. Additionally, no economic evaluations were performed on obesity interventions for children and youth within Canada, so it is difficult to comment on the transferability of the summarized results to the Canadian context.

Introduction

Cost-effectiveness analysis is a form of economic evaluation where the costs and health benefits of two interventions are examined (1). Given that a large proportion of obese children go on to become obese adults (20,21), and given the high medical costs associated with obesity co-morbidities (22), preventing and treating childhood obesity is likely to lead to considerable savings in future medical costs. The purpose of this literature review was to determine the cost-effectives of interventions to prevent or treat overweight or obesity in children and youth aged zero to 19.

Methods

Literature Search Strategy

A librarian-assisted literature search of multiple databases was conducted in May 2012. The search of electronic databases combined the following three concepts: child, obesity and cost. The search was limited to primary research articles published between January 2000 and April 2012. Appendix 4 provides a detailed description of the methods, including the search strategy.

Study Selection

To be included in the review, articles had to report the results of an economic evaluation comparing an intervention for the prevention or treatment of childhood overweight and obesity to an alternative intervention or no intervention. The target population of the studies had to be children and youth aged 0 to 19 years, but they could universally target children and youth of all weights or focus only on children and youth with healthy weights or those who were already overweight or obese. Effectiveness had to be measured or modelled with anthropometric outcomes, such as change in Body Mass Index, BMI z-score, weight, waist circumference, hip circumference, or prevalence of overweight or obesity. Finally, articles had to be published in English and describe research in countries comparable to Canada (i.e., developed countries such the U.S., the U.K. and Europe).

One reviewer independently screened titles and abstracts against these inclusion and exclusion criteria, and a second reviewer validated these results.

Quality Assessment and Data Extraction

For all reviews that met the inclusion criteria, overall methodological quality was evaluated with a checklist for assessing economic evaluations, as outlined in *Methods for the Economic Evaluation of Health Care Programmes 2nd Edition* (1). For data extraction purposes, a standardized table was created to summarize the intervention, costs, effects, incremental cost-effectiveness ratio (ICER) and sensitivity analyses (Appendix 5).

The interventions reviewed were categorized by the macro-level environment they target (i.e., food and beverage, physical activity, school, health care, and message environments) (23) and intervention type (i.e., policy and environmental, social and behavioural or clinical) (24) , although not all environments and interventions types were represented in this literature. Finally, where applicable, interventions were categorized by the setting (i.e., micro-level environment) where they are conducted.

Assessment of Cost-Effectiveness

Threshold values based on the cost per outcome gained are often used to determine whether an intervention is considered cost-effective or not. Since the 1990s, a threshold of $50,000 per quality-adjusted life-year (QALY) gained has been widely used to classify interventions as cost-effective in the U.S. and many other jurisdictions, including Canada (25). A threshold of £30,000 per QALY gained is commonly used in the U.K. (25). In Canada, a range rather than a single cut-off has been suggested, where interventions costing less than CAN$20,000 are considered highly cost-effective, and between CAN$20,000 and CAN$100,000 per QALY cost-effective (26). Finally, the WHO's Choosing Interventions that are Cost-Effective Collaboration (WHO-CHOICE) suggests threshold values based on gross domestic product (GDP) to categorize the relative cost-effectiveness of interventions: an intervention is considered "highly cost-effective" when it is less than GDP per capita per Disability-Adjusted Life-Year (DALY) averted; an intervention is "cost-effective" when it is between one and three times GDP per capita per DALY averted;

and an intervention was "not cost-effective" when it was more than three times GDP per capita per DALY averted (27).

This review assesses cost-effectiveness of child and youth overweight and obesity interventions across a variety of countries and outcomes (QALYs, DALYs). To ensure consistency across countries, threshold values suggested by WHO-CHOICE were chosen for this report, recognizing that DALYs and QALYs are different measures of health-adjusted life-years. However, the threshold of "less than GDP per capita per DALY averted" is consistent with commonly used thresholds using QALY as effectiveness measure (USD$50,000/QALY in the U.S., CAN$20,000-100,000/QALY in Canada and £30,000/QALY in the U.K.). It is also noted that a threshold of three times GDP per capita is high (CAN$119,281/DALY in 2012) and, therefore, interventions at this level are likely to be considered unaffordable. The one-time GDP per capita is, therefore, considered a more desirable threshold than the three times GDP per-capita threshold. Given the arbitrary nature of the thresholds used commonly today, they remain controversial and should be used only for general guidance, as opposed to hard and fast decision rules for funding. Constant GDP for each country in the year of costing was obtained from the World Economic Outlook Database compiled by the International Monetary Fund (28). Interventions were also described as dominant and dominated, as necessary. A dominant intervention is less costly and more effective than a comparator, whereas a dominated intervention is more costly yet less effective than a comparator (1).

Results

Results of the Literature Search

The search of the electronic databases identified 2,045 articles (Table 6.1 and Figure 6.1). After an initial screening for relevance of titles and abstracts, 158 publications were determined to be eligible for screening against inclusion criteria. A total of 49 articles were selected to have their full text assessed for eligibility, and 20 met the inclusion criteria. Of these 20 articles, 15 reported a single economic evaluation of an intervention to reduce child and youth overweight/obesity (2,6-19). The economic evaluations of an additional seven interventions were described in two overview or methods papers and one report (3-5). Two studies reported on cost-effectiveness without naming specific intervention(s) that would prevent or treat overweight and obesity, but rather set a target for reduction and assessed how much could be spent on intervention activities while staying within the cost-effective range (29,30).

Table 6.1: Electronic Database Search Results

Sources	No. of titles
MEDLINE (Ovid)	812
EMBASE (Ovid)	559
Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects (DARE), NHS Economic Evaluation Database, and Health Technology Assessments (EBSCO)	213
EconLit	454
Canadian Agency for Drugs and Technology in Health (CADTH)	7
TOTAL	**2,045**

Figure 6.1: Flow Diagram of Study Selection Process

Study and Intervention Characteristics

The literature search yielded a total of 22 obesity interventions that were conducted within four main environments: message (2), school (3-10), physical activity (after-school settings) (11,12), and health care (13-19). Two studies presented an economic analysis without naming a specific intervention, to assess how much could be invested in childhood obesity interventions in general. A total of nine different interventions were targeted to children who were already overweight or obese (all eight health care interventions and one school-based intervention). The remaining interventions, set in school, after-school and message environments, had a population-based focus and did not select by weight status. Only two interventions were focused on obesity reduction among youth (ages 13-18) and both were in the health care setting (drug therapy and surgery). Two interventions targeted both children and youth (reduction in TV advertising in the message environment and family versus parent-only therapy in the health care environment). The remaining interventions focused solely on primary school-aged children (ages 5-12).

Table 6.2 presents the main methodological limitations for each economic evaluation. The most common methodological limitation was conducting an economic evaluation on an intervention that had been shown to be ineffective or had only limited evidence of effectiveness. Many studies did not identify all costs and consequences associated with the invention and its effects. Additionally, not all studies took into account uncertainty around the parameters used in the models (estimates for the costs and effects usually follow a range or probability distribution). For further details on study limitations, see the discussion and the data extraction table in Appendix 5.

Of the 22 interventions included in this summary, 13 were analysed by the Assessing Cost-Effectiveness (ACE)-Obesity working group from Australia (2-5,8,9,12-14). The cost-effectiveness of these interventions was assessed from a societal perspective. Each study reported cost-effectiveness as the cost per disability-adjusted life year (DALY) prevented using the same method of costing (reported as AUD in 2001) and calculation of DALYs, with a consistent set of assumptions, enabling cost-effectiveness comparisons across interventions. To date, no individually published, complete cost-effectiveness analysis report is available for seven of the 13 interventions assessed by the ACE-Obesity working group. However, some methods, costs, incremental costs, incremental effects and the incremental cost-effectiveness ratios for these interventions have been reported for three aggregate papers (3-5). It was, therefore, possible to extract sufficient information about the cost-effectiveness of these interventions to include them in this summary. Given that there is no write-up of the full methodology used in these studies and complete results and conclusions, the full quality checklist could not be applied, yet any known limitations were summarized in Table 6.2. Most ACE-Obesity studies were of high quality, given that they followed common standards for economic evaluations. However, many of these economic evaluations focused on interventions that have no definitive evidence of effectiveness for the prevention or treatment of childhood and youth overweight and obesity.

The other nine studies were set in the U.S. (6,7,11,17,19), Australia (15,16), New Zealand (10) and Finland (18). These studies reported cost-effectiveness as the cost per health outcome for a variety of measures, such as quality-adjusted life-years (QALYs) saved, kilograms of weight gain prevented, 1% reduction of body fat, 1% decrease in weight for height, one-point reduction in BMI-Standard Deviation Score (SDS), BMI difference and BMI z-score difference. The quality of these studies was mixed. The quality of the two economic evaluations that did not name a specific intervention was very high.

A variety of time horizons were used among the studies, and this affects the comparability of the economic evaluations. All ACE-Obesity studies and one economic analysis that did not name a specific intervention calculated the incremental benefits over the individual's or cohort's lifetime (or to 100 years) (4,29). Two studies calculated the incremental benefits of health care cost savings over 25 years for ages 40 to 65 (6,7), and one study calculated costs until age 55 (30), whereas others did not assess incremental costs and incremental benefits over a longer time horizon, and only reported the immediate costs and benefits (10,11,15-19). The perspective used in the evaluation also affects the comparability of these evaluations. Most studies used a societal perspective, while two studies used the health care payer perspective (15,18). Differences in how costs were calculated from a societal perspective were also observed, with some assessments accounting for productivity losses (7), whereas others accounted for aspects such as parent

time and costs to all sectors, but not productivity losses (2-5,8,9,12-14).

Additionally, the cost-effectiveness evaluations presented are only as valid as the structural validity of the assumptions used in modelling. For example, in many studies it was assumed that 100% of the BMI reduction is maintained, although this has not been proven (2-9,12-14). Further details on the perspective used in the evaluation, assumptions, time horizon, and the costs and effects included in the models are available in the data extraction table in Appendix 5.

Table 6.2: Limitations of Included Reviews by Targeted Environment

	Study	Intervention	Major Limitations
Message	Magnus, 2009 (2)	Ban on TV advertising[+]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified/measured appropriately
School	ACE-Obesity working group (3-5)	Education to reduce TV viewing[++]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified
	ACE-Obesity working group (3-5)	Education to reduce consumption of fizzy drinks[++]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified
	ACE-Obesity working group (3-5)	Targeted multifaceted school-based program[++]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified
	ACE-Obesity working group (3-5)	Multifaceted school-based intervention with active physical education[++]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified
	Brown, 2007 (6)	CATCH (Coordinated Approach to Child Health)	▪ Not all costs and effects identified ▪ Some allowances for uncertainty of estimates
	Wang, 2003 (7)	Planet Health	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified ▪ Some uncertainty included in estimates
	ACE- Obesity working group (3-5)	Multifaceted school-based intervention without active physical education[++]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified
	Moodie, 2011 (8)	TravelSMART Schools Curriculum[+]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified
	Moodie, 2009 (9)	Walking School Bus[+]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified
	McAuley, 2010 (10)	APPLE (A Pilot Program for Lifestyle and Exercise)	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified ▪ Costs not adjusted for differential timing ▪ No allowances for uncertainty of estimates
After-School	Moodie, 2010 (12)	Active After-School Communities (AASC) program[+]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified
	Wang, 2008 (11)	FitKid Project	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified ▪ Costs not adjusted for differential timing ▪ No allowances for uncertainty of estimates

Table 6.2 Limitations of Included Reviews by Targeted Environment – Cont'd

	Study	Intervention	Major Limitations
Health Care	Ananthapavan, 2010 (13)	LAGB Surgery[+]	▪ Did not provide full description of baseline intervention ▪ Not all costs and effects identified
	ACE-Obesity working group (3-5)	Orlistat therapy[++]	▪ Not all costs and effects identified
	Moodie, 2008 (14)	LEAP (Live, Eat and Play)[+•]	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified
	Wake, 2008 (16)	LEAP (Live, Eat and Play)[•]	▪ Limited evidence of effectiveness ▪ Costs not adjusted for differential timing ▪ Incremental analysis not done ▪ Some uncertainty included in estimates
	Wake, 2009 (15)	LEAP2	▪ Limited evidence of effectiveness ▪ Costs not adjusted for differential timing ▪ Incremental analysis not done ▪ Some uncertainty included in estimates
	ACE- Obesity working group (3-5)	Targeted family-based program[++]	▪ Not all costs and effects identified
	Goldfield, 2001 (17)	Group versus mixed family-based therapy	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified ▪ Costs not valued credibly ▪ Costs not adjusted for differential timing ▪ Incremental analysis not done
	Kalavainen, 2009 (18)	Group versus routine individual therapy	▪ Not all costs and effects identified ▪ Costs not valued credibly ▪ Costs not adjusted for differential timing
	Janicke, 2009 (19)	Parent-only versus family-based group interventions	▪ Limited evidence of effectiveness ▪ Not all costs and effects identified/measured appropriately ▪ Incremental analysis not done
Undefined	Trasande, 2010 (30)	Undefined intervention	▪ Effectiveness not established (given no specific intervention assessed)
	Ma, 2011 (29)	Undefined intervention	▪ Effectiveness not established (given no specific intervention assessed)

Note: Studies conducted by the ACE-Obesity working group in Australia are denoted with a [+] and [++]. These 13 interventions were analysed for cost-effectiveness with the same protocol, allowing for comparison.

[+] ACE-Obesity evaluations published as individual study; [++] ACE-Obesity evaluations with some data available from Carter, 2009, Haby, 2006, Victorian Government Department of Human Services, 2006 (3-5). Checklist could not be applied to these interventions because full text version of analysis was not available, but any known limitations were reported.

[•] Moodie, 2008 (14) scales up results of the small trial published by Wake, 2008 (16) to a country-wide approach in Australia

Cost-Effectiveness of Interventions by Environment

The incremental costs per outcome and cost-effectiveness rating based on the WHO-CHOICE thresholds for each intervention are displayed in Table 6.3. Under the assumptions used in the economic evaluations, seven interventions were dominant (less costly and more effective than a comparator) (2-5,17), six were "highly cost-effective" (3-7,11,13,14), two were "cost-effective" (8,12), one was "not cost-effective"(9), and two were dominated (more costly and less effective than a comparator) (15,16). Due to the types of outcome measurements reported, cost-effectiveness could not be determined for four studies (10,11,18,19).

MESSAGE ENVIRONMENT

Policy and Environmental Interventions

One study assessed the cost-effectiveness of an intervention that would adapt the message environment

to reduce childhood obesity. This study modelled the health benefits and cost-effectiveness of a ban on television advertisements for high-fat and high-sugar food and beverages directed at children in Australia (2). In the Australian context, this intervention was found to be dominant compared to the current practice of no intervention. None of the simulated incremental cost-effectiveness ratios (ICERs) were more than AUD$10/DALY prevented (in 2001). Based on the sensitivity analysis, this intervention would remain cost-effective even if the BMI reduction eroded over time, if more staff were needed, or if up to $2 billion of ad revenue and sales were lost. Although it is likely that this intervention is effective, there is limited data on its effect on BMI reduction, so a conservative approach was taken and uncertainty built around this parameter (as with others).

SCHOOL ENVIRONMENT

Social and Behavioural Interventions

The cost-effectiveness of 10 school-based interventions was assessed (3-10), and all were social and behavioural interventions focusing on either dietary or physical activity/sedentary behaviours. Four of these interventions were found to be dominant (two programs were focused around education on health behaviours, and two were multifaceted programs) (3-5). The intervention to reduce TV viewing was conducted by classroom teachers, and found to have a health gain of 8,600 DALYs prevented and a median cost savings of AUD$44 million (in 2001) (3-5). Although this intervention had more than a 98% chance of being dominant, the authors reported that there was inconclusive evidence of the intervention's effectiveness. An intervention to reduce soft drink consumption was conducted in the classroom by non-teacher program workers. Authors reported a health gain of 5,000 DALYs prevented and a median cost savings of AUD$26 million (in 2001) (3-5). It should be noted that the uncertainty interval around these estimates contains a chance of the intervention being dominated (8%). One multifaceted program was delivered by teachers in the classroom and focused on both nutrition and physical activity education, and had a physical activity component (3-5). The cost-effectiveness analysis found a health gain of 8,000 DALYs prevented and a median cost savings to be AUD$14 million (in 2001). It had a 95% chance of being dominant, but no uncertainty interval was reported. The other multifaceted school-based program was a peer-based program that had an overall cost savings of AUD$1.3 million (in 2001) with a health gain of 360 DALYs prevented (3-5). The authors reported that the intervention had a 91% chance of being dominant, but did not report the uncertainty interval.

Three school-based interventions were found to be "highly cost-effective" (3-7). One multifaceted program was delivered by teachers in the classroom setting and focused on both nutrition and physical activity education, but had no additional physical activity component (3-5). The incremental cost of the invention was AUD$6,000/DALY prevented for children (in 2001), but the uncertainty interval contained both dominant (14.7% chance) and dominated estimates (5.3% chance). The intervention was more cost-effective for girls (AUD$13,000/DALY prevented) than boys (AUD$40,000/DALY prevented). The CATCH program had an interdisciplinary curriculum, modified school food service and incorporated a family-/home-based element (6). This program cost USD$900/QALY saved (in 2004) and had a net benefit of USD$68,125 (program costs minus the productivity and medical costs). Authors reported that these estimates were robust to model parameter changes, but sensitive to the discount rate. Planet Health was an interdisciplinary curriculum-based initiative where education on physical activity and healthy eating were incorporated into major subject areas and physical education classes (7). This program cost USD$4,305/QALY saved (in 1996) and had a net benefit of USD$7,313. The authors reported that these estimates were robust to model parameter changes, as all estimates in the uncertainty interval were "highly cost-effective" (UI: $1,612; $9,010). However, the cost-effectiveness was sensitive to the discount rate and teacher stipend amount.

Two school-based interventions focused on children's transport to school (8,9). TravelSMART Schools (8) promoted active transport to school through a classroom curriculum. It was found to be "cost-effective" at AUD$117,000/DALY prevented (in 2001), but the uncertainty interval ranged from dominated to "highly cost-effective." Sources of uncertainty were the costs for coordinators, number of schools that would be recruited and effectiveness. The Walking School Bus program (9), which coordinated walks to school with adult volunteers, was not found to be cost-effective at AUD$0.76 M/DALY prevented (in 2001). All ICER estimates in the uncertainty interval fell in the "not cost-effective" range; however, sensitivity analysis showed that increasing the proportion of students who were new to active transport, reducing costs and

improving capacity could make the intervention "cost-effective" or "highly cost-effective."

The last school-based intervention focused on physical activity and nutrition (APPLE-A Pilot Program for Lifestyle and Exercise) (10). Compared to no intervention, the incremental cost per kilogram of weight gain prevented was NZ$1,708 in seven year olds and NZ$664 in 13 year olds (2006). This analysis did not take into account future health costs and, because cost per QALYs or DALYs was not reported, it was not possible to determine the cost-effectiveness based on WHO-CHOICE thresholds.

PHYSICAL ACTIVITY ENVIRONMENT

Social and Behavioural Interventions

Cost-effectiveness was reported for two interventions conducted primarily within the physical activity environment (11,12), and both were social and behavioural interventions targeting physical activity behaviour.

After-school settings

Both physical activity environment interventions were conducted within after-school settings. The Active After-School Communities program (12) focused on physical activity organized by coordinators who developed programs specific to the individual after-school location. This intervention was found to be "cost-effective" at AUD$82,000/DALY prevented (in 2001) compared to the current practice of no intervention. However, the uncertainty interval ranged from "highly cost-effective" to "not cost-effective" (UI: $40,000; $165,000). Sources of uncertainty around the cost-effectiveness measure were related to the amount of grant funding and number of children enrolled per location. The intervention could potentially be considered "highly cost-effective," if all participants were previously inactive.

The other after-school program (FitKid Project) was designed to fill children's after-school hours with physical activity, but also included a healthy snack and academic enrichment component (11). The costs of this program were compared to the costs of usual after-school care, without accounting for future health care costs. It was found that the incremental cost of the program was USD$417/1 per cent reduction in body fat (in 2003). There was uncertainty around the actual costs of usual after-school care. As this study did not report the incremental cost per QALY or DALY, conclusions about the cost-effectiveness could not be made.

HEALTH CARE ENVIRONMENT

Clinical Interventions

To date, cost-effectiveness assessments have been completed on nine interventions within the health care environment (3-5,13-19). All nine interventions were clinical, and targeted children and youth who were already overweight or obese.

Primary care and hospital settings

Five of these interventions were set in primary care or hospital settings, and three were found to be "highly cost-effective," including laparoscopic adjustable gastric banding (LAGB) (13), Orlistat therapy (5) and GP-mediated secondary prevention (14). LAGB surgery cost AUD$4,400/DALY prevented (in 2001) with a small uncertainty interval and with all estimates within the "highly cost-effective" range (UI: $2,900; $6,120) (13). There was a small variation in patients' resource use and around the cost of the LAP-BAND system. The study found that patients would have to regain about 80% of weight previously lost before this intervention was no longer "highly cost-effective". Orlistat therapy cost AUD$8,000/DALY prevented (in 2001) with all estimates within the uncertainty interval falling in the "highly cost-effective" range (UI: $3,000; $30,000) (3-5). No information on sensitivity analyses was given. Off-sets were based on future savings on health sector expenditure due to obesity-related disease, but costs caused by adverse effects and co-morbidities associated with drug and surgical treatment of obesity were not included.

Three studies looked at the effect of a general practitioner (GP)-mediated secondary prevention intervention. The results of one study suggest that this type of intervention is "highly cost-effective," with an incremental cost of AUD$4,670/DALY prevented (in 2001) (14). However, there was uncertainty around the intervention costs and effectiveness, and the uncertainty interval included "dominated," "highly cost-effective" and "not cost-effective" estimates. This evaluation was a scaled-up model of a small trial of the LEAP intervention (16), which did not find any significant BMI improvements, and, because the intervention was more costly than the alternative, the intervention was considered dominated (16). Another economic evaluation of the GP-mediated secondary prevention intervention (LEAP 2 trial) also found the intervention had a higher cost and no effect (15).

Therapy-based interventions

Counselling or therapy was the central component of four interventions. Two therapy-focused interventions were found to be dominant (less costly and more or equally effective). In the assessment of the targeted family-based therapy program with GP follow-up compared to no intervention (5), overall cost savings were AUD$4.1 million (in 2001) with a total of 5,000 DALYs prevented. Although the authors reported that there was a narrow uncertainty range and an 83% chance of the intervention being dominant, the uncertainty interval was not reported. Group therapy focusing on changing diet and physical activity habits compared to only group therapy and individual therapy (17) was also found to be dominant, but there was no difference in effect. Future health costs were not incorporated, and the authors did not evaluate the cost-effectiveness of the two therapy regimes against current practice. Two studies that focused on counselling did not report the incremental cost per QALY or DALY, and no conclusions about the cost-effectiveness of parent-only versus family-based group therapy (19) and group therapy versus routine counselling (18) can be made. The incremental cost per one-point decrease in BMI-SDS of group sessions conducted by nutritionists/dieticians (with separate sessions for parents) compared to routine individual therapy conducted by school nurses was €2,750 (in 2004) (18). Family-based counselling was more expensive and produced a greater decrease of BMI z-scores compared to parent-based counselling only, but the authors did not report the incremental costs (19).

Table 6.3: Cost-Effectiveness of Obesity Interventions by Targeted Environment

	Study	Intervention	Incremental cost per unit outcome measure	Cost-effectiveness‡
Message	Magnus, 2009 (2)	Ban on TV advertising+	Dominant	Dominant
School	ACE-Obesity (3-5)	Education to reduce TV viewing++	Dominant	Dominant
	ACE-Obesity (3-5)	Education to reduce consumption of fizzy drinks++	Dominant	Dominant
	ACE-Obesity (3-5)	Targeted multifaceted school-based program (peer-based)++	Dominant	Dominant
	ACE-Obesity (3-5)	Multifaceted school-based intervention with active physical education++	Dominant	Dominant
	Brown, 2007 (6)	CATCH (Coordinated Approach to Child Health)	USD$900/QALY saved	Highly cost-effective
	Wang, 2003 (7)	Planet Health	USD$4,305/QALY saved	Highly cost-effective
	ACE-Obesity (3-5)	Multifaceted school-based intervention without active physical education++	All children: AUD$6,000/DALY prevented Girls: AUD$13,000/DALY prevented Boys: AUD$40,000/DALY prevented	Highly cost-effective
	Moodie, 2011 (8)	TravelSMART Schools Curriculum+	AUD$117,000/DALY prevented	Cost-effective
	Moodie, 2009 (9)	Walking School Bus+	AUD$0.76 M/DALY prevented (UI: $0.23 M; $3.32 M)	Not cost-effective
	McAuley, 2010 (10)	APPLE (A Pilot Program for Lifestyle and Exercise)	7 year olds: NZ$1,708/kg of weight gain prevented 13 year olds: NZ$664/kg of weight gain prevented	NA

Table 6.3: Cost-Effectiveness of Obesity Interventions by Targeted Environment – Cont'd

	Study	Intervention	Incremental cost per unit outcome measure	Cost-effectiveness‡
After-School	Moodie, 2010 (12)	Active After-School Communities (AASC) program+	AUD$82,000/DALY prevented (UI: $40,000; $165,000)	Cost-effective
	Wang, 2008 (11)	FitKid Project	USD$417/ 1% body fat reduction	NA
Health Care	Ananthapavan, 2010 (13)	LAGB Surgery+	AUD$4,400/DALY prevented (UI: $2,900; $6,120).	Highly cost-effective
	ACE-Obesity (3-5)	Orlistat therapy++	AUD$8,000/DALY prevented (UI: $3,000; $30,000)	Highly cost-effective
	Moodie, 2008 (14)	LEAP (Live, Eat and Play)+•	AUD$4670/DALY prevented	Highly cost-effective
	Wake, 2008 (16)	LEAP (Live, Eat and Play)•	Dominated	Dominated
	Wake, 2009 (15)	LEAP2	Dominated	Dominated
	ACE-Obesity (3-5)	Targeted family-based program++	Dominant	Dominant
	Goldfield, 2001 (17)	Group versus mixed family-based therapy	Dominant	Dominant
	Kalavainen, 2009 (18)	Group versus routine individual treatment	€2,750/1 point decrease of BMI-SDS	NA
	Janicke, 2009 (19)	Parent-only versus family-based group interventions	NR	NA

Notes: All interventions are compared to no intervention unless specifically stated. Studies conducted by the ACE-Obesity working group in Australia are denoted with a + and ++. These 13 interventions were analysed for cost-effectiveness with the same protocol, allowing for comparison. +ACE-Obesity evaluations published as individual study; ++ ACE-Obesity evaluations with some data available from Carter, 2009, Haby, 2006, Victorian Government Department of Human Services, 2006 (3-5).

• Moodie, 2008 (14) scales up results of the small trial published by Wake, 2008 (16) to a country-wide approach in Australia

‡ Cost-effectiveness definitions: *Dominant* - less costly and more effective; *Dominated* - more costly and less effective; *Highly cost-effective* - less than GDP per capita per QALY or DALY; *Cost-effective* – 1-3 x GDP per capita per QALY or DALY; *Not cost-effective* -more than 3 x GDP per capita per QALY or DALY.

Economic Evaluations of Unidentified Interventions

Two articles were identified that conducted an economic evaluation without assessing a particular intervention (29,30). The objective of both studies was to determine the maximum expenditure/investment at which obesity interventions to prevent and treat obesity would be cost-effective. Mathematical modelling was used to project future economic gains associated with reducing childhood obesity in the U.S. The authors used the best available evidence in the current literature to estimate the proportion of currently obese children who will become obese adults and the health costs associated with obesity among those obese adults.

Trasande (30) found that spending USD$2 billion per cohort or USD$1,526 per child (in 2005) on obesity interventions would be cost-effective from the health care payer perspective (based on a ratio of USD$50,000/QALY saved), if it reduced obesity prevalence among 12 year olds by 1%. When varying the discount rate and cost per QALY in the sensitivity analysis, the cost-effective investment for a reduction in obesity by 1% among 12 year olds could range from USD$572 million to USD$21 billion. Reductions later in childhood produced higher health care cost offsets and QALYs saved so more expensive interventions would be affordable in the older age groups. Ma and Frick (29) reported that from a health payer perspective, if childhood obesity prevalence was reduced by 1%, a total of USD$1.4 (7- to 12-year olds) to USD$1.7 billion (0-6 and 13- to 18-year olds) (in 2006) per birth cohort could be spent on obesity interventions. This is the break-even point, where intervention costs equal savings on future health costs. If obesity can be reduced by 1%, it is affordable to spend USD$280 to USD$339 per child on population-based interventions and USD$1,648 to USD$2,735 per child on targeted

interventions (focus only on obese children). Due to the lower prevalence of obesity in younger age groups, interventions aimed at younger age groups need to be more effective than those targeting older children. Therefore, it may be more cost saving to use targeted interventions among young children (ages 0 to 6) and a population-based approach may be better for older youth, given the higher obesity rate and problems with stigma and feasibility. Both studies concluded that large investments were cost-effective, given the large economic consequences of childhood obesity.

Discussion

Although there is an extensive body of literature on the effectiveness of interventions to reduce overweight and obesity among children and adults, there are relatively few economic assessments of these interventions. Only 20 evaluations of interventions and two assessments of obesity interventions in general were found with a systematic and comprehensive search strategy. The results suggest that there are both prevention and treatment interventions that meet acceptable cost-effectiveness thresholds, and these interventions occur in a variety of environments and settings. A total of seven interventions were found to be dominant or cost saving: a ban on TV advertising of high-fat/high-sugar foods (2), education to reduce TV viewing (3-5), education to reduce soda consumption (3-5), a school-based peer-led program (3-5), a multifaceted school-based program with active physical education (3-5), a family-based therapy with GP follow-up (3-5) and group therapy (17). A total of six interventions were found to be "highly cost-effective" by WHO-CHOICE standards: three multifaceted school-based programs (CATCH) (6), Planet Health (7), a program without active physical education (3-5), bariatric surgery (13), drug therapy (3-5) and a GP-mediated targeted intervention (14). Two interventions were assessed to be "cost-effective" by WHO-CHOICE standards: an active transport education program (TravelSMART) (8)) and the physical-activity-based Active-After-Schools Community Program (12).

Three interventions were not found to meet cost-effectiveness thresholds. One intervention, an active transport to school program (Walking School Bus (9)) was found to be "not cost-effective." Two interventions were found to be more costly and provided equal or fewer health benefits than the alternative (no intervention); both were GP-mediated targeted interventions (LEAP (16) and LEAP2 (15)). Due to reporting and health outcome measurement, cost-effectiveness could not be categorized for four of the 20 interventions (10,11,18,19).

Simulation modelling of the cost-effectiveness of obesity interventions in general suggests that, given the high costs associated with adult obesity and the probability of progression from childhood obesity to adulthood obesity, investing in childhood interventions makes economic sense. Large investments in obesity interventions would be cost-effective from a health care payer perspective (29,30).

None of the cost-effectiveness assessments were conducted in a Canadian setting, so caution must be taken when trying to generalize the results of this synthesis to the Canadian context. Differences in health care and educational systems, culture, current practice of obesity prevention and treatment, population size and obesity rates between jurisdictions affect the transferability of the results (3). Despite this, a majority of interventions were assessed in the Australian context, and there are a number of similarities between Australia and Canada, such as universal health care systems, Aboriginal populations, the rural/urban divide and childhood obesity prevalence. Some degree of generalizability of the Australian results to the Canadian context may be appropriate, although it is not possible to evaluate this from the information captured in this synthesis. Alternatively, both studies that assessed the cost-effectiveness of obesity interventions in general to reduce the prevalence of obesity by 1% were modelled with the American population. Health care costs are typically higher in the U.S. compared to Canada, so the level of affordability of obesity interventions may be lower in Canada.

It is important to note that the perspective of the economic evaluation may affect the classification of the intervention within cost-effectiveness categories. An intervention that is cost-effective from a societal perspective, where productivity losses are prevented and factors other than health status are included in the calculation of the benefits, may not be cost-effective from a health payer perspective, where only saved health care costs are included. All included studies only assessed cost-effectiveness from one perspective, which was generally societal; however, some studies used the health care payer perspective and would, therefore, be more conservative estimates of cost-effectiveness (15,18).

Strengths

The strengths of this review include the systematic search strategy used to capture over a decade of economic evaluations on interventions to reduce overweight and obesity among children and youths. This review is the most comprehensive review found to date. Some previous reviews have focused on specific age groups (31), did not search or include results from the grey literature (32,33), or were commentaries that did not use a systematic search strategy (34). In this review, interventions were not restricted by target age, population, weight status, intervention type or intervention setting. Additionally, this review used results found in the grey literature, primarily the cost-effectiveness results for the seven interventions assessed by the ACE-Obesity working group that have not been reported on as individual peer-reviewed articles to date (5).

Limitations

The foremost limitation of the economic evaluations included in this review was that many of the interventions assessed have not been proven to be effective or the literature provides only limited evidence of effectiveness. For example, two studies assessed a GP-mediated treatment intervention [LEAP (16) and LEAP2 (15)], which involved four consultations with a GP over 12 weeks, delivered to parents of overweight or obese children. Both these studies found that this intervention was dominated by the alternative (no intervention) as it was more costly, but did not produce any significant differences. However, Moodie et al. (14) applied the effects of this small, short-duration LEAP trial to all overweight and obese children in Australia, and this assessment yielded a "highly cost-effective" categorization. The authors suggested that the non-significant results were potentially a product of the small study size or the Hawthorne effect, but didn't include a discussion on their rationale to extrapolate these results to the Australian population. This calls into question the practice of generalizing the results of small trials with little follow-up to populations beyond the study population. However, most authors have been transparent when the intervention's effectiveness has not been conclusively established. Additionally, as there is no consensus on the most effective interventions to reduce obesity, authors use the best evidence available to determine the costs and effects.

To facilitate the assessment of interventions in a wide variety of environments, the ACE-Obesity research team created methods to predict BMI changes based on physical activity and diet changes (3). This allowed for cost-effectiveness evaluations to be conducted on interventions where effectiveness has not been measured with anthropometric outcomes and among interventions where BMI change has not yet been assessed. For example, to assess the cost-effectiveness of a ban on TV advertising for high-fat and sugar foods directed at children, the most relevant study to model effectiveness was an RCT that assessed food choice after reduced advertising (2). Changes in food choices were modelled to changes in BMI and subsequently converted to DALYs. Although the authors found that all estimates would be cost saving, the inconclusive evidence of effectiveness (primarily from cross-sectional and longitudinal evidence) and assumptions made to model BMI changes must be kept in mind.

Modelling was also used to determine the influence of uncertainty around cost and effect on the cost-effectiveness estimate. Results of the cost-effectiveness analysis should be interpreted with calculated uncertainty intervals in mind, as several interventions found to be cost-effective had uncertainty intervals that included not cost-effective or dominated estimates. The validity of cost-effectiveness results relies on the structural validity of modelling assumptions. In many studies, it was assumed that 100% of the BMI reduction is maintained (2-9,12-14). Although the authors reported that this assumption was likely false, there was insufficient evidence to model potential subsequent BMI gains (based on the short follow-up often reported in effectiveness studies). The DALY benefit would be lower if the BMI benefit was not maintained and would be reduced to zero if BMI reduction was completely lost (3).

All economic evaluations conducted by the ACE-Obesity project followed the same protocol to assess costs and benefits of obesity interventions, which allowed for valid comparison across these interventions. However, it is difficult to compare economic evaluations across research groups, given differential reporting of outcomes, perspectives, time horizons, and cost and effect calculations. Four studies did not report the incremental cost per DALY prevented or QALY saved, making it hard to compare these interventions with the current body of literature (10,11,18,19). It is also unclear what the public health significance of the outcomes reported in these studies is (incremental cost/kilogram of weight gain prevented, incremental cost/1% of body fat reduction, etc.).

Studies that evaluated the cost-effectiveness of

undefined interventions provide insight into how much could be spent on childhood obesity interventions from the health payer perspective, but it is important to note that there are limitations to the approaches used. The validity of these analyses rests on the validity of assumptions made within the models. Assumptions were made using the available evidence in the current literature, but as more longitudinal data on childhood obesity become available, the estimates may change. The studies used different time horizons to calculate future health costs, which may account for differences in estimates: Trasande (30) calculated costs to age 55, and Ma and Frick (29) calculated lifetime costs. Neither study accounted for losses to productivity due to adult obesity. Ma and Frick (29) did not factor in quality of life into their analysis. If these factors were accounted for, it would likely be cost-effective to invest more in early interventions. As the literature has not provided conclusive evidence on the most effective interventions, it will be important to identify an intervention or set of interventions that can produce the modelled one-percentage-point reduction in obesity.

It is also important to understand the limitations of the review. This review included studies published between January 2000 and April 2012. Studies published prior to 2000 would not have been retrieved and are therefore missing from this summary. However, hand-searching of reference lists of included studies and systematic/narrative reviews did not return any additional cost-effectiveness assessments. Although the literature was systematically searched, a single reviewer was responsible for determining study eligibility, data extraction and quality assessment. Therefore, this summary of the cost-effectiveness literature should not be considered a systematic review. Although there have been several reports of ineffective (15,16) and not cost-effective (9) obesity interventions, the majority of the interventions included in this synthesis were in the cost-effective range, suggesting that publication bias may exist. The literature summarized in this review focused on childhood obesity interventions, which used or modelled a weight outcome measure to assess the intervention's effectiveness (BMI, weight, percentage overweight, etc.). We are, therefore, unable to comment on the cost-effectiveness of interventions that aim to improve dietary habits and physical activity levels, which may, in turn, lead to a prevention and reduction of overweight and obesity.

Research Gaps

All economic evaluations were conducted from one perspective, most often the societal perspective. Given the different priorities of the various stakeholders concerned with the objective of reducing childhood obesity, it would be advantageous for future evaluations to assess cost-effectiveness from both the health care payer and societal perspectives. None of the economic evaluations that met the inclusion criteria were performed on interventions to reduce overweight and obesity among children and youth within Canada, although one excluded study reported on the costs of a school-based program in Nova Scotia (35). As discussed above, there may be some degree of generalizability of the Australian cost-effective results; however, it will be important to incorporate economic evaluations into any future childhood obesity interventions implemented in Canada.

Conclusions

The results suggest that there are both prevention and treatment interventions that meet acceptable cost-effectiveness thresholds, and these interventions occur in a variety of environments and settings (message, school, after-school and health care). Assessments of obesity interventions in general show that, given the high costs of obesity-related diseases and probability of progression from childhood obesity to adulthood obesity, a large investment in childhood obesity prevention is cost-effective. The major limitation of included studies was the lack of conclusive evidence on the effectiveness of obesity interventions evaluated, and results should be interpreted with caution as there was often a high degree of uncertainty around the costs and effects of interventions. Additionally, no economic evaluations were performed on interventions within Canada, so it is difficult to comment on the transferability of the summarized results to the Canadian context.

References

(1) Drummond MF, O'Brien B, Stoddart GL, Torrance GW. Methods for the economic evaluation of health care programmes. 2nd ed. New York, NY: Oxford University Press; 1997.

(2) Magnus A, Haby MM, Carter R, Swinburn B. The cost-effectiveness of removing television advertising of high-fat and/or high-sugar food and beverages to Australian children. Int J Obes (Lond). 2009;33(10):1094-1102.

(3) Haby MM, Vos T, Carter R, Moodie M, Markwick A, Magnus A, Tay-Teo KS, Swinburn B. A new approach to assessing the health benefit from obesity interventions in children and adolescents: the assessing cost-effectiveness in obesity project. Int J Obes (Lond). 2006;30(10):1463-1475.

(4) Carter R, Moodie M, Markwick A, Magnus A, Vos T, Swinburn B, Haby MM. Assessing cost-effectiveness in obesity (ACE-obesity): an overview of the ACE approach, economic methods and cost results. BMC Public Health. 2009;9:419.

(5) Victorian Government Department of Human Services. ACE-obesity assessing cost-effectiveness of obesity interventions in children and adolescents: summary of results. Melbourne, Australia: State of Victoria; 2006 [cited 2013 Jun 26]. Available from: http://docs.health.vic.gov.au/docs/doc/0AE260B1268E0450CA257B2C000F9178/$FILE/ace_obesity.pdf

(6) Brown HS,3rd, Perez A, Li YP, Hoelscher DM, Kelder SH, Rivera R. The cost-effectiveness of a school-based overweight program. Int J Behav Nutr Phys Act. 2007;4:47.

(7) Wang LY, Yang Q, Lowry R, Wechsler H. Economic analysis of a school-based obesity prevention program. Obes Res. 2003;11(11):1313-1324.

(8) Moodie M, Haby MM, Swinburn B, Carter R. Assessing cost-effectiveness in obesity: active transport program for primary school children--TravelSMART Schools Curriculum program. J Phys Act Health. 2011;8(4):503-515.

(9) Moodie M, Haby M, Galvin L, Swinburn B, Carter R. Cost-effectiveness of active transport for primary school children – Walking School Bus program. Int J Behav Nutr Phys Act. 2009;6:63.

(10) McAuley KA, Taylor RW, Farmer VL, Hansen P, Williams SM, Booker CS, Mann JI. Economic evaluation of a community-based obesity prevention program in children: the APPLE project. Obesity (Silver Spring). 2010;18(1):131-136.

(11) Wang LY, Gutin B, Barbeau P, Moore JB, Hanes J,Jr, Johnson MH, Cavnar M, Thornburg J, Yin Z. Cost-effectiveness of a school-based obesity prevention program. J Sch Health. 2008;78(12):619-624.

(12) Moodie ML, Carter RC, Swinburn BA, Haby MM. The cost-effectiveness of Australia's Active After-School Communities program. Obesity (Silver Spring). 2010;18(8):1585-1592.

(13) Ananthapavan J, Moodie M, Haby M, Carter R. Assessing cost-effectiveness in obesity: laparoscopic adjustable gastric banding for severely obese adolescents. Surg Obes Relat Dis. 2010;6(4):377-385.

(14) Moodie M, Haby M, Wake M, Gold L, Carter R. Cost-effectiveness of a family-based GP-mediated intervention targeting overweight and moderately obese children. Econ Hum Biol. 2008;6(3):363-376.

(15) Wake M, Baur LA, Gerner B, Gibbons K, Gold L, Gunn J, Levickis P, McCallum Z, Naughton G, Sanci L, Ukoumunne OC. Outcomes and costs of primary care surveillance and intervention for overweight or obese children: the LEAP 2 randomised controlled trial. BMJ. 2009;339:b3308.

(16) Wake M, Gold L, McCallum Z, Gerner B, Waters E. Economic evaluation of a primary care trial to reduce weight gain in overweight/obese children: the LEAP trial. Ambul Pediatr. 2008;8(5):336-341.

(17) Goldfield GS, Epstein LH, Kilanowski CK, Paluch RA, Kogut-Bossler B. Cost-effectiveness of group and mixed family-based treatment for childhood obesity. Int J Obes Relat Metab Disord. 2001;25(12):1843-1849.

(18) Kalavainen M, Karjalainen S, Martikainen J, Korppi M, Linnosmaa I, Nuutinen O. Cost-effectiveness of routine and group programs for treatment of obese children. Pediatr Int. 2009;51(5):606-611.

(19) Janicke DM, Sallinen BJ, Perri MG, Lutes LD, Silverstein JH, Brumback B. Comparison of program costs for parent-only and family-based interventions for pediatric obesity in medically underserved rural settings. J Rural Health. 2009;25(3):326-330.

(20) Freedman DS, Khan LK, Serdula MK, Dietz WH, Srinivasan SR, Berenson GS. The relation of childhood BMI to adult adiposity: the Bogalusa Heart Study. Pediatrics. 2005;115(1):22-27.

(21) Whitaker RC, Wright JA, Pepe MS, Seidel KD, Dietz WH. Predicting obesity in young adulthood from childhood and parental obesity. N Engl J Med. 1997;337(13):869-873.

(22) Anis AH, Zhang W, Bansback N, Guh DP, Amarsi Z, Birmingham CL. Obesity and overweight in Canada: an updated cost-of-illness study. Obes Rev. 2010;11(1):31-40.

(23) Glickman D, Parker L, Sim LJ, Cook HDV, Miller EA. Accelerating progress in obesity prevention: solving the weight of the nation. Washington, DC: National Academies Press; 2012 [cited 2013 Jun 26]. p. 6. Available from: http://www.iom.edu/Reports/2012/Accelerating-Progress-in-Obesity-Prevention.aspx

(24) Zaza S, Briss PA, Harris KW. The guide to community preventive services: what works to promote health? New York, NY: Oxford University Press; 2005 [cited 2013 Jun 26]. Available from: http://www.thecommunityguide.org/library/book/index.html

(25) Grosse SD. Assessing cost-effectiveness in healthcare: history of the $50,000 per QALY threshold. Expert Rev Pharmacoecon Outcomes Res. 2008;8(2):165-178.

(26) Laupacis A, Feeny D, Detsky AS, Tugwell P. How attractive does a new technology have to be to warrant adoption and utilization? Tentative guidelines for using clinical and economic evaluations. CMAJ. 1992;146(4):473.

(27) World Health Organization. CHOosing Interventions that are Cost Effective (WHO-CHOICE): cost-effectiveness thresholds. Geneva, Switzerland: World Health Organization; 2012 [cited 2012 May 21]. Available from: http://www.who.int/choice/costs/CER_thresholds/en/index.html

(28) International Monetary Fund. World economic outlook database. Washington, DC: International Monetary Fund; 2011 [cited 2012 May 21]. Available from: http://www.imf.org/external/pubs/ft/weo/2011/02/weodata/index.aspx

(29) Ma S, Frick KD. A simulation of affordability and effectiveness of childhood obesity interventions. Acad Pediatr. 2011;11(4):342-350.

(30) Trasande L. How much should we invest in preventing childhood obesity? Health Aff (Millwood). 2010;29(3):372-378.

(31) Bond M, Wyatt K, Lloyd J, Welch K, Taylor R. Systematic review of the effectiveness and cost-effectiveness of weight management schemes for the under fives: a short report. Health Technol Assess. 2009;13(61):1-75, iii.

(32) John J, Wolfenstetter SB, Wenig CM. An economic perspective on childhood obesity: recent findings on cost of illness and cost effectiveness of interventions. Nutrition. 2012 Sep;28(9):829-39.

(33) John J, Wenig CM, Wolfenstetter SB. Recent economic findings on childhood obesity: cost-of-illness and cost-effectiveness of interventions. Curr Opin Clin Nutr Metab Care. 2010;13(3):305-313.

(34) Cawley J. The cost-effectiveness of programs to prevent or reduce obesity: the state of the literature and a future research agenda. Arch Pediatr Adolesc Med. 2007;161(6):611-614.

(35) Ohinmaa A, Langille JL, Jamieson S, Whitby C, Veugelers PJ. Costs of implementing and maintaining comprehensive school health: the case of the Annapolis Valley Health Promoting Schools program. Can J Public Health. 2011;102(6):451-454.

Part C: Who is Taking Action: Jurisdictional and Ontario Public Health Unit Scans

Governments, PHUs and non-government agencies have shown leadership in developing and implementing strategies and initiatives for obesity prevention in children and youth. This part of the report provides an overview of strategies and initiatives that have been implemented by these organizations.

In each chapter, the integrated Evidence Review Framework described in Chapter 1 (Figure 1.1) was used to group interventions and guide the structure. Specifically, each section is organized according to the recently released framework from the Institute of Medicine (IOM), which identified five key intersecting environments to prevent childhood obesity (1). The strategies, initiatives and activities identified through the jurisdictional scan and Ontario public health unit scan are further classified as either policy and environment interventions or social and behavioural interventions (2). For each environment, a table of example initiatives is provided, and these initiatives are categorized, where possible, by the type of intervention, life-course stage and setting to highlight the diversity of activities recommended and conducted in reviewed jurisdictions.

References

(1) IOM (Institute of Medicine). Accelerating progress in obesity prevention: solving the weight of the nation. Washington, DC: National Academies Press; 2012 [cited 2013 Jun 26]. p.6. Available from: http://books.nap.edu/catalog.php?record_id=13275

(2) Zaza S, Briss PA, Harris KW. The guide to community preventive services: what works to promote health? New York, NY: Oxford University Press; 2005 [cited 2013 Jun 26]. Available from: http://www.thecommunityguide.org/library/book/index.html

7. Jurisdictional Scan of Obesity-Related Strategies and Initiatives

Summary

To understand how other jurisdictions have addressed childhood obesity, a scan of strategies and initiatives adopted in several states and provinces, countries and WHO regions was completed. The search yielded 28 documents describing government strategies, as well as jurisdiction-wide initiatives, such as childhood obesity prevention programs. The strategies and initiatives seek to reduce obesity in children or the whole population by influencing these environments, either through policy and environmental changes or through social and behavioural interventions. Most jurisdictions are engaged in activities to influence the broader food and beverage environments, physical activity environments or both simultaneously. These interventions include community education programs on healthy eating and physical activity, encouraging the food industry to reformulate products to be healthier, and adopting urban planning policies that promote active transportation.

Many jurisdictions have identified school environments as important settings for childhood obesity prevention. Interventions targeting these settings include improving nutrition and physical education in schools, increasing active play in child care settings and increasing access to drinking water in schools. Health care and work environments have also been identified as important settings for supporting healthy eating and physical activity for infants, children and youth, and adults. Interventions in these settings include promoting supportive workplaces for breastfeeding, and providing weight screening and management services through the health care system. Jurisdictional strategies and initiatives also often included efforts to influence the broader message environments. Common interventions include voluntary and regulatory means to reduce the marketing of unhealthy foods to children, and social marketing campaigns to promote healthy eating and physical activity.

In addition to these interventions, most jurisdictions are engaged in a number of leadership, capacity-building and other enabling activities to support an overall obesity prevention strategy. These activities include providing funding, developing multi-sectoral and multi-level partnerships, and surveillance and monitoring systems.

The documents reviewed represented a wide range of jurisdictions and approaches for addressing obesity in children and youth. However, because the literature search sought to capture initiatives focused specifically on obesity prevention, initiatives that focused solely on improving obesity risk and protective factors, such as healthy eating and physical activity, may have been overlooked. In addition, only English- and French-language documents were reviewed, further limiting results.

Although Ontario does not yet have a comprehensive childhood obesity strategy, the province is already engaged in some strategies and initiatives that were frequently supported by jurisdictions included in this scan. Various initiatives across several provincial ministries are currently in place, and the knowledge, expertise and leadership from these and other stakeholders can help inform the development and implementation of future childhood obesity reductions strategies.

Introduction

To understand how jurisdictions have approached the challenge of overweight and obesity in children and youth, a scan was conducted of strategies and activities adopted in a variety of domestic and international jurisdictions, including states and provinces, countries and WHO regions.

Methods

Literature Search

A library-assisted search of government strategies and/or jurisdiction-wide initiatives was completed in April and May 2012. A detailed description of the literature search strategy is provided in Appendix 4. In summary, the jurisdictional scan was completed through a general search and two targeted Internet searches. One independent reviewer screened the literature against inclusion criteria and a second reviewer validated the results.

To be included in the review, the literature had to describe a jurisdiction-wide strategy initiative geared toward the prevention of childhood obesity. Strategies and initiatives could target obesity in children or the whole population, as many jurisdictions are taking a universal approach to obesity prevention. The jurisdiction had to be at the regional, country, state or provincial level. Finally, articles had to be published in English or French, and describe research in countries comparable to Canada (i.e., developed countries such as Canada, the U.S., the U.K. and Europe).

Given the limited amount of time available for the completion of this review, it was not possible to do an individual search for each jurisdiction that would be comparable to Canada, so an initial general search was used to narrow down the number of reports. The general and initial targeted searches identified 135 reports. This was used to help formulate the search strategy for the second targeted search, which yielded 21 documents to be reviewed for the scan. An additional seven documents were found through "pearl growing" (i.e., using a relevant source, such as a seminal report, to identify keywords, themes and descriptors for use in subsequent searches) for a total of 28 documents.

The strategies and initiatives found in the literature search were categorized by the macro-level environment they target (i.e., food and beverage, physical activity, school, health care and work, and message environments) (1), and intervention type (i.e., policy and environmental or social and behavioural) (2). Finally, where applicable, initiatives and strategies were categorized by the life stage they target (i.e., infant/early childhood, children and youth, and parents) and the settings (i.e., micro-level environment) where they are conducted.

Results

Characteristics of Reviewed Reports

A total of 28 documents were reviewed, reflecting 21 initiatives from 17 jurisdictions (Europe (Eur), eight countries [Australia (Aus), Canada (Can), Denmark (Den), England (Eng), New Zealand (NZ), Scotland (Scot), Spain, United States (US)], and eight states and provinces [Alberta (AB), Arkansas (Ark), British Columbia (BC), New South Wales (NSW), Newfoundland (NF), Nova Scotia (NS), Ontario (ON), Quebec (QC)]). Initiatives in about half of these jurisdictions targeted children and youth, while the other half targeted the whole population. Two jurisdictions, Australia and England, have recently shifted their national strategies to a whole-population approach, rather than focusing exclusively on children (for these countries, both strategies were included in this jurisdictional scan) (3-6). Within their strategies, most jurisdictions directed their efforts at improving energy balance in their respective target populations, and included interventions directed at policy and environmental change. All of the strategy documents reviewed were from 2003 to 2012; however, most were from 2008 to 2012.

Food and Beverage Environments

Most jurisdictions examined in this review included interventions directed at food and beverage environments. Common activities include the delivery of community education programs on healthy eating, policies to increase the availability of healthy foods, and community-level initiatives to promote healthy eating and reduce food insecurity. A summary of these interventions is presented in Table 7.2.

POLICY AND ENVIRONMENTAL INTERVENTIONS

Most of the jurisdictions included in the scan were working to make changes to the broader food environment to enable healthy eating. For most jurisdictions, efforts at policy and environmental changes to the food environments targeted the whole population, rather than children and youth only. In addition to the activities described below, a number of policy and environmental interventions targeting child care and school settings are described later. Policy and environmental interventions to support infant nutrition through breastfeeding promotions are also described.

Many jurisdictional strategies included efforts to enable people to make healthier food choices by increasing the availability and accessibility of healthier foods at the community level or throughout the whole jurisdiction. Strategies for Quebec, Australia, the U.S. and other jurisdictions included actions to encourage the food industry to improve the nutritional quality of foods produced through reduced portion sizes or reformulation of existing products (4,5,7-11). A number of jurisdictional strategies also included the introduction of economic policies, such as price controls, economic incentives and tax policies, as a way to increase the availability and accessibility of healthy foods (5,8,12). For example, the U.S. White House Task Force on Obesity recommended that incentives be provided to the food industry to increase the production of healthier foods (8).

Some jurisdictions also included interventions intended to limit the availability of unhealthy foods in communities. In their strategies, both England and Scotland identified the need to reduce access to unhealthy foods served at quick-serve restaurants (by limiting the number of such outlets in the community, or locations near places frequented by children and youth) as a possible action for addressing obesity (3,4,7).

A number of jurisdictions included efforts to reduce food insecurity as part of their obesity strategies (7,8,11-13). These actions included providing financial support to low-income and vulnerable groups, addressing food deserts in urban, rural and remote communities (areas that lack access to affordable healthy food) and supporting local food initiatives such as farmers' markets. Many identified priority populations, such as indigenous people, geographically remote and low-income communities as target populations for initiatives addressing food insecurity (8,9,11,12,14).

SOCIAL AND BEHAVIOURAL INTERVENTIONS

In addition to policy and environmental interventions targeting the food and beverage environment, some initiatives included interventions geared toward influencing eating behaviours. The bulk of social and behavioural interventions captured in the jurisdictional scan were located within the school setting and are described in more detail under "School Environments." Interventions addressing breastfeeding are also described in a subsequent section of this jurisdictional scan (see "Health Care and Work Environments"). The scan captured a number of social and behavioural interventions delivered at the community level or the wider jurisdiction. Some jurisdictions targeted nutrition-related behaviours in children and parents through efforts to increase knowledge about healthy eating and to improve food skills (7,9,10,13,15). This type of approach was taken by EPODE (Ensemble Prévenons l'Obesité des Enfants – Together Let's Prevent Childhood Obesity), a program that originated in France but has since been taken up by 500 communities in six countries (16,17). In one participating French community, for example, children engage in the planting, harvesting and consumption of fruits in order to stimulate their interest in and exposure to healthy foods (16).

Table 7.2: Summary of Initiatives Targeting Food and Beverage Environments

Life stage	Policy and environmental changes	Social and behavioural programs/ initiatives
Infant, early childhood	▪ None	**No setting specified** ▪ Provide young children with exposure to new fruits (Eur)
Children and youth	**No setting specified** ▪ Increase availability of healthy foods for children in all settings (Can, Den) ▪ Improve nutrition of foods sold near schools or places where children frequent (Den, Scot)	**No setting specified** ▪ Increase children's knowledge of healthy eating (Den, Eur) ▪ Increase food skills (Den, Eur, Spain) ▪ Increase exposure to new fruits, vegetables and other healthy foods (Eur)
Parents	▪ None	**No setting specified** ▪ Educate parents about child and/or adult nutrition (Scot, Spain, BC) ▪ Enhance parental food skills (BC, NS)
All	**Macro-environment** ▪ Encourage industry to offer healthier foods through reformulation, reduced portion size, etc. (Eng, Aus, Scot, Spain, US, NS, ON, QC) ▪ Consider economic policies to increase access to healthy foods and provide incentives for healthy eating (QC, Aus, Can, US) ▪ Provide assistance to low-income individuals and families and/ or those in the north (Can, Eng, US) ▪ Improve living conditions of Indigenous people to provide basic amenities (cooking facilities, etc.) (Aus) ▪ Community ▪ Support community efforts to limit the number of fast-food outlets (Eng, Scot) ▪ Support community food security/food skills initiatives (farmers' markets, community gardens, etc.) (Can, Scot, BC, QC, US) ▪ Eliminate food deserts/improve access to healthy foods in urban, rural and/or remote areas (Aus, Can, ON, QC, US) ▪ Reduce food insecurity, especially in vulnerable populations (NL, NS, QC) ▪ Enhance food skills for vulnerable populations (NL)	▪ None

Physical Activity Environments

Most of the jurisdictional initiatives examined in this scan included interventions directed at creating or enhancing environments that support physical activity. Common interventions included promoting active travel to and from school and work, increasing access to sports and recreation facilities, and promoting reduced screen time among children and youth. Details of these initiatives are provided in Table 7.3.

POLICY AND ENVIRONMENTAL INTERVENTIONS

Most of the jurisdictions reviewed were working to make changes to the broader environment, in order to enable physical activity and reduce sedentary behaviours. A number of jurisdictions, including Australia, the U.S., Quebec and Ontario, identified urban planning, expansion of the cycling and pedestrian infrastructure, and parking policies as potential vehicles for enabling physical activity. Particularly common were planning, transportation and community design policy interventions to ensure that environments are conducive to safe, active travel to and from school and work (3,4,6,8,11,13,18).

Initiatives from England, the U.S., New South Wales, Quebec and other jurisdictions include interventions geared toward increasing access to recreation facilities and parks for children or the whole population (3,8,11,13,19). The U.S. strategy, for example, included a recommendation to increase the number of safe, accessible parks, especially in low-income communities, as an intervention to increase physical activity in the population (8).

SOCIAL AND BEHAVIOURAL INTERVENTIONS

In addition to policy and environmental interventions, some initiatives included interventions geared toward increasing physical activity and reducing sedentary behaviours through the delivery of community programs intended to change individual behaviours. A common intervention found in a number of jurisdictions, including Ontario, was the delivery of community programs to reduce children's screen time (3,6,9,20). A few jurisdictional initiatives, including EPODE, include efforts to increase children's participation in sports and physical activity at the community level (rather than in school settings) (12,15). The bulk of the social and behavioural interventions captured in the jurisdictional scan were located within the school setting and are described in subsequent sections of this jurisdictional scan.

Table 7.3: Summary of Initiatives Targeting Physical Activity Environments

Life stage	Policy and environmental changes	Social and behavioural programs/ initiatives
Infant, early childhood	▪ None	**Community** ▪ "Baby Gym" program to provide venue for parents to engage in physical activities with their young children (Eur)
Children and youth	**Community** ▪ Create supportive environment for safe, active travel to and from school (Aus, Eng, US, BC, QC, ON) ▪ Increase sports opportunities or access to community sites for recreation (US, BC, QC, NSW, Eng) ▪ Increase opportunities for sports for children in deprived areas (Eng)	**No setting specified** ▪ Programs to reduce children's screen time (Aus, Eng, NS, US-school) ▪ Increase children's participation in sports/ physical activity (QC, Can, Den, Eur)
Parents	▪ None	▪ None
All	**Community** ▪ Create environments that support safe daily physical activity and active transportation through urban planning and infrastructure (Aus, Den, Eng, NZ, Scot, Spain, US, NSW, NS, ON, BC, QC) ▪ Increase access to sports facilities (NS, QC, NSW) ▪ Increase the number of safe parks, especially in low-income areas (US)	▪ None

Intersecting Environments (Physical Activity, and Food and Beverage)

While some interventions included in the jurisdictional scan focused on healthy eating or physical activity, community-based initiatives were often directed at influencing both behaviours simultaneously. England's obesity strategy, for example, includes Go on, try it!, a community program that encourages people to try healthy foods and physical activities that are new to them (21). A summary of community-based initiatives that combine physical activity and healthy eating follows (Table 7.4).

POLICY AND ENVIRONMENTAL INTERVENTIONS

Many jurisdictional initiatives, including those outlined for Quebec, Australia, Canada and the U.S., incorporated efforts to create supportive environments for both healthy eating and physical activity through community design, planning policies and attention to the built environment (3,4,6-8,11,22). Two jurisdictions, England and Scotland, emphasized a need to address health inequalities and prioritize at-risk groups when using planning policies to foster health-promoting environments (4,7).

SOCIAL AND BEHAVIOURAL INTERVENTIONS

Some jurisdictional initiatives included efforts to influence healthy eating and physical activity behaviours in the community or jurisdiction-wide setting. Several jurisdictions included programs to provide education on healthy lifestyles (6,16,22). Two jurisdictions, England and New South Wales, identified jurisdiction-wide advisory services, such as a healthy weights hotline, as an intervention to address obesity (3,19). As well, a number of strategies, including Ontario's, supported healthy eating and physical activity programs specifically targeting low-income, Aboriginal and/or other at-risk populations (5,14,18,22).

Table 7.4: Summary of Initiatives Targeting Intersecting Environments (Physical Activity and Food and Beverage)

Life stage	Policy and environmental changes	Social and behavioural programs/ initiatives
Infant, early childhood	▪ None	▪ None
Children and youth	**Macro-environment** ▪ Ensure that physical environment supports healthy eating/ physical activity for children through attention to community design/built environment (Can, Eng, Scot, US, QC)	▪ None
Parents	▪ None	▪ None
All	**Macro-environment** ▪ Consider policies to support healthy eating/physical activity, including regulations (QC, NZ) ▪ Ensure planning policies promoting healthy eating/physical activity that prioritize at-risk groups or address health inequalities (Scot, Eng) ▪ Promote supportive environments for healthy eating/ physical activity, including through community design, planning policies, built environment (QC, Aus, Can, Scot, US) ▪ Evaluate the impact of chemical influences on healthy weights (US)	**Community** ▪ Community programs to provide education on healthy eating/physical activity (Eur, Aus, NZ, US) ▪ Enhance/support healthy choice programs and initiatives for low-income, Aboriginal and/or at-risk communities (Aus, NZ, ON, NL) **No setting specified** ▪ Provide telephone information line/ advisory service to support healthy weights (Eng, NSW)

School Environments

Interventions to support healthy eating and/or physical activity in child care, school and/or after-school settings were common to all jurisdictions. These interventions are described in detail below, and included the enhancement of nutritional and physical education in schools, policies to increase active play in child care settings and increased access to drinking water in schools. A summary of each initiative is provided in Table 7.5.

POLICY AND ENVIRONMENTAL INTERVENTIONS

Many jurisdictions are moving ahead with policy and environmental interventions to support healthy eating and physical activity in child care, school and after-school settings. A number of jurisdictional strategies, such as those for Quebec, the U.S. and Scotland, identified child care as a key setting for obesity prevention. These initiatives commonly included the introduction of guidelines and policies for ensuring that healthy eating and active play are supported in child care facilities (6-8,11,15,23).

All jurisdictional initiatives, including those targeting the whole population, identified school as a key setting for promoting healthy eating in children and youth. Many initiatives included the development or enhancement of nutritional standards for foods and beverages served and/or sold in schools (3,4,6-8,10-13,15,19,22,24). Several initiatives also included efforts to ensure access to drinking water in schools (15,24).

Many jurisdictional initiatives featured policies to restrict or regulate the location and/or contents of vending machines in schools (8,10,11,13,15,23,25).

A few jurisdictions, including the U.S., proposed restrictions around the marketing of food and beverages to children in the school setting (8,10).

While most policy and environmental interventions in school and after-school settings targeted healthy eating specifically, a number of initiatives included recommendations for the introduction of school policies to support both healthy eating and physical activity, or physical activity specifically (11,12,14,18,19,24). The strategies for New South Wales and Quebec, for example, highlighted intentions to increase access to school recreation facilities and fields available for use in after-school settings (11,19).

SOCIAL AND BEHAVIOURAL INTERVENTIONS

Many jurisdictional initiatives also included interventions to change healthy eating and physical activity behaviour in child care, school and after-school settings, primarily through nutrition and physical education, and the provision of opportunities for physical activity during and after school. A few initiatives identified child care as an important setting for educating children about healthy eating and physical activity (6,11,13,19). More commonly, initiatives identified school and after school as important settings for nutrition education and food skills development (5-8,10,12,14,19). Many initiatives also included efforts to enhance physical education and increase opportunities for physical activity in and after school (4-8,10-12,15,20). Several initiatives mentioned a need to increase physical activity opportunities during and after school for students who are not physically active (3,8,13,19), and New South Wales' strategy recommended the incorporation of Indigenous games into physical education curricula (19).

Table 7.5: Summary of Initiatives Targeting School Environments

Life stage	Policy and environmental changes	Social and behavioural programs/initiatives
Infant, early childhood	**Child care** ▪ Policies to promote healthy eating/physical activity in child care settings (US, AB, QC, Denmark) ▪ Remove legal barriers to healthy child care settings; introduce guidelines (Aus, Scot, US)	**Child care** ▪ Provide education on healthy eating, physical activity and screen time in child care settings (Aus, BC, QC, NSW)
Children and youth	**School/after school** ▪ Develop and adopt nutritional standards/guidelines for food served in schools (incl. vending machines) (Aus, Can, Den, Eng, Scot, Spain, US, AB, BC, ON, QC, NSW) ▪ Regulations for/restricted access to vending machines (Den, Spain, US, Ark, AB, BC, ON, QC) ▪ Access to drinking water in schools (US, Den) ▪ Support breakfast or lunch programs in schools (NS, Scot) ▪ Fund and make school facilities, fields and infrastructure available for use after school hours (NSW, QC) ▪ Support healthy eating/physical activity in schools through school policies and/or guidelines (Can, US, NL, ON, QC) ▪ Restrict advertising of foods and beverages in school settings, such as on vending machines (Spain, US)	**School/after school** ▪ Enhance nutrition education in schools and in after-school settings (Aus, Can, Scot, Spain, US, NL, ON, NSW) ▪ Enhance food skills in school/after school (Eng, Can) ▪ Increase physical activity/physical education in and after school (Aus, Can, Den, Eng, Scot, Spain, US, BC, NSW, NS, ON, QC) ▪ Include Indigenous games in PE at school (Aus) ▪ Create opportunities for less active students to participate in physical education/physical activity in and after school (Eng, US, BC, NSW) ▪ Healthy eating/physical activity education in schools and after-school settings (Aus, US, NL, NS, QC)
Parents	▪ None	▪ None
All	▪ None	▪ None

Health Care and Work Environments

Both health care and work environments were commonly targeted by many jurisdictions as settings for supporting healthy eating and physical activity for infants, children and youth, and adults. Interventions targeting these settings included the promotion of supportive environments for breastfeeding, the provision of weight management services through the health care system and workplace health promotion programs. A summary of initiatives targeting work and health care environments is provided in Table 7.6.

POLICY AND ENVIRONMENTAL INTERVENTIONS

The most common policy and environmental interventions targeting work and health care settings involved the promotion of supportive environments for breastfeeding (3,6,8-11,13,19,22). A number of jurisdictional initiatives also included efforts to strengthen or increase access to maternal care services as a way to support healthy maternal weights (6,7,9,13,19). A few initiatives also pointed to policies encouraging employers to promote healthy eating and physical activity in the workplace as a way to address obesity in adults (5,11,14,15).

SOCIAL AND BEHAVIOURAL INTERVENTIONS

Social and behavioural interventions included in the initiatives more commonly targeted the health care sector rather than the workplace. They included several programs targeting pregnant women and new mothers, such as providing healthy eating and physical activity information (3,4,7,11,19), educating women on healthy maternal weight (3,4,7,8,11,19), and breastfeeding support and promotion programs (3,8,19). Screening and referral (to specialized treatment or intervention) is considered by several jurisdictions, including Canada and the U.S. (8,12). Alberta and England have many provisions to address treatment of overweight and obesity, including increasing the capacity of services and use of bariatric surgeries (although not specifically directed at children and youth) (3,4,26). In terms of workplace interventions, six jurisdictions, including Quebec, have called for an increased promotion of healthy eating and physical activity in the workplace (3-7,9,11,19).

Table 7.6: Summary of Initiatives Targeting Health Care and Work Environments

Life stage	Policy and environmental changes	Social and behavioural programs/initiatives
Infant, early childhood	**Macro-environment** ▪ Promote supportive environments for breastfeeding, including work and health care settings (Aus, Eng, NZ, Spain, US, BC, NSW, NS, ON, QC) ▪ Increase access to and/or strengthen maternal care to promote healthy weights (Aus, BC, NSW, NS, Scot)	**Health care** ▪ Provide breastfeeding programs in maternal health context (Aus, Scot) ▪ Provide support for breastfeeding mothers (such as a support hotline) (Eng, US, NSW) ▪ Health care providers to inform women about healthy weight at conception and breastfeeding (Scot, US) ▪ Provide culturally appropriate maternal care services for Aboriginal populations (Aus, NSW) ▪ Provide information to pregnant women, those planning pregnancy and new mothers about maternal health, healthy weights (Eng, Scot, NSW, QC) ▪ Midwives, health professionals to provide information to pregnant women and parents of young children about healthy eating/physical activity (Eng)
Children and youth	▪ None	**Health care** ▪ Screening and referral for children through health care system (Can, Den, Spain, US)
Parents	▪ None	**Health care** ▪ Encourage physicians to discuss healthy eating/physical activity with patients (Eng, Spain) ▪ Increase the number or capacity of weight management services (Aus, Eng, Scot, AB, QC) ▪ Detect and treat obesity through the health care system (Den, Eng, AB, NSW) ▪ Provide medical services, including bariatric surgery (Eng, AB, NSW) ▪ Improve access to dieticians (ON)
All	**Workplace** ▪ Encourage healthy eating/ physical activity promotion in the workplace, including through legislation (Aus, Den, NL, QC)	**Health care** ▪ Encourage physicians to discuss healthy eating/physical activity with patients (Eng, Spain) ▪ Increase the number or capacity of weight management services (Aus, Eng, Scot, AB, QC) ▪ Detect and treat obesity through the health care system (Den, Eng, AB, NSW) ▪ Provide medical services, including bariatric surgery (Eng, AB, NSW) ▪ Improve access to dieticians (ON) **Workplace** ▪ Healthy eating/physical activity promotion in workplace (Aus, Eng, Scot, NSW, NS, QC)

Message Environments

Most jurisdictions included in this scan were engaged in efforts to influence the broader message environment, in order to address obesity in children or the whole population. The most common activities included interventions to reduce the marketing of unhealthy foods and social marketing interventions to promote healthy weights. A summary of these initiatives targeting message environments is provided in Table 7.7.

POLICY AND ENVIRONMENTAL INTERVENTIONS

The most common policy and environmental interventions targeting message environments seek to reduce the marketing and promotion of unhealthy foods to children (3-9,11,12,15,19). Some jurisdictions have called for voluntary approaches to reduce marketing and promotion of these foods targeting children, while others have considered regulatory or legislative means. Many initiatives also included interventions to improve overall food and menu nutrition labelling (3-8,10,12,15,19).

SOCIAL AND BEHAVIOURAL INTERVENTIONS

Almost all jurisdictions support a social marketing and communications intervention or larger campaign as part of their obesity prevention strategies. The objectives of these campaigns are highly varied. Among those targeting children and youth, there are efforts to promote dietary guidelines (5,6), healthy eating (13,15,19), and to educate children and youth on the impact of candy and soft drinks (15). In several jurisdictions, social marketing campaigns aim to reduce screen time and increase physical activity (3,4,8,15). Similarly, parents, infants and young children are also targeted to increase physical activity and healthy eating (3-6,12,14), and one of England's strategic documents includes social marketing to promote breastfeeding (21). A number of population-level social marketing interventions also seek to be culturally appropriate and to reach vulnerable populations (5-7,14,19,22).

Table 7.7: Summary of Initiatives Targeting Message Environments

Life stage	Policy and environmental changes	Social and behavioural programs/initiatives
Infant, early childhood	▪ None	**No setting specified** ▪ Social marketing to promote breastfeeding (Eng) ▪ Promote physical activity guidelines for children under five (Aus) ▪ Campaign promoting healthy eating/physical activity for young children (Eng)
Children and youth	**Macro-environment** ▪ Decrease marketing of unhealthy foods and beverages to children through voluntary approach (Aus, Can, Scot, US, NSW, NS) ▪ Consider or introduce regulatory approaches to reduce marketing of unhealthy foods and beverages to children (Aus, Den, Eng, Scot, US, QC)	**No setting specified** ▪ Disseminate/promote dietary guidelines for children and youth (Aus) ▪ Campaigns about candy and soft drinks (Den) ▪ Campaigns to reduce children's' screen time/increase physical activity (Den, Eng, US) ▪ Communications and social marketing campaign for children on healthy eating/physical activity (BC, NSW)
Parents	▪ None	**No setting specified** ▪ Social marketing to parents about healthy eating, physical, activity and childhood obesity (Aus, Can, Eng, NL)
All	**No setting specified** ▪ Enhanced and/or more clear labelling of packaged foods (Aus, Eng, Den, Scot, Spain, US, NSW) ▪ Encourage healthier choices and/or nutrition labelling in restaurants (Aus, Can, Scot, Spain, US, ON, QC) ▪ Ensure that nutrition information is accessible and/or clearly conveyed (Eng, US, NL)	**No setting specified** ▪ Promote awareness of healthy eating (Can, Scot, BC) ▪ Campaign to promote physical activity for whole population (Den, Eng, Scot, NL) ▪ Communications campaign and social marketing to broader audience on healthy eating, physical activity and behaviour change (EPODE, Aus, Can, Eng, NZ, Spain, AB, NL, NSW, NS, ON, QC) ▪ Increase awareness of childhood obesity, healthy eating and physical activity through in-person events, web-based tools and online social networking (Can, Eng, US) ▪ Ensure communications promoting healthy eating/physical activity are culturally appropriate and available to at-risk, vulnerable and inactive groups (NZ, Scot) ▪ Deliver obesity prevention strategy culturally appropriate ways for Aboriginal groups (NL, NSW, Aus)

Leadership, Measurement and Capacity-Building Activities

In addition to the interventions described in this scan, most jurisdictions are engaged in a number of leadership, capacity-building and other enabling activities to support the prevention of obesity in children and the whole population. These activities include the provision of funding and resources, the formation of multi-sectoral and multi-level partnerships, and leadership in the surveillance of obesity-related indicators. A summary of these leadership, measurement and capacity-building activities is provided in Table 7.8.

Leadership

Nearly all jurisdictions support a whole-of-government approach and working in partnership with all relevant stakeholders (3-6,8,9,11-13,18,22,27). A whole-of-government approach involves collaboration across ministries and at all levels of government in partnership with stakeholders, such as researchers, the food industry, communities and schools. A government ministry or agency may also be identified to lead the obesity prevention strategy (5,6,8,25). In a number of strategies, government is called upon to serve as a champion for obesity prevention (3,4,7,12,22), fund prevention efforts appropriately (3,4,13) and make decisions based on the best available evidence.

Measurement

Many jurisdictions, including Canada, have called for the development of a system to measure the weight and height of children and youth as part of a larger obesity prevention strategy (3-6,10,12,13,15,19). One jurisdiction, B.C., recommended the measurement of physical activity as a potential component of the province's obesity strategy (13). The collection of BMI in schools is supported by two jurisdictions (7,25).

Monitoring, Evaluation and Research

In terms of monitoring and evaluation, there is strong support to develop indicators, monitor progress and provide regular reports on progress made (5,6,9,11,12,18,22,25,27). The evaluation of jurisdictional strategies and their component interventions is also mentioned in several strategy documents (3,4,9,18,19,27). Lastly, several jurisdictions support ongoing research on healthy eating and physical activity to prevent obesity (including addressing risk factors for obesity) (5,6,9,11,12,14,19,27).

Knowledge Translation and Exchange, and Capacity-Building

Several jurisdictions support increasing the capacity of professionals working to prevent childhood obesity (3-6,8,9,11,14,18,22); this may occur through the development of networks, providing training courses and other resources. Targets for intervention include caregivers, early learning centres, schools and daycares. Four jurisdictions identified information sharing in their strategies (9,11,12,18).

Table 7.8: Summary of Leadership, Measurement and Capacity-Building Activities

Life stage	Policy and environmental changes
Leadership	**No setting specified** ▪ Adopt a whole-of-government approach (including health in all policies) across all ministries, levels of government and sectors (Aus, Can, Eng, NZ, US, BC, NS, ON, QC, Eur) ▪ Government to champion the issue of obesity (Can, Eng, NZ,QC, Scot) ▪ Government and/or public sector to be a model employer in obesity prevention (e.g., healthy foods, active workplace) (Eng, BC) ▪ Establish a lead agency or ministry (and necessary advisory committees) to oversee the implementation of the government's strategy on obesity (Aus, US, Ark) ▪ Develop the necessary action plans to address certain aspects of obesity prevention (e.g., nutrition plan, type 2 diabetes) (Aus, BC) ▪ Develop partnerships and work with all relevant stakeholders, including schools, communities, private sector, international, food industry, etc. (Aus, Eng, Eur, Scot, Spain, US, NL, NSW, NS, ON, QC) ▪ Raise policy and decision-makers' knowledge about obesity (Scot) ▪ Make decisions based on the best available evidence (ON) ▪ Leverage large sporting events (e.g., Olympic Games) in obesity prevention (e.g., media campaigns, private sector contributions) (Eng,) ▪ Fund the obesity strategy appropriately (Eng, Eur, BC)
Measurement	**No setting specified** ▪ Develop a child and youth weights and heights measurement program (Den, Eng, Eur, Spain, BC, NSW, Aus, Can) ▪ Measure physical activity (BC) **School** ▪ Collect BMI in schools (Scot, Ark)
Monitoring and evaluation	**No setting specified** ▪ Develop indicators, monitor progress and provide reporting (Aus, Can, NZ, Ark, ON, NS, QC, Eur). ▪ Evaluate the obesity prevention strategy or aspect of it (Eng, NSW, NS, ON, Eur)
Research	**No setting specified** ▪ Conduct and support research on healthy eating and physical activity to prevent obesity (including risk factors and pilots) (Aus, Can, NL, NSW, NS, QC, Eur)
Knowledge translation and exchange	**No setting specified** ▪ Share information on successful initiatives across all relevant stakeholders (Can, NS, ON, QC)
Capacity-building	**No setting specified** ▪ Provide technical assistance to school food service providers (to provide healthier options) (US, NSW, ON) **No setting specified** ▪ Promote nutrition and physical activity professional capacity development (networks, training, resources, etc.) (Aus, Eng, NZ, US, NL, NS, ON, QC) ▪ Develop resources for families, caregivers and early-learning and daycare facilities on healthy eating and physical activity (ON, QC, Eng, US)

Discussion

This scan provides an overview of the strategies and initiatives taken by jurisdictions to address obesity in children and youth. Although the reports reviewed describe initiatives that are supported or currently being implemented within a number of jurisdictions, it is important to keep in mind that the evaluation components of these initiatives have not been considered.

It is also important to consider the diversity among jurisdictions. Although the majority of the initiatives described took place in Canadian provinces, many of them were international initiatives, which may not necessarily be applicable or may differ when applied within a Canadian setting.

Lastly, it appears that a comprehensive approach to obesity prevention (1) has been adopted, as all five intervention environments are being targeted by various jurisdictions.

Limitations

Not all of the strategies and initiatives captured in the jurisdictional scan identified obesity as the primary strategic target, but focused instead on healthy eating and/or physical activity. For example, Newfoundland and Labrador's *Provincial Food and Nutrition Action Plan* (released in 2006) focused on healthy eating. However, our search strategy did not include terms such as "healthy eating" and "physical activity," and, therefore, likely did not capture all strategies focusing only on risk factors for obesity rather than obesity by itself. Additionally, several jurisdictions of interest, such as The Netherlands and Portugal, were not included in the scan, because documents were unavailable in English or French.

Across the initiatives included in the scan, there is a wide range in the year of initiation, which may impact the underlying evidence base informing their development. There is also wide variation in the language used to describe the initiatives. For example, the whole-of-government approach is described in many different ways; sometimes it is mentioned explicitly in a strategy, while in other cases the description provided is consistent with the common understanding of a whole-of-government approach.

It was challenging to determine how to best categorize some interventions, especially when they target a variety of environments. For example, interventions to promote and support breastfeeding could be categorized under "Food and Beverage Environments," "Message Environments" or "Health Care and Work Environments." For this report, breastfeeding interventions were categorized under "Health Care and Work Environments," with the exception of social marketing interventions, which were categorized under "Message Environments."

Importantly, it was not possible to determine whether any of the strategies included in the scan were actually implemented, how they were implemented and if there was any impact on anthropometric outcomes. Some of the strategies reviewed described interventions at a very high level (consistent with the nature of these types of reports) and lacked specificity, which may be important for understanding how they can be applied in other jurisdictions.

Research Gaps

In addition to addressing the limitations described above, there are several actions that can be taken to inform the development of the Ontario childhood obesity prevention strategy. Promising interventions can be identified and additional research completed to assess its effectiveness and feasibility for implementation in Ontario. Of particular interest would be evaluations of initiatives describing implementation and procedural aspects of the intervention, including indicators and methods for evaluation.

Mapping to the Ontario Context

Although Ontario does not currently have a childhood obesity reduction strategy, there are many activities and resources within the province that deserve mention, including government policy in key areas (e.g., curriculum, foundations for healthy schools). To supplement this jurisdictional scan, a separate inventory of current provincial, federal and multi-level government initiatives relevant to childhood obesity prevention was compiled by the Ministry of Health and Long-Term Care (see Appendix 6). This inventory demonstrates that Ontario is already taking action in a number of areas aligned with the key IOM environments. For example, Ontario has a number of initiatives geared toward influencing

food and beverage environments, including the Ontario School Food and Beverage Policy, which sets nutritional standards for all food and beverages sold in public schools, and bans the sale of candy and other unhealthy foods (28,29). There are also programs delivered in school, community and/or health care settings to support healthy eating, including the provision of nutritional standards for Student Nutrition Program sites across Ontario. Ontario also has a number of programs relevant to early childhood obesity prevention, including the Healthy Babies Healthy Children program, that provides support and referrals to new parents who may benefit from help with issues such as breastfeeding and child nutrition (29,30).

In terms of influencing the physical activity environments, Ontario also has a number of initiatives in place, including the provincial policy requiring daily physical activity (DPA) in elementary schools, support for physical activity in school, community and health care settings, such as after-school program, as well as the Promoting Life Skills in Aboriginal Adolescents (PLAY) program administered by the Ministry of Aboriginal Affairs. The province also has several initiatives, such as the Ontario Trails Strategy, that seek to create supportive built environments for healthy eating, physical activity or both (29).

In addition to the diversity of programs and policies currently being implemented across the province, there are diverse resources that can support efforts to reduce childhood obesity through leadership and capacity-building. The inventory of provincial initiatives indicates that many provincial ministries, including Health and Long-Term Care, Children and Youth Services, Aboriginal Affairs, Education, Transportation, Agriculture, Food and Rural Affairs, and Municipal Affairs and Housing, are already engaged in activities and policies highly relevant to childhood obesity prevention. Knowledge, expertise and leadership from these and other provincial stakeholders can inform the development and implementation of a comprehensive childhood obesity reduction strategy for Ontario (29).

There are several initiatives occurring at the federal and federal/provincial/territorial (F/P/T) levels which are relevant to childhood obesity prevention. Federal initiatives include the provision of the *Eat Well and Be Active Education Toolkit* (31), as well as the creation and promotion of *Eating Well with Canada's Food Guide* (32). F/P/T initiatives include the Healthy Eating Education and Awareness Initiative led by the F/P/T Group on Nutrition and the *Curbing Childhood Obesity Framework for Action* (2010) led by the Healthy Peoples, Healthy Communities Steering Committee (29).

Table 7.9 summarizes Ontario's participation in interventions that were frequently supported by jurisdictions included in the jurisdictional scan, which was arbitrarily defined as supported by seven or more jurisdictions. The summary is based on the inventory of initiatives compiled by the Ministry of Health and Long-Term Care, as well as *Ontario's Action Plan for Healthy Eating and Active Living* (2006), which was included in the jurisdictional scan. This shows that Ontario is already involved, at least to some extent, in many of the highly supported interventions, such as developing nutritional standards for schools, and promoting and supporting breastfeeding. However, some interventions, such as polices for enhanced and/or more clear labelling of packaged foods and implementation of a coordinated program for height and weight measurement, are not included in the current Ontario strategies and initiatives.

Table 7.9: Ontario's Participation in Frequently Supported Interventions from the Jurisdictional Scan

Frequently supported interventions	Ontario initiatives		Other jurisdictions
	Ontario Government initiatives (30)	Ontario's action plan for healthy eating and active living (2006) (19)	
Create environments that support safe daily physical activity and active transportation through urban planning and infrastructure	X	X	Aus, Den, Eng, NZ, Scot, Spain, US, NSW, NS, BC, QC
Develop and adopt nutritional standards/guidelines for food served in schools (including vending machines)	X	X	Aus, Can, Den, Eng, Scot, Spain, US, AB, BC, QC, NSW
Encourage industry to offer healthier foods through reformulation, reduced portion size, etc.	*Insufficient information*	X	Eng, Aus, Scot, Spain, US, NS, QC
Enhance nutrition education in schools and in after-school settings	X	X	Aus, Can, Scot, Spain, US, NL, QC, NSW
Increase physical activity/physical education in and after school	X	X	Aus, Can, Den, Eng, Scot, Spain, US, BC, NSW, NS, QC
Promote supportive environments for breastfeeding, including work and health care settings	X	X	Aus, Eng, NZ, Spain, US, BC, NSW, NS, QC
Enhanced and/or more clear labelling of packaged foods	*Insufficient information*	*Not included*	Aus, Eng, Den, Scot, Spain, US, NSW
Encourage healthier choices and/or nutrition labelling in restaurants	X	X	Aus, Can, Scot, Spain, US, QC
Regulations for/restricted access to vending machines in schools	X	X	Den, Spain, US, Ark, AB, BC, QC
Communications campaign and social marketing to broader audience on healthy eating, physical activity and behaviour change	X	X	Eur, Aus, Can, Eng, NZ, Spain, Alberta, NL, NSW, NS, QC
Promote nutrition and physical activity-related professional development	*Insufficient information*	X	Aus, Eng, NZ, US, NL, NS, QC
Adopt a whole-of-government approach (including health in all policy) across all ministries, levels of government and sectors	X	X	Aus, Can, Eng, NZ, US, BC, NS, QC, Eur
Develop partnerships and work with all relevant stakeholders, including schools, communities, private sector, international, food industry, etc.	X	X	Aus, Eng, Eur, Scot, Spain, US, NL, NSW, NS, QC
Develop a child and youth weights and heights measurement program	*Insufficient information*	*Not included*	Den, Eng, Eur, Spain, BC, NSW, Aus, Can
Develop indicators, monitor progress and provide reporting	*Insufficient information*	X	Aus, Can, NZ, Ark, NS, QC, Eur
Conduct and support research on healthy eating and physical activity to prevent obesity (including risk factors and pilots)	X	*Not included*	Aus, Can, NL, NSW, NS, QC, Eur

Note: Insufficient information indicates that there was not enough information contained in the inventory of initiatives prepared by MOHLTC (Appendix 6) to determine if the Ontario government is engaged with a particular initiative.

Conclusions

This chapter provided a summary of obesity prevention strategies and initiatives from several regional, national and sub-national jurisdictions in Canada and internationally. It provided a high-level overview of interventions and approaches that are supported or currently being implemented by various governments and stakeholders. This overview is intended to provide a starting point for identifying promising approaches that can be implemented in Ontario with the support of further research, monitoring and evaluation (33). However, it must be noted that without proper contextualization, programs implemented within one jurisdiction may not be effective in another.

The following interventions have received a high degree of support by the jurisdictions scanned:

- Create environments that support safe daily physical activity and active transportation through urban planning and infrastructure (Aus, Den, Eng, NZ, Scot, Spain, US, NSW, NS, ON, BC, QC)
- Develop and adopt nutritional standards/ guidelines for food served in schools (including vending machines) (Aus, Can, Den, Eng, Scot, Spain, US, AB, BC, ON, QC, NSW)
- Encourage industry to offer healthier foods through reformulation, reduced portion size, etc. (Eng, Aus, Scot, Spain, US, NS, ON, QC)
- Enhance nutrition education in schools and in after-school settings (Aus, Can, Scot, Spain, US, NL, ON, QC, NSW)
- Increase physical activity/physical education during and after school (Aus, Can, Den, Eng, Scot, Spain, US, BC, NSW, NS, ON, QC)
- Promote supportive environments for breastfeeding in work and health care settings (Aus, Eng, NZ, Spain, US, BC, NSW, NS, ON, QC)
- Enhanced and/or more clear labelling of packaged foods (Aus, Eng, Den, Scot, Spain, US, NSW)
- Encourage healthier choices and/or nutrition labelling in restaurants (Aus, Can, Scot, Spain, US, ON, QC)
- Regulations for/restricted access to vending machines in schools (Den, Spain, US, Ark, AB, BC, ON, QC)
- Communications campaign and social marketing to broader audience on healthy eating, physical activity and behaviour change (Eur, Aus, Can, Eng, NZ, Spain, AB, NL, NSW, NS, ON, QC)
- Promote nutrition and physical activity-related professional development (networks, training, resources, etc.) (Aus, Eng, NZ, US, NL, NS, ON, QC)
- Adopt a whole-of-government approach (including health in all policy) across all ministries, levels of government and sectors (Aus, Can, Eng, NZ, US, BC, NS, ON, QC, Eur)
- Develop partnerships and work with all relevant stakeholders, including schools, communities, private sector, international, food industry, etc. (Aus, Eng, Eur, Scot, Spain, US, NL, NSW, NS, QC, ON)
- Develop a child and youth weights and heights measurement program (Den, Eng, Eur, Spain, BC, NSW, Aus, Can)
- Develop indicators, monitor progress and provide reporting (Aus, Can, NZ, Ark, ON, NS, QC, Eur)
- Conduct and support research on healthy eating and physical activity to prevent obesity (including risk factors and pilots) (Aus, Can, NL, NSW, NS, QC, Eur)

References

(1) IOM (Institute of Medicine). Accelerating progress in obesity prevention: Solving the weight of the nation. Washington, DC: National Academies Press; 2012. p. 6. Available from: http://books.nap.edu/catalog.php?record_id=13275

(2) Zaza S, Briss PA, Harris KW. The guide to community preventive services: what works to promote health? New York, NY: Oxford University Press Inc; 2005.

(3) Cross-Government Obesity Unit (for Department of Health and Department of Children, Schools and Families). Healthy weight, healthy lives: A cross-government strategy for England. London: HM Government; 2008 [cited 2013 Jun 26]. Available from: http://webarchive.nationalarchives.gov.uk/20100407220245/http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_084024.pdf

(4) Department of Health. Healthy lives, healthy people: A call to action on obesity in England. London: HM Government; 2011 [cited 2013 Jun 26]. Available from: http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_130487.pdf

(5) National Preventative Health Taskforce. Australia: The healthiest country by 2020 – national preventative health strategy – overview. Canberra: Commonwealth of Australia, 2009 [cited 2013 Jun 26] . Available from: http://www.preventativehealth.org.au/internet/preventativehealth/publishing.nsf/Content/nphs-overview/$File/nphs-overview.pdf

(6) The National Obesity Taskforce Secretariat. Healthy weights 2008, Australia's future: The national action agenda for children and young people and their families. Canberra: Commonwealth of Australia; 2003 [cited 2013 Jun 26]. Available from: http://www.healthyactive.gov.au/publications.htm

(7) Donnelly RR. Preventing overweight and obesity in Scotland: A route map towards healthy weight. Edinburgh: Scottish Government; 2012 [cited 2013 Jun 26]. Contract No. B62286 02/10. Available from: http://www.scotland.gov.uk/Resource/Doc/302783/0094795.pdf

(8) White House Task Force on Childhood Obesity. Solving the problem of childhood obesity within a generation: White House Task force on Childhood Obesity report to the President. Washington, DC: Executive Office of the President of the United States; 2010 [cited 2013 Jun 26]. Available from: http://www.letsmove.gov/sites/letsmove.gov/files/TaskForce_on_Childhood_Obesity_May2010_FullReport.pdf

(9) Department of Health and Wellness. Growing up healthy: Discussion framework for a childhood obesity prevention strategy. Province of Nova Scotia; 2011 [cited 2013 Jun 26]. Available from: http://www.gov.ns.ca/growinguphealthy/Growing-Up-Healthy-Discussion-Framework.pdf

(10) Ministry of Health and Consumer Affairs. Spanish strategy for nutrition, physical activity and prevention of obesity (NAOS). Madrid: Spanish Agency for Food Safety and Nutrition; 2005 [cited 2013 Jun 26] . Available from: http://www.naos.aesan.msssi.gob.es/naos/ficheros/estrategia/NAOS_Strategy.pdf

(11) Quebec Ministry of Health and Social Services. Plan d'action gouvernemental de promotion des saines habitudes de vie et de prévention des problèmes reliés au poids, investir pour l'avenir. 2006-2012. Quebec City: Government of Quebec; 2012. Available from: http://publications.msss.gouv.qc.ca/acrobat/f/documentation/2012/12-289-08W.pdf

(12) Public Health Agency of Canada. Actions taken and future directions 2011 – curbing childhood obesity: A federal, provincial and territorial framework for action to promote healthy weights. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2011 [cited 2013 Jun 26]. Available from: http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/framework-cadre/2011/hw-os-2011-eng.php

(13) Select Standing Committee on Health. A strategy for combatting childhood obesity and physical inactivity in British Columbia. Victoria, BC: The Legislative Assembly of British; 2006 [cited 2013 Jun 26]. Available from: http://www.leg.bc.ca/cmt/38thparl/session-2/health/reports/Rpt-Health-38-2-29nov2006.pdf

(14) Provincial Food and Nutrition Framework Advisory Committee. Eating healthier in Newfoundland and Labrador: Provincial food and nutrition framework and action plan. St. John's, NL: Government of Newfoundland and Labrador, 2006 [cited 2013 Jun 26]. Available from: http://www.health.gov.nl.ca/health/publications/provincialnutritionplan.pdf

(15) National Board of Health. National action plan against obesity: Recommendations and perspectives – short version. National Board of Health, Center for Health Promotion and Prevention; 2003 [cited 2013 Jun 26]. Available from: http://www.sst.dk/publ/publ2003/National_action_plan.pdf

(16) Diesnis C, Bellenoux E. EPODE: 5 ans deja et un pari reussi. France: Service de Press National EPODE; 2010.

(17) Summerbell CD, Moore HJ, Borys JM, Raffin S, Batterham AM. Prevalence of overweight and obesity in serial cross-sectional surveys of the ensemble, prevenons l'obesite des enfants (EPODE) campaign. Obesity Facts. 2009;2(suppl 2):119-120.

(18) Ontario. Ministry of Health Promotion. Ontario's action plan for healthy eating and active living. Toronto, ON: Queen's Printer for Ontario; 2006 [cited 2013 Jun 26]. Available from: http://www.mhp.gov.on.ca/en/heal/actionplan-EN.pdf

(19) NSW Department of Health. NSW government plan for preventing overweight and obesity in children, young people and their families: 2009-2011. North Sydney, NSW: NSW Department of Health; 2009 [cited 2013 Jun 26]. Available from: www.health.nsw.gov.au/pubs/2009/pdf/obesity_action_plan.pdf

(20) National Institutes of Health. We can! progress report: Cirriculum implementations by the intensive sites. U.S. Department of Health & Human Services (DHHS); 2007 [cited 2013 Jun 26]. Available from: http://www.nhlbi.nih.gov/health/public/heart/obesity/wecan/downloads/progsummary.pdf

(21) Mitchell S. Change4Life: Three year social marketing strategy. London: HM Government; 2011 [cited 2013 Jun 26]. Available from: http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/documents/digitalasset/dh_130488.pdf

(22) Ministry of Health. Healthy eating – healthy action. oranga kai – oranga pumau: A strategic framework. Wellington, New Zealand: Ministry of Health; 2003 [cited 2013 Jun 26]. Available from: http://www.southerndhb.govt.nz/files/20100701120218-1277942538-0.pdf

(23) Alberta Health and Wellness. Alberta nutrition guidelines for children and youth: A childcare, school and recreation/community centre resource manual. Edmonton, AB: Government of Alberta; 2008 [cited 2013 Jun 26]. Available from: http://www.health.alberta.ca/documents/Nutrition-Guidelines-Children-AB-2011.pdf

(24) White House Task Force on Childhood Obesity. Fact sheet: Child nutrition reauthorization healthy, hunger-free kids act of 2010. Washington, DC: Executive Office of the President of the United States; 2010 [cited 2013 Jun 26]. Available from: http://www.whitehouse.gov/sites/default/files/Child_Nutrition_Fact_Sheet_12_10_10.pdf

(25) Raczynski JM, Thompson JW, Phillips MM, Ryan KW, Cleveland HW. Arkansas Act 1220 of 2003 to reduce childhood obesity: its implementation and impact on child and adolescent body mass index. J Public Health Policy. 2009;30 Suppl 1:S124-40.

(26) Alberta Health Services. Backgrounder: Alberta health services obesity initiative – first-year highlights of obesity prevention and management initiative. Edmonton, AB: Alberta Health Services; 2011[cited 2013 Jun 26]. Available from: http://www.albertahealthservices.ca/rls/ne-rls-2011-09-07-obesity-bkg.pdf

(27) Borys JM, Le Bodo Y, Jebb SA, Seidell JC, Summerbell C, Richard D, De Henauw S, Moreno LA, Romon M, Visscher TL, Raffin S, Swinburn B, EEN Study Group. EPODE approach for childhood obesity prevention: methods, progress and international development. Obes Rev. 2012;13(4):299-315. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2011.00950.x/pdf

(28) Ontario. Ministry of Education. Ontario schools have new food and beverage standards. Toronto, ON: Queen's Printer for Ontario; 2011[cited 2013 Jun 26]. Available from: http://www.edu.gov.on.ca/eng/healthyschools/NS_fact_sheet_ENG_final.pdf

(29) Ontario. Ministry of Health and Long-Term Care. Inventory of provincial, federal, and F/P/T initiatives relevant to childhood obesity prevention. Toronto, ON: Queen's Printer for Ontario; 2012 (Unpublished report).

(30) Healthy babies healthy children [homepage on the Internet]. Toronto, ON: Queen's Printer for Ontario; c2011 [updated 2010; cited 2012 May 25]. Available from: http://www.children.gov.on.ca/htdocs/English/topics/earlychildhood/health/index.aspx

(31) Eat well and be active educational toolkit [homepage on the Internet]. Ottawa, ON: Health Canada; c2011 [cited 2012 May 25]. Available from: http://www.hc-sc.gc.ca/fn-an/food-guide-aliment/educ-comm/toolkit-trousse/index-eng.php

(32) Health Canada. Eating well with Canada's food guide: a resource for educators and communicators. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2011[cited 2013 Jun 26]. Available from: http://www.hc-sc.gc.ca/fn-an/pubs/res-educat/res-educat-eng.php

(33) Swinburn B, Bell C, King L, Magarey A, O'Brien K, Waters E, Primary Prevention Group of the Australian Childhood and Adolescent Obesity Research Network. Obesity prevention programs demand high-quality evaluations. Aust N Z J Public Health. 2007;31(4):305-307.

8. Ontario Public Health Unit Scan of Obesity-Related Initiatives

Summary

A web-based survey was administered to gather information from all 36 Ontario PHUs regarding the healthy weight promotion and obesity prevention initiatives in which they were involved, including programs, policy interventions and communications campaigns. For each initiative, respondents were asked to provide a brief description of the initiative, including type of initiative, population targeted, setting and key action areas. The survey was analyzed using descriptive statistics for quantitative data and thematic analysis for qualitative data. A response rate of 100% was achieved, with all 36 PHUs in Ontario responding. Overall, 433 initiatives, several with multiple components, were submitted.

The interventions described in this scan target the promotion of healthy weights and the reduction of obesity in children or the whole population through policy and environmental changes or through social and behavioural interventions. PHUs reported being engaged in activities to influence the broad food and beverage environments, physical activity environments or both simultaneously. These interventions include food and nutrition policies that influence the environment in which children live and play, and urban planning policies that promote active transportation.

Many PHUs identified school environments as important settings for the promotion of healthy weights. Interventions targeting these settings include improving nutrition and physical education in schools, and implementing nutrition guidelines and increasing active play in child care settings. PHUs also identified health care and work environments as an important setting for supporting healthy eating and physical activity for infants, children and youth, and adults.

Interventions in these settings include promotion of and support for breastfeeding, and education sessions that promote healthy weights. Ontario health unit initiatives also included efforts to influence the broader message environments. Among common interventions are community campaigns and media sources that include print materials, such as pamphlets, posters and newsletters.

Frequently reported initiatives:

- 90% of the policy and environmental interventions reported by Ontario PHUs pertained to the creation of supportive food environments
- 75% of Ontario PHUs report multi-sectoral planning on healthy eating/food and nutrition in community design and the built environment
- 75% of Ontario PHUs reported that they planned to achieve or already had the Baby-Friendly Initiative (BFI) designation
- 72% of Ontario PHUs report multi-sectoral planning on physical activity in community design and the built environment
- Approximately 81% of Ontario PHUs reported providing parenting programs and support groups
- Half (50%) of the 433 initiatives reported by Ontario PHUs were offered within the school setting
- 70% of Ontario PHUs reported offering initiatives within the daycare setting

This survey did not capture all initiatives related to healthy weights and the prevention of childhood obesity provided by Ontario PHUs. Dependent upon the survey respondent, the categorization of the initiative and the level of detail provided for each initiative varied substantially.

Introduction

Public health units (PHUs) in Ontario have a mandate to provide public health programs and services that focus on the health and well-being of the whole population through the promotion and protection of health, the prevention of illness and actions that address the needs of priority populations. This is done through assessment and surveillance, health promotion and policy development, disease and injury prevention, and health protection. The Ontario Public Health Standards (OPHS), based on evidence-informed practice, outline the expectations for boards of health. Expectations include the assessment, planning, delivery, management and evaluation of a variety of public health programs and services that address multiple health needs, as well as the contexts in which these needs occur (1).

Within the OPHS, there are several program standards, including the Chronic Diseases and Injuries Program Standards. Within this standard, the Chronic Disease Prevention program mandates PHUs to "ensure that the public is aware of the importance of healthy eating, healthy weights and physical activity." Additionally, within the Family Health Program Standards, the Reproductive Health and Child Health Program Standards have requirements to address issues relevant to the prevention of childhood obesity and the promotion of healthy weights, including healthy pregnancies, healthy birth outcomes, breastfeeding and parenting.

PHUs are engaged in leadership, capacity-building and other enabling activities to support the promotion of healthy weights and the prevention of obesity within their respective health areas. These activities include developing multi-sectoral and multi-level partnerships, and community development and engagement. In addition, PHUs have a mandate within the Foundational Standard of the OPHS to conduct population health assessments, surveillance, research and program evaluations.

In Ontario, there are 36 PHUs that cover the entire province and are individually responsible for serving the population within their geographical borders. Each of these 36 PHUs is governed by a board of health and appoints a Medical Officer of Health. The boards of health are composed of municipal members, either elected officials or community representatives, with provincial appointees within autonomous boards. Almost two-thirds of Ontario's boards are independent bodies created to provide public health services within the community, while the remaining one-third are part of regional or municipal government. The *Health Protection and Promotion Act* (HPPA) provides the legislative mandate for boards of health (2).

The purpose of this scan was to identify initiatives (i.e., programs, policies, communications campaigns) that address healthy weight, and the prevention of obesity in children and youth in which Ontario PHUs are involved.

Methods

Data Collection

A FluidSurvey was sent electronically to all 36 Ontario PHUs. This eight-question survey (provided in Appendix 7) asked PHUs to identify initiatives in which they were currently involved as a leader or a partner to address healthy weights/the prevention of childhood obesity. For each initiative, respondents were asked to provide a brief description of the initiative, type of initiative, population being targeted, setting and key action areas. The action areas were based on the OPHS and the document entitled *Actions Taken and Future Directions 2011, Curbing Childhood Obesity: A Federal, Provincial and Territorial Framework for Action to Promote Health Weights* (3). There was no limit on the number of initiatives that respondents could provide. Initiatives could target obesity in children or the whole population, as many jurisdictions are taking a universal approach to obesity prevention.

The survey was pilot-tested by four PHUs and suggested changes were incorporated into the final survey. An email outlining the purpose of the survey and other pertinent details was sent to all Medical Officers of Health and was copied to the managers of chronic disease prevention programs. Follow-up phone calls were made to those PHUs that did not submit a completed survey to ensure a high response rate was achieved.

Data Analysis

Initiatives reported were categorized by the macro-level environment they targeted (i.e., food and beverage, physical activity, school, health care and work, and message environments) (4) and interventions type (i.e., policy and environmental or

social and behavioural) (5). Finally, where applicable, initiatives were categorized by the life stage targeted (i.e., infant/early childhood, children and youth, and parents) and the settings where they are conducted.

One reviewer independently populated the tables from the survey results. For the close-ended questions, frequencies and distributions were calculated by PHU and by initiatives submitted, and these are provided in Appendix 8.

Results

A response rate of 100% was achieved with all 36 PHUs in Ontario responding to the survey. Four hundred and thirty-three initiatives, several with multiple components, were submitted. Given that healthy weights initiatives often spanned several program areas, the survey was often completed by multiple PHU staff, including managers, chronic disease prevention, managers of family health and school health, public health nutritionists, public health nurses and/or health promoters.

Food and Beverage Environments

POLICY AND ENVIRONMENTAL INTERVENTIONS

Almost all (90%) of the policy and environmental interventions submitted by PHUs pertained to the creation of a supportive food environments. Specifically, interventions included:

- The development of food charters, documents that outline values and beliefs about the food system in the community to inform and direct local initiatives for food security, and the development of a sustainable food system
- Participating and/or leading a local food security network/coalition to ensure the community has access to adequate, accessible, safe and nutritious food
- Policies/guidelines that support healthy eating choices at recreation centres

There were also policy initiatives that targeted vulnerable populations. An example is the Nutritious Food Basket (NFB) program (6). The NFB is a survey tool that measures the cost of basic healthy eating, representing current nutrition recommendations and average food purchasing patterns. Food costing is used to monitor affordability and accessibility of foods by relating the cost of the food basket to individual/family incomes.

PHUs collaborate with their respective municipal/regional planning departments to support access, availability and promotion of healthy food within the community. There was also frequent use (75% of PHUs) of multi-sectoral planning on healthy eating/food and nutrition in community design and the built environment. Most PHUs (75%) reported that they plan to achieve or have already achieved the Baby-Friendly Initiative (BFI) designation (7). BFI is the Breastfeeding Committee for Canada's interpretation of the Baby-Friendly Hospital Initiative (BFHI), which is an international initiative established by the WHO and United Nations Children's Fund (UNICEF) in 1991 (8). The BFI contributes to changing public policy, creating supportive environments, strengthening community action, developing personal skills and reorienting health services. It promotes, protects and supports breastfeeding, and is considered evidence-based best practice for agencies working with pregnant and parenting families so that they are empowered to make informed infant feeding decisions. BFI is inclusive of all families, so that each family's choice of infant feeding method is respected and supported.

SOCIAL AND BEHAVIOURAL INTERVENTIONS

A large majority of PHU initiatives were geared toward influencing eating behaviours through programs and services offered within the local community. Programs included breastfeeding support groups, parenting programs and infant feeding workshops.

Close to 39% of PHUs reported that they currently used the 2006 *WHO Child Growth Standards* and 2007 *WHO Growth References Charts* in their programming (9). The standards and charts were updated to reflect the global surge of childhood obesity. It portrays how children "should" grow rather than how children "do" grow, and is considered to be a best health practice. As discussed in Part 1, these growth charts are recommended by Dietitians of Canada.

NutriSTEP is a nutrition risk screening questionnaire (10). Parents answer questions to assess the eating habits of their toddlers and preschoolers, in order to identify nutrition issues. This screening tool was reported as being offered by over half of all PHUs.

Numerous food and food-skill related programs offered by PHUs included:

- Good Food Box program, a food security program that allows individuals to pre-purchase a monthly, affordable box of fresh fruit and vegetables delivered to one of a large network of host sites throughout the community
- Food-skill development programs
- Supermarket tours
- Gleaning (food-recovery) programs, in which fresh produce is available to community members by taking advantage of farmers' surplus
- Eat Smart! recreation centre program (11), a program that supports healthy environments by qualifying recreation centres on a set of three standards, including nutrition, safe food handling and smoke-free environment
- The Community Food Advisor program (12) provides, through trained volunteers, reliable information and education that promotes safe and nutritious food selection, preparation and storage practices to consumers

Additionally, vulnerable populations were targeted through numerous initiatives, including the Canada Prenatal Nutrition Program (13). The goal of this program is to improve the health of mothers and infants, reduce the incidence of unhealthy birthweights, and promote and support breastfeeding by building partnerships and strengthening community supports for vulnerable pregnant women. The Healthy Babies Healthy Children Program (14) provides resources and supports to vulnerable families to help children get a healthy start to life.

Table 8.1: Examples of Initiatives Targeting Food and Beverage Environments

Life stage	Policy and environmental changes	Social and behavioural programs/initiatives
Infant, early childhood	**Macro-environment** ▪ Municipal Child Care policy initiative, in which nutrition guidelines have been created for foods procured and served to children ▪ Baby-Friendly Initiative	**Daycare** ▪ Planning nutritious menus in home child care settings ▪ NutriSTEP **Community** ▪ Nutrition education/training for adult influencers of children, (e.g., child care providers, health professionals) ▪ Breastfeeding Buddies support program for new moms ▪ Canada Prenatal Nutrition Program
Children and youth	**Macro-environment** ▪ Healthy Eating Group Home Guidelines ▪ Municipal Child Care policy initiative	**Community** ▪ Peer nutrition cooking classes ▪ Gleaning program to local farms ▪ Food skills literacy program and training
Parents	▪ None	**Community** ▪ Peer nutrition program and cooking classes ▪ Nobody's Perfect Parenting Program ▪ Introduction to Solid Foods for Infants workshop ▪ Healthy Measures healthy weights for pregnant women ▪ Food-skill development in priority populations
All	**Community** ▪ Baby-Friendly Initiative ▪ Healthy eating guidelines/policy for recreation sites ▪ Nutritious Food Basket ▪ Food security work groups/networks/ coalitions ▪ Food Charter development ▪ GIS Food Mapping	**Community** ▪ Supermarket tours ▪ Gleaning programs ▪ Eat Smart! recreation centre program ▪ Good Food Box program ▪ Food-skills development programs ▪ Cooking programs

*A full inventory and description of initiatives is available in Appendix 9

Physical Activity Environments

POLICY AND ENVIRONMENTAL INTERVENTIONS

Almost three quarters (72%) of PHUs reported that they take action in areas related to multi-sectoral planning on physical activity in community design and the built environment. The built environment has been defined as the human-made space in which people live, work and are active on a day-to-day basis. It includes buildings, parks and transportation systems, healthy food access, community gardens, walkability and bikeability (15).

The most common policy and environmental initiative cited by PHUs was involvement in municipal and regional planning decisions that incorporate built environment structures that impact healthy eating, physical activity, air and water quality, and injury prevention. These policies promote healthy urban design, and safe and active transportation plans.

Additionally, PHUs reported being involved in community coalitions/partnerships that increase public awareness of the importance of physical activity, walkability initiatives designed to promote a culture of walking, biking and other active transportation; promotion and advocacy of trail development within a community; and policies that reduce barriers and increase access to physical activity, sport and recreation.

SOCIAL AND BEHAVIOURAL INTERVENTIONS

PHUs reported the provision of a wide variety of programs and services geared to changing individual behaviours by increasing physical activity and reducing sedentary behaviours.

Interventions reported include:

- Pedometer lending programs
- Screen-time reduction initiatives, which encourage children and their families to reduce screen time and sedentary behaviour
- Physical literacy development programs, defined as the fundamental skills of movement that are the cornerstone of a healthy, active life
- The provision of financial assistance and equipment to children and youth who meet eligibility criteria, in order to participate in organized sport

Table 8.2: Examples of Initiatives Targeting Physical Activity Environments*

Life stage	Policy and environmental changes	Social and behavioural programs/initiatives
Infant, early childhood		**Community** ▪ Physical literacy development for children aged 0-6
Children and youth	**Macro-environment** ▪ Increase access to affordable physical activity opportunities for low -income families	**Community** ▪ Screen Time Reduction Initiative ▪ KidSport program ▪ Grade 5 Action Passes ▪ Live Outside the Box program
Parents		**Community** ▪ Screen Time Reduction Initiative
All	**Macro-environment** ▪ WalkOn ▪ Pathways for People advocating trail use ▪ Cycling and Walking Trail advocacy ▪ Hub Trail initiative-built environment focus ▪ Active Transportation Planning ▪ Share the Road active transportation ▪ Access to affordable recreation ▪ Built Environment working groups ▪ Development Application Reviews ▪ Environmental Assessments Transportation	**Community** ▪ Healthy Eating Playbook for Coaches ▪ Access to recreation and sustainable mobility ▪ Count Your Steps Pedometer Program

*A full inventory and description of initiatives is available in Appendix 9

Intersecting Environments (Physical Activity, and Food and Beverage)

POLICY AND ENVIRONMENTAL INTERVENTIONS

While the majority of initiatives in this scan of Ontario PHUs targeted healthy eating or physical activity, numerous community-wide initiatives focused on both healthy eating and physical activity.

Approximately 22% of PHUs reported having a comprehensive healthy weights program in their community that targets both risk factors simultaneously. In one PHU, there is a Healthy Weights Task Force and Strategy. This task force is interdisciplinary and aims to develop and coordinate healthy weights initiatives that support the healthy weights strategy across programs and target audiences. It is based on the balanced approach to promoting the healthy weights strategy, and targets schools, work sites, families and municipalities to build capacity, community awareness and partnerships. The task force also develops policies to promote healthy eating, active living and self-esteem where people live, learn and play. Other similar initiatives reported include the Healthy Eating and Healthy Physical Activity Priority Group, an initiative of a Child and Youth Network that identifies community priorities and builds local community initiatives around the priorities. Key areas of planning and implementation have included: *(1)* healthy eating and healthy physical activity awareness and education; *(2)* creating healthy and active neighbourhoods; *(3)* changing resident behaviours and habits; *(4)* building community connections for populations with barriers to physical activity and healthy eating; and *(5)* building an evidence base in healthy eating and healthy physical activity measurement and tracking.

SOCIAL AND BEHAVIOURAL INTERVENTIONS

Several key PHU interventions were reported that influence healthy eating and physical activity behaviours, primarily within the community setting. These include parenting programs and support groups, which are being provided by close to 81% of PHUs, prenatal education classes and a program called Motiv8. Motiv8 is a program designed to help individuals, families and organizations address healthy lifestyle behaviours through specific activities that promote and support physical activity and healthy eating in a variety of settings.

Table 8.3: Examples of Initiatives Targeting Intersecting Environments (Physical Activity and Food and Beverage)*

Life stage	Policy and environmental changes	Social and behavioural programs/initiatives
Infant, early childhood		**Community** ▪ Mix It Up-moving, mixing and munching together
Children and youth		
Parents		**Community** ▪ Young Parents Connection support group ▪ Triple P Parenting Program ▪ Prenatal education classes
All	**Macro-environment** ▪ Healthy Weights task force/community coalition ▪ Municipal policy scan ▪ Healthy Living Strategy ▪ Healthy Eating and Healthy Physical Activity Priority Group ▪ Healthy Communities Initiative	**Community** ▪ Motiv8

*A full inventory and description of initiatives is available in Appendix 9

School Environments

Close to 95% of PHUs reported that almost half of their initiatives were being offered within the school setting. Initiatives were offered within the daycare setting by 70% of PHUs. Within the school setting, PHUs reported that they support policies developed within the Foundations for a Healthy School Framework (16). The Framework takes a comprehensive approach to creating a healthy school and establishes a common understanding of the components that make up a healthy school. Healthy eating and physical activity are two of the health-related topics identified in the Framework.

POLICY AND ENVIRONMENTAL INTERVENTIONS

The primary policy and environmental interventions to support healthy eating and physical activity in child care, the school and after-school settings included guidelines and policies to ensure that healthy eating and physical activity were supported.

PHUs have a mandate to collaborate with school boards across the province in the area of healthy schools, which includes the implementation of the School Food and Beverage Policy released by the Ministry of Education in January 2010. This policy includes comprehensive nutrition standards for food and beverages sold in publicly funded elementary and secondary schools in Ontario (17).

In 2008, the Ministry of Children and Youth Services released nutrition guidelines as part of the Ontario Student Nutrition Program (18). The program supports the healthy growth and development of children and youth by providing universal access to nutritious meals and snacks, so that students are ready to learn. Most PHUs collaborate with community partners for the delivery of this program. In addition, 78% of PHUs reported involvement in facilitating broader implementation of existing policies and guidelines to promote healthy eating in places where children gather.

Significant policy initiatives targeting schools included the creation and implementation of vending machine guidelines, assistance with the negotiation of local school board food-service contracts, and policies that create safe and walkable routes to school. As well, 39% of PHUs reported having food and nutrition guidelines for child daycare settings.

SOCIAL AND BEHAVIOURAL INTERVENTIONS

All Ontario PHUs (100%) reported being involved in programming and services to influence healthy eating and physical activity behaviour in the daycare/school/after-school setting. This is done primarily through the development of nutrition- and physical activity-related programming that supports school curriculum through after-school programs and support groups, as well as outreach to parents of daycare and school-aged children. Increased knowledge and skill development related to healthy eating, physical activity and promotion of healthy weights is the primary focus of programming within the school setting. Most PHUs (86%) reported working with colleagues in the education, sport, physical activity and recreation sector to enhance food skills and create supportive environments, both at school and in the after-school time period.

Table 8.4: Examples of Initiatives Targeting School Environments*

Life stage	Policy and environmental changes	Social and behavioural programs/initiatives
Infant, early childhood	**Daycare** ▪ Raising the Bar Childcare Quality Assurance Program ▪ Healthy Eating Environment Guidelines for Child Care	**Daycare** ▪ Workshops for daycare cooks and early childhood educators ▪ Healthy Eating and Active Fun for Young Children ▪ Vegetable and Fruit Initiative ▪ Review child care menus ▪ Cooking programs
Children and youth	**School** ▪ School Food and Beverage Policy (PPM150) ▪ Daily Physical Activity (DPA) ▪ Nutrition Tools for Schools ▪ Vending machine guidelines/policies ▪ School Cafeteria Food Service Contracts ▪ Physical Activity School Handbook ▪ Ontario Student Nutrition Program ▪ Healthy Active School Communities ▪ Healthy School Initiative ▪ Creating Healthy School Nutrition Environments ▪ Healthy body Image Initiative ▪ SHAPES Survey recommendations implementation	**School/After-school** ▪ Active Safe Routes to School (ASRTS) ▪ DPA (Daily Physical Activity) ▪ Healthy Eating Playbook for Coaches ▪ Nutrition Tools for Schools ▪ Live Outside the Box ▪ GO Girls mentoring program ▪ Let's Get Cooking : food skills literacy program ▪ PROPS: Schoolyard games ▪ Kids in Motion Pedometer Lending program ▪ Healthy School awards ▪ Girl Talk and Training on Weight Bias ▪ Food for Thought cooking program ▪ Fit for Life program ▪ Farm to School program ▪ PALS (Physical Activity Leaders in Schools)
Parents		**Community** ▪ Screen Time Reduction Initiative ▪ ASRTS
All		

*A full inventory and description of initiatives is available in Appendix 9

Health Care and Work Environments

Approximately 60% of PHUs reported being involved in the provision of programs and services to workplaces. Also, 75% of PHUs reported that they had guidelines for the provision and procurement of food that support healthy eating in the workplace. PHUs reported offering education sessions on healthy weights to health care providers.

POLICY AND ENVIRONMENTAL INTERVENTIONS

Only a few PHUs reported initiatives related to policy and environmental support in the health care or work environments. Two key initiatives reported included the Baby-Friendly Initiative and use of the 2006 WHO Child Growth Standards and 2007 WHO Growth Reference Charts in PHUs clinics, and for distribution to physicians in primary health care settings.

SOCIAL AND BEHAVIOURAL INTERVENTIONS

Health unit clinics that provide programs and services are offered within various health care settings in the community. Most focus on assessments related to healthy growth and development of infants, toddlers and preschoolers. Maternal health is another focus for these clinics. Examples include screening clinics for preschoolers for growth and development issues, nutrition and oral health; breastfeeding clinics; Mother and Young Child clinics, pre- and post-natal clinics offered by a nurse practitioner; and Baby & Me Clinics, which offer well-baby checks that include plotting the height and weight of children using WHO growth charts.

Programs and services related to continuing education for the health professional is a key offering by PHUs. For example, training is provided for health professionals on weight bias (i.e., discrimination based on weight), Baby-Friendly Initiative, healthy weights initiatives, physical literacy (i.e., the ability and confidence to participate in a variety of physical activities in a variety of settings), and knowledge and skills related to obesity prevention. The workplace also provides a unique setting in which to offer programs using the comprehensive workplace health promotion approach (15). PHUs reported that they offer a wide variety of programs related to healthy eating and physical activity using this approach. They also reported collaborating with workplaces in offering the Eat Smart! Workplace Program (11). This program supports healthy environments by qualifying workplaces for bronze, silver or gold awards based on a set five standards: nutrition, food safety, smoke-free environment, supportive environment and healthy eating policy.

Table 8.5: Examples of Initiatives Targeting Health Care and Work Environments*

Life stage	Policy and environmental changes	Social and behavioural programs/initiatives
Infant, early childhood	**Health care** ▪ Use of WHO growth charts ▪ Baby-Friendly Initiative	**Health care** ▪ On Track Screening clinics for growth and development ▪ Mother and young child clinics ▪ Wellness clinics for tots
Children and youth		
Parents		**Health care** ▪ Healthy weight messaging ▪ Breastfeeding clinics ▪ Eat Smart! Workplace Program ▪ Supermarket tours ▪ Motiv8 workplace series
All	**Workplace** ▪ Health unit collaboration to support healthy environments related to healthy eating and physical activity ▪ Baby-Friendly Initiative	**Health care** ▪ Healthy weights staff education ▪ Training for health care workers on physical literacy ▪ Professional capacity-building re: healthy eating

*A full inventory and description of initiatives is available in Appendix 9

Message Environments

POLICY AND ENVIRONMENTAL INTERVENTIONS

The primary focus for these interventions was the promotion of guidelines and policies that support healthy eating and physical activity throughout the life cycle.

SOCIAL AND BEHAVIOURAL INTERVENTIONS

Most PHUs reported being engaged in some form of programming related to a communications campaign. The focus of these campaigns was highly varied, and media sources utilized include print materials, such as pamphlets, posters, newsletters and common messages documents, and social media including websites, Facebook, blogs and Twitter.

Reported campaigns targeted parents-to-be and new parents, and focused on the promotion of healthy eating for the mother and infant. Reported campaigns targeting the community at large tended to focus on the promotion of healthy eating, specifically vegetables and fruit. These also targeted physical activity, specifically the increase of physical activity through active transportation. Other reported campaigns targeted the community at large, in order to change societal norms related to weight and shape preoccupation, and to promote healthy weights.

Table 8.6: Examples of Initiatives Targeting Message Environments*

Life stage	Policy and environmental changes	Social and behavioural programs/initiatives
Infant, early childhood	**Community** ▪ Baby-Friendly Initiative	**Community** ▪ Social media strategy (Twitter and blog) targeting parents of young children ▪ On Track screening clinics for growth and development
Children and youth		**Community** ▪ Be Your Best Self communication campaign to take action on health issues ▪ Vegetable/fruit campaign ▪ Newsletters and other health communication to schools re: healthy eating and physical activity ▪ Energy drink advocacy campaign
Parents	**Community** ▪ Creating a Healthy School Nutrition Environment campaign	**Community** ▪ Social marketing campaigns about healthy eating and physical activity ▪ Road safety communication campaign
All	**Community** ▪ Health unit collaboration to support healthy environments related to healthy eating and physical activity	**Community** ▪ Healthy body image promotion ▪ Sodium campaign ▪ Healthy Eating-Rethink Your Drink healthy eating campaign ▪ Directory of Food Assistance resource ▪ Healthy eating, physical activity, body image and self-esteem common messages

*A full inventory and description of initiatives is available in Appendix 9

Discussion

This scan of Ontario PHUs provides an overview of programs in which PHUs are involved relating to healthy weights and obesity prevention in children and youth. A response rate of 100% was achieved, with all 36 Ontario health units responding to the survey, despite other survey requests received by them at the same time. A significant amount of information was gathered from PHUs, including the title of the initiative, a brief descriptor of the initiative, web links associated with initiatives and whether the initiative had been evaluated.

PHUs typically do not provide programming that specifically targets the reduction of childhood obesity. Their mandate, in accordance with the OPHS, is to provide programs/services, and support policy development that promotes and supports modifiable risk and protective factors — specifically breastfeeding, maternal and infant health, healthy eating, physical activity and healthy weights — as they relate to the promotion of chronic disease prevention and child health.

Overall, the 36 PHUs reported a total of 433 initiatives that target the promotion of healthy weights and the reduction of obesity in children or the whole population. The initiatives submitted were diverse, targeting childhood obesity at each life-course stage (i.e., preconception, prenatal, infant, toddler, preschool children, school-age children and youth), in addition to parents and specific vulnerable groups. Some initiatives were universal, targeting the general population, as opposed to focusing solely on children. There were initiatives that targeted each of the five IOM environments, both from a policy and environmental direction and a social and behavioural perspective. Similar to the interventions reported in Chapters 4 and 5, it was found that many of the initiatives had multiple components. However, it was reported that only one-third of all initiatives had been evaluated by the PHUs.

Limitations

This scan does not capture all initiatives related to healthy weights and the prevention of childhood obesity provided by PHUs across the province. Dependent upon the survey respondent, the number of initiatives submitted, categorization of the initiative and level of detail provided for each initiative varied quite substantially. In addition, PHUs have a mandate within the Foundational Standard of the OPHS to conduct population health assessment, surveillance, research and program evaluation. It is recognized that PHUs are engaged in additional activities in these areas that could not be captured through this survey, such as surveillance of childhood obesity.

Conclusion

PHUs in Ontario achieve their mandate through implementation of the OPHS offered within the community. The majority of PHUs provide programming by environment and risk and protective factors for obesity prevention, and/or as a comprehensive healthy weights program/initiative, and not as a childhood obesity reduction initiative. The majority (70%) of initiatives submitted by PHUs were related to programs or services, while 52% were related to policy, legislation or advocacy. Although there were 433 initiatives submitted in total, many of the initiatives were multi-component interventions. A significant portion of the initiatives (30%) were related to health communications, such as written materials, campaigns, etc. The bulk of programming offered was within the school/after-school setting and the community at large.

References

(1) Ontario. Ministry of Health and Long-Term Care. Ontario public health standards. Toronto, ON: Queen's Printer for Ontario; 2008 [cited 2013 Jun 26]. Available from: http://www.health.gov.on.ca/english/providers/program/pubhealth/oph_standards/ophs/index.html

(2) *Health Protection and Promotion Act*, R.S.O. 1990, c. H. 7.Availble from: http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90h07_e.htm

(3) Public Health Agency of Canada. Actions taken and future directions 2011. Curbing childhood obesity: a federal, provincial and territorial framework for action to promote healthy weights. Ottawa, ON: Her Majesty The Queen in Right of Canada; 2011 [cited 2013 Jun 26]. Available from: http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/framework-cadre/2011/hw-os-2011-eng.php

(4) IOM (Institute of Medicine). Accelerating progress in obesity prevention: solving the weight of the nation. Washington, DC: National Academies Press; 2012 [cited 2013 Jun 26]. p.6. Available from: http://books.nap.edu/catalog.php?record_id=13275

(5) Zaza S, Briss PA, Harris KW. The guide to community preventive services: what works to promote health? New York, NY: Oxford University Press; 2005 [cited 2013 Jun 26]. Available from: http://www.thecommunityguide.org/library/book/index.html

(6) Ontario. Ministry of Health Promotion. Nutritious food basket guidance document. Toronto, ON: Queen's Printer for Ontario; 2010 [cited 2012 Jun 07]. Available from: http://www.mhp.gov.on.ca/en/healthy-communities/public-health/guidance-docs/NutritiousFoodBasket.PDF

(7) Breastfeeding Committee for Canada [homepage on the Internet]. Drayton Valley, AB: Breastfeeding Committee for Canada; c2012. Baby-friendly initiative documents; 2012 [cited 2013 Mar 18]. Available from: http://breastfeedingcanada.ca/BFI.aspx

(8) United Nations Children's Fund (UNICEF) [homepage on the Internet]. New York, NY: UNICEF; c2013. The baby-friendly hospital initiative; 2013 [cited 2013 Mar 18]. Available from: http://www.unicef.org/programme/breastfeeding/baby.htm

(9) de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007 [cited 2013 Jun 26];85(9):660-7. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2636412/pdf/07-043497.pdf

(10) Nutristep [homepage on the Internet]. Sudbury, ON: Sudbury and District Health Unit; c2011. Nutrition screening tool for every preschooler; 2011 [cited 2013 Jun 26]. Available from: http://www.nutristep.ca/

(11) Eat Smart! [homepage on the Internet]. Toronto, ON: Eat Smart! and the Nutrition Resource Centre; c2013. Eat Smart! for recreation centres; 2013 [cited 2012 Jul 6]. Available from: http://www.eatsmartontario.ca/recreation_centre

(12) Community Food Advisor [homepage on the Internet]. Toronto, ON: Nutrition Resource Centre; c2010. The community food advisor program in Ontario; 2010 [cited 2012 Jul 6]. Available from: http://www.communityfoodadvisor.ca/

(13) Public Health Agency of Canada. Canada Prenatal Nutrition Program. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2011 [cited 2012 Jul 06]. Available from: http://www.phac-aspc.gc.ca/hp-ps/dca-dea/prog-ini/cpnp-pcnp/

(14) Ontario. Ministry of Health and Long-Term Care. Healthy Babies Healthy Children program. Toronto, On: Queen's Printer for Ontario; c2009-2010 [cited 2012 Jul 06]. Available from: http://www.health.gov.on.ca/en/common/ministry/publications/reports/healthy_babies_report/hbabies_report.aspx

(15) Public Health Agency of Canada [homepage on the Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; c2011. Supportive environments for physical activity: how the built environment affects our health; 2011 Mar 11 [cited 2012 Jul 06]. Available from: http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/be-eb-eng.php

(16) Ontario. Ministry of Education. Foundations for a healthy school framework. Toronto, ON: Queen's Printer for Ontario; 2012 [cited 2012 Jul 06]. Available from: http://www.edu.gov.on.ca/eng/healthyschools/foundations.pdf

(17) Ontario. Ministry of Education. Policy/program memorandum No. 150: School food and beverage policy. Toronto, ON: Queen's Printer for Ontario; 2010 [cited 2012 Jun 14]. Available from: http://www.edu.gov.on.ca/extra/eng/ppm/ppm150.pdf

(18) Ontario. Ministry of Children and Youth Services [homepage on the Internet]. Toronto, ON: Queen's Printer for Ontario; c2010. Student nutrition programs; 2011 Oct 26 [cited 2012 Jun 14]. Available from: http://www.children.gov.on.ca/htdocs/English/topics/schoolsnacks/index.aspx

9. Conclusion

This report was developed to serve as an evidence primer on the issue of child and youth overweight and obesity for a panel convened to advise the Ministry of Health and Long-Term Care on the best way to achieve its obesity reduction target. Determining the primary factors associated with childhood obesity is a starting point to understanding how to reduce and prevent obesity. Overweight and obesity is a result of a complex web of risk and protective factors that begin before birth and continue throughout the life course at the individual, family, community and societal levels. Although there is a genetic component, many modifiable risk factors are associated with overweight and obesity in children and youth. These include maternal smoking, high birthweight, rapid infant weight gain, consumption of sugar-sweetened beverages, physical inactivity, sedentary behaviour and inadequate sleep. Additionally, there are factors that have been shown to be protective against child and youth overweight and obesity, such as breastfeeding, breakfast consumption and physical activity. Although there is limited information about obesity risk factors among children and youth in Ontario, it has been shown that a substantial number of Ontario's children and youth do not get enough physical activity, and many engage in sedentary behaviours for long periods of the day, a trend that increases with age. Additionally, only half of youth consume the recommended number of vegetable and fruit servings per day, and many children and youth are consuming too many calories from sugar-sweetened beverages.

Despite these multi-factorial causal pathways, research on the effectiveness of interventions to prevent obesity evaluated with anthropometric outcomes has primarily focused on interventions set in the school environment, which have been consistently shown to be effective at producing small, but clinically and statistically significant, reductions in measured anthropometric outcomes in children and youth. These were most often social and behavioural interventions that aimed to increase healthy eating and physical activity behaviours and reduce sedentary behaviours. More effective interventions tend to address both sides of the energy balance equation, engage parents, have a longer duration, are designed to be culturally sensitive, and use both educational and environmental activities. There is also some evidence of effectiveness for interventions conducted within home, community, and preschool and health care settings, and those that are web- or computer-based.

This review identified three different approaches to treatment interventions that have been assessed for efficacy and effectiveness: lifestyle, pharmaceutical and surgical. Lifestyle approaches were found to be more effective when they include behavioural therapy, address several risk factors and include parental involvement. Pharmaceutical and surgical interventions for the treatment of obesity in youth can similarly be effective, but there is limited evidence regarding their long-term safety. As treatment approaches generally target individuals rather than populations, the potential population impact is low when compared to prevention initiatives. However, in order to prevent the complications of obesity in children and youth, obesity treatment approaches play a complementary role. Fortunately, there are both prevention and treatment approaches that meet acceptable cost-effectiveness thresholds, and these interventions can occur in a variety of settings (e.g., message environment, school and after-school setting, and within the health care system).

Although there is limited evidence on the effectiveness of prevention interventions outside of the school environment, international, national, provincial jurisdictions and local Ontario public health units are moving forward with comprehensive multi-level strategies based on the causal pathway evidence. These include policies and capacity-building activities to facilitate the creation of environments in which healthy eating and physical activity behaviours are fostered, such as in home, community, workplace, daycare, after-school, school and health care settings. Various jurisdictions and settings, including PHUs, have also focused their efforts beyond risk factors related to healthy eating and physical activity. For example, some organizations have established programs or policies to increase breastfeeding, a protective factor against childhood obesity.

Evaluating the success of efforts to achieve the Ontario government's obesity reduction goal relies on the ability to establish baseline measurements for childhood obesity and related risk factors, as well as the monitoring of these measures over time. Measured BMI-for-age is most commonly used for monitoring overweight and obesity in children and youth at the population level. There are several growth charts to define healthy growth ranges and related percentiles of BMI relative to age and sex. Recently, a number of Canadian organizations have recommended WHO growth charts

for the standard. Within Ontario, there are a number of surveys that collect height and weight data, and although all have limitations, there are opportunities to leverage existing surveys to measure progress on meeting Ontario's obesity reduction goal.

For the purpose of this report, intervention effectiveness was measured as a reduction in anthropometric outcomes, given the focus on childhood obesity reduction. However, many interventions focusing on obesity prevention target risk factors for obesity and, therefore, measure effectiveness as changes to these risk factors, such as increases in physical activity or improved dietary intake. Measuring behavioural changes that result from an intervention is often more feasible due to the amount of follow-up time needed to capture changes in anthropometric measures, such as weight or waist circumference. While a change in behaviour may be observed soon after a programmatic intervention or when an environmental or policy change is implemented, anthropometric changes occur over a long time period and a study's duration may not be sufficient to capture the change. Additionally, it is unknown if reductions in weight/BMI and behaviour changes are sustained in the long term.

Given the short timeline to deliver this report and the rapidly growing literature base on childhood obesity, it was not possible to assess the primary literature on prevention and treatment interventions. The systematic review literature privileges experimental design studies, which are less conductive to assessing the effectiveness of policy and environmental interventions. Despite this, there was some evidence of effectiveness, based on anthropometric outcomes for policy and environmental interventions in schools (e.g., changes to the types of food available in cafeterias/vending machines and increased opportunities for physical activity), although the evidence of effect on behaviour change was generally more conclusive. Overall, this report shows a divide between the current evidence and the action taken by jurisdictions and PHUs. Both scans demonstrated that there is strong support for policy and environmental interventions, but evaluations of these actions are largely missing from the literature examined. It is possible that these interventions have not yet been evaluated or they are currently in progress. However, jurisdictions have moved forward with the development of strategies that are not only based on the effectiveness literature, but also on what is known from the epidemiologic literature and by extrapolation from other public health issues, such as tobacco control.

In conclusion, for children and youth, the dynamic relationships between individual and environmental factors across a variety of settings are important for childhood obesity causality, and these relationships represent important opportunities for intervention. Given these complex pathways, successful reduction of overweight and obesity in children and youth will require a comprehensive approach. This is especially imperative, as no single intervention emerged from the literature as a silver bullet to the problem of childhood obesity, and the accumulation of small effects from a variety of interventions that target all relevant environments and settings will likely contribute to an overall solution.

List of Acronyms

AASC – Active After-School Communities

ACE – Assessing Cost-Effectiveness

aIPHa – Association of Local Public Health Agencies

AMSTAR – A Measurement Tool to Assess Systematic Reviews

APPLE – A Pilot Program for Lifestyle and Exercise

APS – Aboriginal Peoples Survey

BFI – Baby-Friendly Initiative

BIA – Bioelectrical impedance analysis

BMI – Body mass index

BPA – Bisphenol A

CAMH – Centre for Addiction and Mental Health

CANPLAY – Canadian Physical Activity Levels Among Youth

CATCH – Coordinated Approach to Child Health

CCHS – Canadian Community Health Survey

CDC – Centers for Disease Control and Prevention

CFLRI – Canadian Fitness and Lifestyle Research Institute

CHMS – Canadian Health Measures Survey

CI – Confidence interval

COMOH – Council of Ontario Medical Officers of Health

DALY – Disability-adjusted life-year

DPA – Daily physical activity

DXA – Dual-energy X-ray absorptiometry

EHR – Electronic health record

EMR – Electronic medical record

EPODE – Ensemble Prévenons l'Obesité des Enfants

F/P/T – Federal/Provincial/Territorial

FNIGC – First Nations Information Governance Centre

FNIM – First Nations, Inuit and Métis

GDP – Gross domestic product

GP – General practitioner

HBSC – Health Behaviour in School-aged Children

HDL – High-density lipoprotein

HPPA – Health Protection and Promotion Act

ICER – Incremental cost-effectiveness ratio

IOM – Institute of Medicine

IOTF – International Obesity Task-Force

KPS – Kindergarten Parent Survey

LAGB – Laparoscopic adjustable gastric banding

LDL – Low-density lipoprotein

LEAP – Live, Eat and Play

MHPS – Ministry of Health Promotion and Sport

MOHLTC – Ministry of Health and Long-Term Care

MVPA – Moderate to vigorous physical activity

NCMP – National Child Measurement Program

NFB – Nutritious Food Basket

NGO – Non-governmental organization

NHANES – National Health and Nutrition Examination Survey

NLSCY – National Longitudinal Survey of Children and Youth

OPHS – Ontario Public Health Standards

OR – Odds ratio

OSDUHS – Ontario Student Drug Use and Health Survey

PAM – Physical Activity Monitor

PCB – Polychlorinated biphenyl

PHO – Public Health Ontario

PHU – Public health unit

QALY – Quality-adjusted life-year

RCT – Randomized control trial

RHS – Regional Health Survey

SDS – Standardized deviation score

SES – Socioeconomic status

SHAPES – School Health Action Planning and Evaluation System Ontario

SMD – Standardized mean difference

SSB – Sugar-sweetened beverages

UI – Uncertainty interval

UNICEF – United Nations Children's Fund

WHO – World Health Organization

WHO-CHOICE – World Health Organization's Choosing Interventions that are Cost-Effective Collaboration

YRBS – Youth Risk Behaviour Survey

Glossary of Key Terms

Adiposity	"The state of an excess of body fat" (1).
Advertising	"A paid public presentation and promotion of ideas, goods, or services by a sponsor that is intended to bring a product to the attention of consumers through a variety of media channels, such as broadcast and cable television, radio, print, billboards, the Internet, or personal contact" (1).
Behaviour	"The manner in which persons or groups conduct themselves, that may be indicative of thoughts, feelings, moods, emotions, motivation, etc." (2).
Behaviour modifications	"A method of changing an individual's conduct based on manipulating environmental conditions in order to evoke different stimulus-response reactions from those of past experience, for instance associating unpleasant stimuli with compulsive gambling aims to discourage the addiction" (2).
Body mass index (BMI)	"A simple index of weight-for-height that is commonly used in classifying overweight and (BMI) obesity in adult populations and individuals. It is calculated as the weight in kilograms divided by the square of the height in metres (kg/m2)" (3). "In children and youth, BMI is interpreted using growth charts for age and gender and is referred to as BMI-for-age and sex, which is used to assess underweight, overweight, and obesity" (1).
Built environment	"Elements of the physical environment that are man-made, in contrast to the natural environment."(3). The built environment includes buildings, parks, transportation systems, healthy food access, community gardens, walkability and bikeability to name a few (4).
Calorie-dense food	"Foods and beverages that contribute few vitamins and minerals to the diet but contain substantial amounts of fat and/or sugar and are high in calories. Consumption of these foods, such as sugar-sweetened beverages, candy, and chips may contribute to excess caloric intake and unwanted weight gain in children" (1).
Cochrane Review	"Cochrane Reviews are systematic reviews of primary research in human health care and health policy, and are internationally recognised as the highest standard in evidence-based health care. They investigate the effects of interventions for prevention, treatment and rehabilitation. They also assess the accuracy of a diagnostic test for a given condition in a specific patient group and setting. They are published online in *The Cochrane Library*" (5).
Communication	"The process by which knowledge, ideas, beliefs, techniques, and methods are transmitted among individuals by word of mouthy, printed media, electronic means, etc." (2).
Community	"A social entity that can be spatial based on where people live in local neighbourhoods, residential districts, or municipalities, or relational, as with people who have common ethnic or cultural characteristics or share similar interests" (1).
Disability-adjusted life years (DALYs)	"A population-based measure of the burden of disease and injury expressed in terms of hypothetical healthy life years that are lost as a result of specified disease and injuries" (2).

Diet	"The composition of food intake, often that a person or a specified group over a specified period, e.g. the daily diet, or dietary intake" (2).
Environment	"The external influences on the life of an individual or community" (1).
Evidence	"Evidence comprised the interpretation of empirical data derived from formal research or systematic investigations, using any type of science or social science methods" (6).
Evidence-based practice	Consideration of evidence about likely consequences of interventions, such as effectiveness and cost-effectiveness, not evidence about need for services (evidence on the implementation and outcomes of interventions) (6).
Exercise	"Muscular activity that requires energy expenditure, using inspired oxygen to transform and metabolize carbohydras" (2).
Grey literature	"Documentary material which is not commercially published or publicly available, such as technical reports or internal business documents" (3).
Health disparities	"The difference between the levels of health indicators that are observed in a defined population group and the level that would be expected if this group had the health experience of the segment of the population that ranks highest in health indicators"(2).
Incremental cost-effectiveness ratio (ICER)	Ratio of the change in costs to changes in effects for an intervention compared to another. Costs are usually described as monetary units, and effect on health is often measured in QALYs or DALYs. It provides a way to compare cost-effectiveness across a variety of disease states and interventions (7).
Intervention	"Any kind of planned activity or group of activities (including programs, policies, and laws) designed to prevent disease or injury or promote health in a group of people" (8). Interventions can be described on the basis of four dimensions: its type (including content, activities and breadth of focus), how it's delivered? (e.g., who delivers it, time-period frequency and duration), its target population and where it's delivered (e.g. setting).
Intervention, multi-component	"An intervention that includes more than one activity. For example, mass media campaigns to motivate young people to remain tobacco-free can be combined or coordinated with additional intervention activities, such as increases in tobacco product excise taxes, school-based education, and other community-wide education activities" (8).
Jurisdiction	"Jurisdiction generally describes any authority over a certain area or certain persons. In the law, jurisdiction sometimes refers to a particular geographic area containing a defined legal authority. For example, the federal government is a jurisdiction unto itself. Its power spans the entire United States. Each state is also a jurisdiction unto itself, with the power to pass its own laws. Smaller geographic areas, such as counties and cities, are separate jurisdictions to the extent that they have powers that are independent of the federal and state governments" (9).
Life-course approach	"The natural history of human life. A term for conditions that evolve over a large part or all of the life span from infancy, or even from conception, through adolescence, adult life, and senescence, sometimes peaking in early adult life, sometimes in middle age, but generally progressing throughout life as a person grows older. The term is recognition of the fact that the natural history of many chronic disease and the natural life span of humans are intertwined" (2).

Meta-analysis	"The critical review and analysis of multiple studies of a causal relationship or a therapeutic or preventive regiment that yields a quantitative aggregate summary of all the results. It is a systematic, organized, and structured evaluation of a problem and of methods used in earlier studies of the problem…The aim is to identify and evaluate the overall trend in the pooled results of all studies included in the meta-analysis. It is most often applied to sets of randomized controlled trials (RCTs), but is also used to pool the results of case control and cohort studies" (2).
Non-governmental organization (NGO)	"A generic name for not-for-profit organizations or agencies that are separate and independent from government. Many provide health and social services. Some are partially supported by government funds" (2).
Nutrition	"The field of science and technology that deals with the process by which an organism assimilates, digests, and uses food and liquids for normal function, growth, and development. Nutrition is concerned with the energy value (calories) and the content of carbohydrate, protein, fat, minerals, and vitamins in food items (Last, 2007)"
Obesity	"An excess amount of subcutaneous body fat in proportion to lean body mass." (1).
Public health	"Public health focuses on the entire population at both the individual and the community level. It encompasses a range of activities performed by all three levels of government (federal, provincial/territorial, and municipal) in collaboration with a wide variety of stakeholders and communities across the country." (6).
Physical activity	"Body movement produced by the contraction of skeletal muscles that results in energy expenditure above the basal level. Physical activity consists of athletic, recreational, housework, transport, or occupational activities that require physical skills and utilize strength, power, endurance, speed, flexibility, range of motion, or agility" (1).
Physical changes	Changes in measurements that are used as surveillance of chronic non-communicable disease risk factors. Examples include BMI, waist circumference, blood pressure, pulse rate and hip circumference. In this report, changes in physical and clinical measurements are presented together.
Prevention	"Policies and actions to eliminate a disease or minimize its effect; to reduce the incidence and/or prevalence of disease, disability, and premature death; to reduce the prevalence of disease precursors and risk factors in the population; and, if none of these is feasible, to retard the progress of incurable disease" (2). "With regard to obesity, *primary* prevention represents avoiding the occurrence of obesity in a population; *secondary* prevention represents early detection of disease through screening with the purpose of limiting its occurrence; and *tertiary* prevention involves preventing the sequelae of obesity in childhood and adulthood" (1).
Program	"An integrated set of planned strategies and activities that support clearly stated goals and objectives designed to lead to desirable changes and improvements in the well-being of people, institutions, or environments or all of these" (1). "More formally, an outline of the way a system or service will function, with specifics such as roles and responsibilities, expected expenditures, outcomes, etc. A health program is generally long term and often multifaceted, whereas a health project is a short-term and usually narrowly focused activity" (2).

Policy	"A written statement reflecting a plan or course of action of a government, business, community, or institution that is intended to influence and guide decision making. For a government, a policy may consist of a law, regulation, ordinance, executive order, or resolution" (1).
Population health	"The state of health of an entire community or population as opposed to that of an individual. It is concerned with the interrelated factors that affect the health of populations over the life course and the distribution of the patterns of health outcomes" (1).
Psychosocial changes	Changes in knowledge, attitudes, self-efficacy, and stage of change on diet and physical activity.
Quality-adjusted life years (QALYs)	"An adjustment of life expectancy to allow for the fact that chronic diseases, disabilities, and handicaps often shorten life by predictable amounts" (2). "[A QALY] is arrived at in each case by adjusting the length of time affected through the health outcome by the utility value (on a scale of 0 to 1) of the resulting level of health status"(7).
Risk factor	"Determinant of disease that can be modified by specific actions, behaviours or treatment regimens" (2). Risk factors may be divided into those directly related to disease outcomes (proximal risk factors), such as increased consumption of sugar-sweetened beverages and risk of overweight and obesity in children, and those with indirect effect on outcomes (distal risk factors), such as the influence of high food prices, particularly on vegetables and fruit, on the risk of childhood obesity, which is mediated by reduced consumption of vegetables and fruit because of higher food prices.
Social and behavioural programs/initiatives	Social and/or behavioural programs/initiatives aim to increase physical activity or healthier dietary behaviour in order reduce risk of childhood obesity. They do so by teaching behaviour change skills and/or providing social support for people who are trying to begin or continue regular physical activity or achieve healthier dietary behaviours. Often these programs/initiatives involve individuals or group counselling and/or the individual's friends or family.
Social marketing	"The application of commercial marketing principles to the analysis, planning, implementation, and evaluation of programs designed to influence voluntary behavioral changes in target audiences to improve their personal welfare and benefit society" (1).
Socio-ecological approach	"Policy actions that shape the economic, social and physical (built and natural) environments" (10). In the context of childhood obesity, these may include policy actions that influence (a) underlying determinants of health in society; (b) the food system; or (c) physical activity environments.
Strategy	"A formally planned set of actions to deal with a problem, with the implication that it is a long-range plan rather than a short-term, ad hoc solution. Tactics are the details of a strategic plan" (2).
Systematic review	"A review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research and to collect and analyze data from the studies that are included in the review. Statistical methods (meta-analysis) may or may not be used to analyze and summarize the results of the included studies" (1).
Vulnerable groups	"This term is applied to any designated group identified by epidemiological or other studies as being at higher risk than the general population of either specific conditions such as coronary heart disease and HIV/AIDs or for a broad class of conditions such as childhood infectious diseases. Vulnerability implies more than merely being at risk because it reflects that the impact of disease may be aggravated by other factors, such as poverty or malnutrition" (2).

References

(1) IOM (Institute of Medicine). Accelerating progress in obesity prevention: solving the weight of the nation. Washington, DC: National Academies Press; 2012. Available from: http://books.nap.edu/catalog.php?record_id=13275

(2) Last JM. A dictionary of public health. New York, NY: Oxford University Press; 2007.

(3) World Health Organization. Interventions on diet and physical activity: what works: summary report. Geneva: World Health Organization; 2009 [cited 2013 Jun 26]. Available from: http://www.who.int/dietphysicalactivity/summary-report-09.pdf

(4) Public Health Agency of Canada [homepage on the Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; c2011. Supportive environments for physical activity: how the built environment affects our health; 2011 Mar 11 [cited 2012 Jul 06]. Available from: http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/be-eb-eng.php

(5) The Cochrane Collaboration [homepage on the Internet]. Oxford, EN: The Cochrane Collaboration; c2013. Cochrane reviews; 2012 [cited 2012 May 25]. Available from: http://www.cochrane.org/cochrane-reviews

(6) Public Health Agency of Canada [homepage on the Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; c2011. Mandate; 2011 Jun 16 [cited 2013 Aug 30]. Available from: http://www.phac-aspc.gc.ca/about_apropos/what-eng.php

(7) Drummond MF, O'Brien B, Stoddart GL, Torrance GW. Methods for the economic evaluation of health care programmes. 2nd ed. New York, NY: Oxford University Press; 1997.

(8) Zaza S, Briss PA, Harris KW. The guide to community preventive services: what works to promote health? New York, NY: Oxford University Press; 2005 [cited 2013 Jun 26]. Available from: http://www.thecommunityguide.org/library/book/index.html

(9) The Free Dictionary [homepage on the Internet]. Huntingdon Valley, PA: Farlex, Inc; c2013. Jurisdiction; 2012 [cited 2012 May 28]. Available from: http://legal-dictionary.thefreedictionary.com/jurisdiction

(10) Sacks G, Swinburn B, Lawrence M. Obesity Policy Action framework and analysis grids for a comprehensive policy approach to reducing obesity. Obes Rev. 2009;10(1):76-86.

Appendix 1: Data Tables for Part A Figures

Table 1: Measured overweight and obesity using WHO BMI-for-age cut-offs in children and youth, by sex, Canada, 1978-79 (ages 2 to 17), 2004 (ages 2 to 17), 2009-11 (ages 5 to 17) (Figure 2.1)

Sex	Year	Obese		Overweight		Combined overweight and obese	
		Per cent	95% CI	Per cent	95% CI	Per cent	95% CI
Both	1978-1979	6.3	4.7 - 7.9	17.0	N/A	23.3	20.5 - 26.0
	2004	12.7	11.7 - 13.8	22.0	N/A	34.7	33.0 - 36.4
	2009-2011	11.7	9.9 - 13.7	19.8	16.6 - 23.4	31.5	N/A
Males	1978-1979	7.3	5.1 - 9.4	20.0	N/A	27.3	23.4 - 31.1
	2004	14.8	13.0 - 16.6	23.2	N/A	38.0	35.5 - 40.4
	2009-2011	15.1	12.6 - 17.9	19.4	15.1 - 24.4	34.5	N/A
Females	1978-1979	5.2	2.6 - 7.9	13.8	N/A	19.0	13.6 - 24.3
	2004	10.6	9.2 - 12.0	20.7	N/A	31.3	29.0 - 33.6
	2009-2011	8.0	5.7 - 11.1	20.2	15.8 - 25.6	28.2	N/A

Sources: 1) Shields M, Tremblay MS. Canadian childhood obesity estimates based on WHO, IOTF and CDC cut-points. Int J Pediatr Obes 2010 May 3;5(3):265-273; 2) Roberts KC, Shields M, de Groh M, Aziz A, Gilbert JA. Overweight and obesity in children and adolescents: results from the 2009 to 2011 Canadian Health Measures Survey. Health Rep. 2012 Sep;23(3):37-41.

Notes:

1) Population aged 2 to 17 (1978-1979 and 2004) or aged 5 to 17 (2009-2011) with a measured height and weight classified as overweight or obese according to WHO BMI-for-age growth charts.
2) N/A = Confidence Interval not published in source.

Table 2: Measured overweight and obesity using WHO BMI-for-age cut-offs in children and youth, by age group and sex, Canada, 2009-2011 (Figure 2.2)

Sex	Age group	Obese		Overweight	
		Per cent	95% CI	Per cent	95% CI
Both	5 to 11	13.1	10.5 - 16.3	19.7	16.4 - 23.4
	12 to 17	10.2	7.3 - 14.1	19.9	15.0 - 25.8
Males	5 to 11	19.5	15.5 - 24.1	19.8	14.8 - 26.0
	12 to 17	10.7	7.5 - 15.0	18.9	12.6 - 27.5
Females	5 to 11	6.3	4.1 - 9.8	19.6	16.1 - 23.6
	12 to 17	9.6	6.0 - 15.1	20.9	14.9 - 28.6

Source: Roberts KC, Shields M, de Groh M, Aziz A, Gilbert JA. Overweight and obesity in children and adolescents: results from the 2009 to 2011 Canadian Health Measures Survey. Health Rep. 2012 Sep;23(3):37-41.

Notes:

1) Population aged 5 to 17 with a measured height and weight classified as overweight or obese according to WHO BMI-for-age growth charts.
2) Results for obese females in both age groups and overweight males aged 12 to 17 should be interpreted with caution due to high sampling variability.

Table 3: Self-reported overweight and obesity using WHO BMI-for-age cut-offs in youth aged 12 to 17, by sex, Ontario and Canada, 2003 to 2009/2010 (Figure 2.3)

Sex	Year	Ontario		Canada	
		Per cent	95% CI	Per cent	95% CI
Both	2003	25.7	23.8 - 27.5	25.7	24.6 - 26.8
	2005	27.7	25.7 - 29.7	26.7	25.6 - 27.8
	2007/2008	26.5	24.4 - 28.6	26.2	25.0 - 27.4
	2009/2010	27.1	24.9 - 29.4	26.4	25.0 - 27.8
Males	2003	32.9	30.0 - 35.8	31.8	30.2 - 33.5
	2005	33.7	30.7 - 36.7	32.3	30.6 - 34.0
	2007/2008	32.4	29.1 - 35.6	32.0	30.1 - 33.9
	2009/2010	33.5	30.2 - 36.7	32.5	30.3 - 34.6
Females	2003	17.6	15.3 - 20.0	19.0	17.8 - 20.5
	2005	21.1	18.5 - 23.7	20.4	19.0 - 21.9
	2007/2008	20.2	17.6 - 22.7	19.9	18.3 - 21.5
	2009/2010	20.4	17.3 - 23.4	20.1	18.3 - 21.9

Source: Canadian Community Health Survey 2003 - 2009/2010, Statistics Canada, Canada Share File, Distributed by Ontario MOHLTC.

Notes:

1) Population aged 12 to 17 who reported a height and weight classified as overweight or obese according to WHO BMI-for-age growth charts. Estimates were made using age in years of respondent.

Table 4: Self-reported consumption of vegetables and fruit at least 5 times per day in youth aged 12 to 19, Ontario and Canada, 2003 to 2011 (Figure 2.5)

Year	Ontario		Canada	
	Per cent	95% CI	Per cent	95% CI
2003	44.9	43.0 - 46.9	45.3	44.1 - 46.5
2005	49.1	44.9 - 53.4	49.0	46.8 - 51.3
2007	44.0	41.0 - 47.1	48.0	46.3 - 49.8
2008	44.2	41.3 - 47.1	49.3	47.6 - 51.1
2009	45.8	42.9 - 48.6	49.2	47.3 - 51.1
2010	46.5	43.4 - 49.6	49.3	47.5 - 51.1
2011	42.4	39.1 - 45.8	43.8	41.8 - 45.9

Source: Statistics Canada. Table 105-0501 - Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2011 boundaries) and peer groups.

Notes:

1) Indicates the usual number of times (frequency) per day a person reported eating fruits and vegetables. Measure does not take into account the amount consumed.

Table 5: Percentage of daily calories derived from sugar-sweetened beverages in children and youth aged 1 to 18 by sex and age group, Canada, 2004 (Figure 2.6)

Age group	Males (%)	Females (%)
1 to 3	3	3
4 to 8	5	4
9 to 13	6	6
14 to 18	8	7

Source: Garriguet D. Beverage consumption of children and teens. Health Rep. 2008 Dec;19(4):17-22.

Notes:
1) Data published in source as whole numbers. Confidence Intervals not available.

Table 6: Self-reported breastfeeding initiation and exclusive for at least 6 months (in those who reported being pregnant in the past 5 years), Ontario, 2003 to 2011 (Figure 2.7)

Year	Initiation		Exclusive > 6 Months	
	Per cent	95% CI	Per cent	95% CI
2003	87.1	85.2 - 89.0	17.6	15.4 - 19.8
2005	87.9	86.1 - 89.7	19.7	17.6 - 21.7
2007	88.6	86.3 - 90.8	21.6	17.7 - 25.5
2008	89.7	87.4 - 92.0	25.6	21.8 - 29.4
2009	87.8	85.0 - 90.5	23.1	20.1 - 26.1
2010	89.6	86.3 - 92.9	28.9	24.3 - 33.6
2011	87.1	84.0 - 90.3	27.3	22.9 - 31.7

Source: Statistics Canada. Table 105-0501 - Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2011 boundaries) and peer groups.

Notes:
1) Based on information provided by females aged 15 to 55 who had a baby in the last 5 years.
2) Initiated breastfeeding refers to mothers who breastfed or tried to breastfeed their last child even if only for a short time.
3) Exclusive breastfeeding refers to an infant receiving only breast milk, without any additional liquid (even water) or solid food.

Table 7: Average daily steps taken by children and youth aged 5 to 19 by age group, Ontario, 2005-2007 and 2007-2009 (Figure 2.8)

Age group	2005-2007	2007-2009
5 to 10	12,583	12,668
11 to 14	11,338	11,838
15 to 19	9,771	10,322

Source: 2005-2009 Canadian Physical Activity Levels Among Youth survey, CFLRI.

Notes:
1) Confidence Intervals not published in source.

Table 8: Daily physical activity during the past week in students grades 7 to 12, Ontario, 2011 (Figure 2.9)

Grade	Per cent	95% CI
7	27.0	23.8 - 30.4
8	27.8	24.4 - 31.4
9	24.3	21.3 - 27.7
10	22.5	19.4 - 26.0
11	15.7	13.2 - 18.6
12	15.6	12.8 - 18.9

Source: Paglia-Boak A, Adlaf EM, Hamilton HA, Beitchman JH, Wolfe D, Mann RE. The mental health and well-being of Ontario students, 1991-2011: Detailed OSDUHS findings (CAMH Research Document Series No. 34). Toronto, ON: Centre for Addiction and Mental Health. 2012.

Notes:

1) Daily physical activity was defined as those who indicated that they were physically active (both school and non-school-based activities) at least 60 minutes for every day in the previous week.

Table 9: Participation in organized physical activities and sports by children and youth aged 5 to 17 by sex and age group, Ontario, 2006-2007 (Figure 2.10)

Age group	Males (%)	Females (%)
5 to 11	82	80
12 to 17	69	68

Source: 2006-2007 Canadian Physical Activity Levels Among Youth survey, CFLRI.

Notes:

1) Data published in source as whole numbers. Confidence Intervals not available.

Table 10: Self-reported physical inactivity during leisure time in youths aged 12 to 19, by sex, Ontario, 2003 to 2011 (Figure 2.11)

Year	Males		Females	
	Per cent	95% CI	Per cent	95% CI
2003	22.7	20.6 - 24.8	33.8	31.2 - 36.4
2005	22.7	20.4 - 25.0	32.9	30.5 - 35.4
2007	25.2	21.5 - 29.0	36.1	32.3 - 39.9
2008	21.5	18.3 - 24.8	39.3	35.1 - 43.5
2009	24.1	20.8 - 27.4	38.4	34.4 - 42.5
2010	24.3	21.0 - 27.7	38.6	34.5 - 42.6
2011	24.3	20.4 - 28.1	30.4	26.1 - 34.8

Source: Statistics Canada. Table 105-0501 - Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2011 boundaries) and peer groups.

Notes:

1) Population aged 12 to 19 who reported a level of physical activity, based on their responses to questions about the nature, frequency and duration of their participation in leisure-time physical activity.
2) Respondents are classified as active, moderately active or inactive based on an index of average daily physical activity over the past 3 months. For each leisure-time physical activity engaged in by the respondent, an average daily energy expenditure is calculated by multiplying the number of times the activity was performed by the average duration of the activity by the energy cost (kilocalories per kilogram of body weight per hour) of the activity. The index is calculated as the sum of the average daily energy expenditures of all activities. Respondents are classified as follows: 3.0 kcal/kg/day or more = physically active; 1.5 to 2.9 kcal/kg/day = moderately active; less than 1.5 kcal/kg/day = inactive.

Table 11: Sedentary behaviour (>7 hours "screen time" per day) in students grades 7 to 12, Ontario, 2011 (Figure 2.12)

Grade	Per cent	95% CI
7	4.4	3.0 - 6.3
8	8.8	6.9 - 11.2
9	9.1	6.5 - 12.8
10	12.7	9.6 - 16.6
11	11.5	9.3 - 14.0
12	11.8	8.3 - 16.5

Source: Paglia-Boak A, Adlaf EM, Hamilton HA, Beitchman JH, Wolfe D, Mann RE. The mental health and well-being of Ontario students, 1991-2011: Detailed OSDUHS findings (CAMH Research Document Series No. 34). Toronto, ON: Centre for Addiction and Mental Health. 2012.

Notes:

1) Those who reported spending at least 7 hours a day on average in the past 7 days watching TV, playing video/computer games, or on a computer chatting, emailing or surfing the Internet.

Table 12: Self-Reported Overweight and Obesity (Youth Aged 12 to 17) by Quintile of Neighbourhood Material Deprivation, Ontario, 2009/2010 (Figure 2.13)

Quintile	Per cent	95% CI
Q1 (Most deprived)	37.3	30.8 - 43.7
Q2	29.5	24.0 - 35.0
Q3	28.1	23.2 - 33.0
Q4	29.8	25.5 - 34.2
Q5 (Least deprived)	17.7	14.3 - 21.0

Sources: 1) Canadian Community Health Survey 2003 - 2009/2010, Statistics Canada, Canada Share File, Distributed by Ontario MOHLTC; 2) Ontario Marginalization Index (ON-Marg) 2006, Distributed by the Chair in Research on Urban Neighbourhoods, Community Health and Housing (CRUNCH), McMaster University.

Notes:

1) Population aged 12 to 17 who reported a height and weight classified as overweight or obese according to WHO BMI-for-age growth chart. Estimates were made using age in years of respondent.
2) The 'Material Deprivation' dimension of the Ontario Marginalization (ON-Marg) index is a composite measure consisting of the following components of neighbourhood level deprivation from the 2006 census: proportion of the population aged 20 and over without a high school diploma, proportion of families who are lone parent families, proportion of the population receiving government transfer payments, proportion of the population aged 15 and older who are unemployed, proportion of the population considered low-income (defined as below the Statistics Canada low-income cutoff) and proportion of households living in dwellings that are in need of major repair

Appendix 2: List of Federal/Provincial/ Territorial Indicators

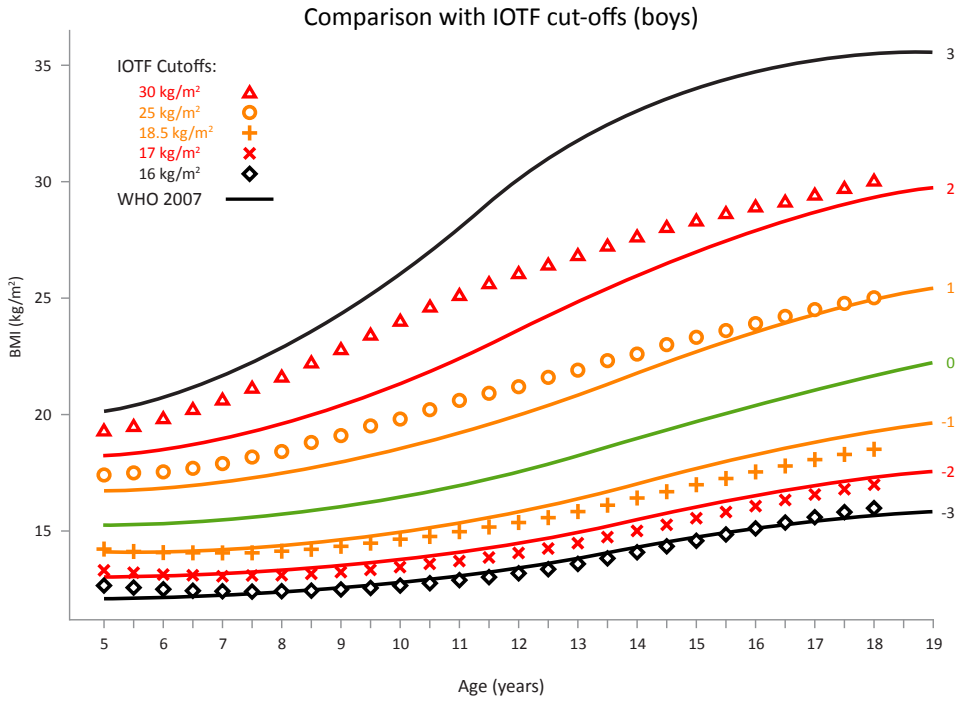
Indicator	Measures
Weight and behavioural indicators	
Unhealthy weight BMI	% of children, 2-17 years of age who are overweight or obese
Amount of daily physical activity	% of children who meet the new physical activity guidelines of 60 minutes of moderate to vigorous physical activity per day (>13,500 average daily step count)
Families being active together	% of parents that report playing active games with their children often or very often in the past year
Walking or cycling to school	% of children and youth 5-17 years of age who use active modes of travel at least part of the time, as reported by parents
Sedentary behaviour	% children who pursue sedentary activities (e.g. TV, reading, computer and video games) after school and before dinner (as reported by their parents)
Screen time	Amount of screen time per week outside of school hours for children and youth 11–15 years of age
Eating behaviours	% of youth (12-19 years of age) eating fruits and vegetables at least 5 times daily
Breakfast consumption	% of students 11-15 years of age that report eating breakfast on weekdays
Sugar-sweetened beverage consumption	% of students 11-15 years of age who report consuming soft drinks once or more a day, every day
Environmental indicators	
Household food insecurity	% of households with children that report moderate or severe food insecurity
Exposure to food advertising	Number of and type of foods and beverage ads children view on TV each month
School policies Active Transportation	% of schools with programs designed to encourage active transportation
Physical education	% of Canadian children 5-17 years of age who receive physical education classes each week, as reported by parents
Public facilities / programs	% of parents who report that the public facilities and programs meet their child's physical activity needs well or very well

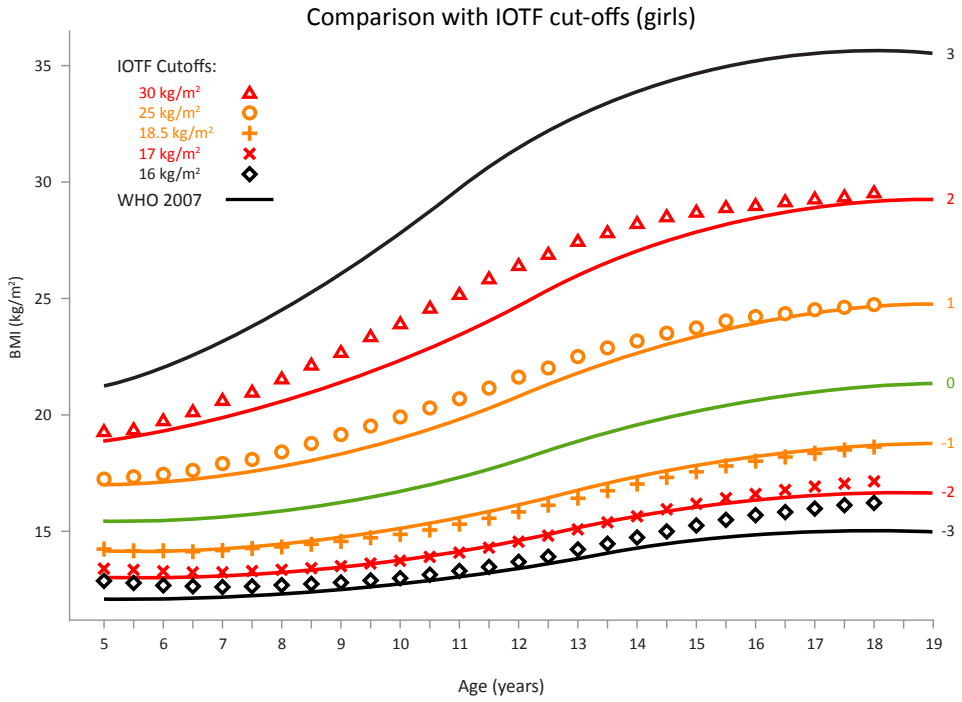
Source: Public Health Agency of Canada. Actions taken and future directions. Queen's Printer for Canada, November 2011. Available from: http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/framework-cadre/2011/overview-resume-eng.php

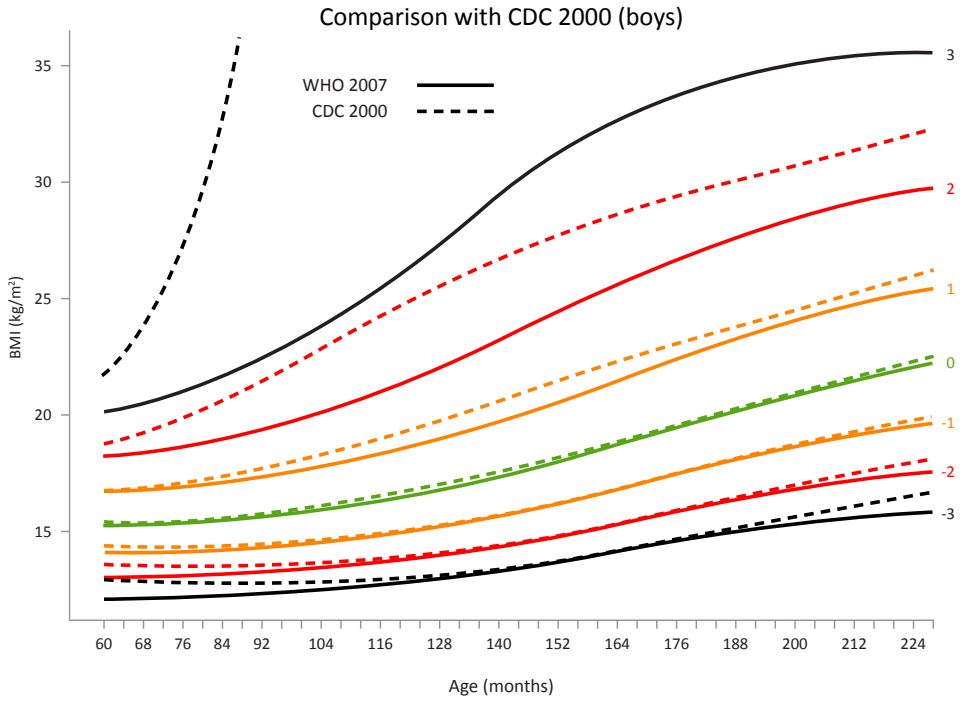
Note: Potential data sources for baseline measures have been identified in source document.

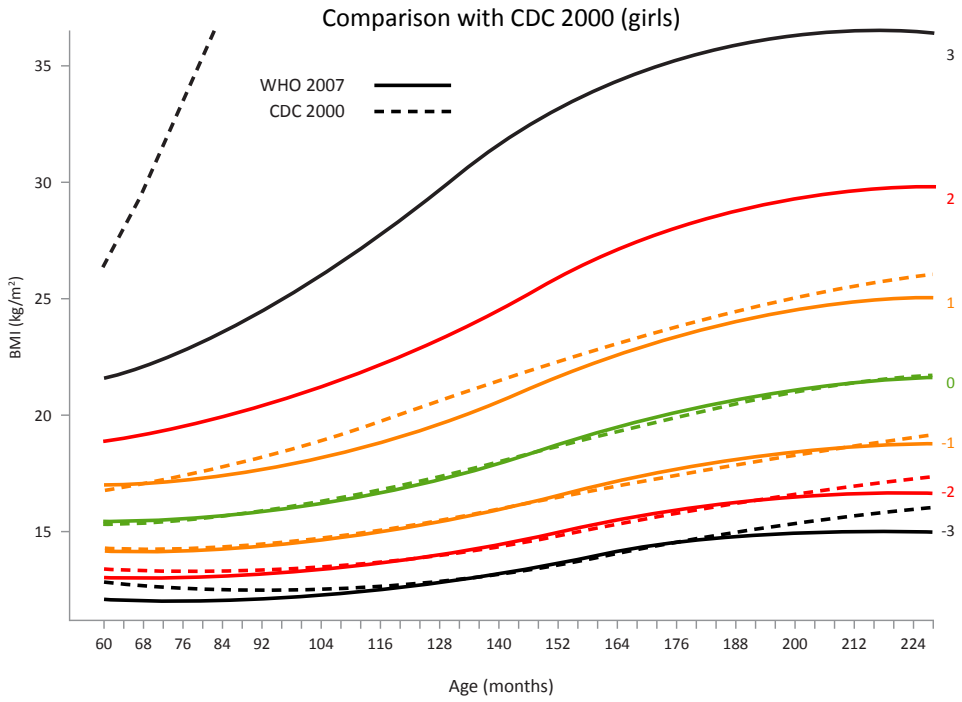
Appendix 3: Comparison of WHO, IOTF and CDC Growth Charts

The below graphs display the differences in overweight and obesity classification of children based on the CDC, IOTF and WHO reference indexes. The first two graphs show the WHO curves for boys and girls plotted against the IOTF curves, while the second two graphs show the WHO curves for boys and girls plotted against the CDC curves.









Source: WHO Growth Reference Charts. http://www.who.int/growthref/who2007_bmi_for_age/en/index.html

Appendix 4: Methods

Part 1: Methods and Limitations

Data Acquisition

Child and youth overweight and obesity prevalence and trend data, as well as related risk and protective data, were taken from readily available sources both in the scientific as well as the grey literature. No new analysis was undertaken for this report with the exception of those presented in Figure 2.3 in Part 1 of this report for self-reported overweight and obesity CCHS according to WHO BMI-for-age cut-offs. The balance of the results were obtained from grey literature sources, including data published by Statistics Canada on its website (e.g., CCHS and CHMS results), as well as statistics found throughout various government and non-government reports published by the Public Health Agency of Canada, Centre for Addiction and Mental Health (who administer the OSDUHS) and Active Healthy Kids Canada. Self-reported overweight and obesity by sex in Ontario and Canada was calculated using the 2003 – 2009/2010 Canadian Community Health Survey Canada Share File distributed by the Ontario Ministry of Health and Long-Term Care. Specifically, rates were calculated using the following variables: sex (DHH_SEX), age in years (DHH_AGE), weight in kilograms (HWTDWTK) and height in metres (HWTDHTM), and a SAS macro and growth chart data from the World Health Organization to determine overweight and obesity based on the BMI (available from: http://www.who.int/growthref/tools/en/). To calculate rates by quintile of neighbourhood material deprivation, survey respondents were assigned the appropriate 2006 Census dissemination area (GEODDA06) and Ontario Marginalization Index (available from: http://www.crunch.mcmaster.ca/ontario-marginalization-index) based on their postal code. Bootstrapping techniques were used to produce the coefficient of variation (for verification of acceptable levels of variability) and 95% confidence intervals.

Literature Search Strategy

A systematic search strategy was undertaken for the literature review on the causes of overweight and obesity among children and youth, which is outlined in Tables 1, 2 and 3 (below). The scope of the search included reviews, systematic review and meta-analyses published since 2005. The search was supplemented with individual studies looking at gestational diabetes in order to assess effect size. Evidence was described as “consistent evidence” when all reviews concluded that there was clear evidence of an association in a particular direction, “some evidence” when reviews concluded the evidence was less consistent and “no evidence” where appropriate. Expert opinion was sought in some areas to help with interpretation of the literature (e.g., vegetable and fruit consumption, exposure to chemicals).

Table 1: Etiology of child obesity: search strategy (Ovid MEDLINE)

#	Searches	Results
1	exp Child/ or exp Infant/ or Adolescent/ or Child Development/ or Child Behavior/ or Pediatrics/ or Child Health Services/ or Child Nutrition Sciences/ or Child Nutrition Disorders/	2,623,446
2	exp Obesity/ or Overnutrition/ or Overweight/ or Body Mass Index/ or Body Size/ or Body Weight/ or exp Body Weight Changes/	317,179
3	exp Obesity/etiology or Overnutrition/etiology or Overweight/etiology or Risk Factors/ or "Genetic Predisposition to Disease"/ or Causality/ or (cause$ or etiolog$).tw. or (risk adj1 factor$).tw. or predispos$.tw.	2,085,468
4	(synthes$ or pooled or ((literature or systematic or evidence or quantitativ$ or integrativ$ or research$ or critical) adj5 (review$ or overview$)) or (integrative$ adj3 research$) or meta-analy$ or metaanaly$ or (meta adj1 analy$) or metanaly$).tw.	943,112
5	(extract$ or (search$ adj5 (medline or embase or cinahl or psycinfo or psychinfo or Cochrane or (science adj1 citation) or (web adj2 science) or (web adj2 knowledge) or scopus)) or handsearch$ or (hand adj1 search$) or (manual adj1 search) or bibliography or bibliographies or (reference adj1 list$)).ab.	441,867
6	4 or 5	1,323,438
7	1 and 2 and 3 and 6	674
8	limit 7 to yr="2005 -Current"	482

Table 2: Social Determinants of child obesity: search strategy (Ovid MEDLINE)

#	Searches	Results
1	exp Child/ or exp Infant/ or Adolescent/ or Child Development/ or Child Behavior/ or Pediatrics/ or Child Health Services/ or Child Nutrition Sciences/ or Child Nutrition Disorders/	2,623,446
2	exp Obesity/ or Overnutrition/ or Overweight/ or Body Mass Index/ or Body Size/ or Body Weight/ or exp Body Weight Changes/	317,179
3	exp Obesity/et or Overnutrition/et or Overweight/et or Risk Factors/ or "Genetic Predisposition to Disease"/ or Causality/ or (cause$ or etiolog$).tw. or (risk adj1 factor$).tw. or predispos$.tw.	2,086,249
4	(synthes$ or pooled or ((literature or systematic or evidence or quantitativ$ or integrativ$ or research$ or critical) adj5 (review$ or overview$)) or (integrative$ adj3 research$) or meta-analy$ or metaanaly$ or (meta adj1 analy$) or metanaly$).tw.	943,626
5	(extract$ or (search$ adj5 (medline or embase or cinahl or psycinfo or psychinfo or Cochrane or (science adj1 citation) or (web adj2 science) or (web adj2 knowledge) or scopus)) or handsearch$ or (hand adj1 search$) or (manual adj1 search) or bibliography or bibliographies or (reference adj1 list$)).ab.	442,167
6	4 or 5	1,324,200
7	1 and 2 and 3 and 6	674
8	limit 7 to yr="2005 -Current"	482
9	exp Socioeconomic Factors/ or Health Status Disparities/ or (soci$ adj1 determinan$).tw. or (health adj1 (equalit$ or inequalit$ or equit$ or inequit$ or disparit$)).tw.	303,632
10	1 and 2 and 6 and 9	150
11	10 not 7	88
12	limit 11 to yr="2000 -Current"	77
13	from 12 keep 6-7, 11-12, 21, 30-31, 41, 43...	14

Table 3: Risk Factors for Childhood Obesity in First Nations, Inuit & Metis Populations: search strategy (Ovid MEDLINE)

#	Searches	Results
1	exp Obesity/ or Overnutrition/ or Overweight/ or Body Mass Index/ or Body Size/ or Body Weight/ or exp Body Weight Changes/ or Ideal Body Weight/ or Waist Circumference/ or Sedentary Lifestyle/ or Adiposity/ or Skinfold Thickness/ or Waist-Hip Ratio/ or Body Fat Distribution/	323,655
2	exp Child/ or exp Infant/ or Adolescent/ or Child Development/ or Child Behavior/ or exp Pediatrics/ or exp Child Health Services/	2,637,937
3	Indians, North American/ or Inuits/ or Health Services, Indigenous/ or American Native Continental Ancestry Group/ or (first adj1 nation$).mp. or inuit$.mp. or metis.mp. or aborig$.mp. or native$.mp. or indigenous.mp. or (torres adj1 strait).mp.	165,991
4	1 and 2 and 3	923
5	limit 4 to yr="2005 -Current"	357
6	from 5 keep …	83

A systematic search strategy was undertaken for the literature review on the measurement of overweight and obesity among children and youth, which is outlined in Table 4 (below). The scope of the search included reviews, systematic review and meta-analyses published since 2000 and did not include measurement of related risk factors such as physical activity or healthy eating. The results were used to summarize the key measures of overweight and obesity in children and youth as well as their suitability for measurement and monitoring in the population.

Table 4: Measurement and monitoring: search strategy (Ovid MEDLINE)

#	Searches	Results
#	Searches	Results
1	Body Mass Index	61,693
2	BMI	53,063
3	Body Weight	150,033
4	Anthropometry	28,562
5	(measure* or assess* or surveillance or monitor*)	3,564,210
6	(child* or adolescen*)	2,439,274
7	1 or 2 or 3	228,798
8	5 and 6 and 7	24,023
9	(surveillance or assess*)	1,715,062
10	7 and 9	44,178
11	6 and 10	12,611
12	healthy weight*	797
13	9 and 12	273
14	limit 13 to (English language and yr="2000 - Current")	255
15	from 14 keep 27,46-47,71-72,77-79,94,99,126,162,164,173,191,218-219,231,243-244	20
16	limit 11 to (English language and humans and yr="2009 -Current")	3,545
17	limit 16 to "review articles"	78
18	(systematic or analysis or randomized)	3,072,450
19	16 and 18	1479
20	from 17 keep 4,7,21-22,32,39-40,42,47,58,61-62	12

Table 4: Measurement and monitoring: search strategy (Ovid MEDLINE) – Cont'd

#	Searches	Results
21	15 or 20	31
22	4 and 6 and 9	3,477
23	18 and 22	1,313
24	23 and review	47

Search Strategy for Measurement Activities in International Jurisdictions and Public Health Units in Ontario

The scan of countries with existing plans to collect height and weight data in children and youth (Table 3.1 in Part 1 of this report) was summarized from information collected as part of the international jurisdictional scan of obesity-related interventions (Part 3).

Public health units with data collection activities in the past (Table 3.2 in Part 1 of this report) had been identified through the 2008 COMOH report on childhood obesity surveillance (1). This table was updated through personal communication with the epidemiologist at each health unit identified in the report to confirm any recent collection. The Association of Public Health Epidemiologists of Ontario (APHEO) email listserv was used to notify epidemiologists of the results and solicit any additions or revisions.

Existing data sources (Table 3.5 in Part 1 of this report) were identified both through the 2008 COMOH paper as well as through a joint PHO/Youth Excel environmental scan completed independent of this report. Although it is possible that additional initiatives may exist in PHUs in Ontario, the approach employed should have captured all current health unit efforts to collect data.

Limitations

This report was developed to provide a high-level overview of the trends and prevalence of child and youth overweight and obesity; causal relationships; trends and prevalence of risk and protective factor trends; and consequences. In order to fully explore many of the causal factors related to child and youth overweight and obesity it would be necessary to perform a literature review on each factor individually. Additionally, individual study results would need to be included within the scope of the literature review as emerging evidence is not often captured in systematic reviews, and effects may be diluted when combining the results across heterogeneous studies.

Efforts were made to include trend data for child and youth overweight and obesity and related risk and protective factors where possible. However, in many instances there are gaps in the data where the metric of interest had not been consistently collected and reported on over time, and therefore trends were not available. Additionally, as the report relied on published sources it was not possible to use standard age groups or source files (e.g., CCHS data is reported both for the age group up to 17 as well as up to 19 based on the source from which it was taken).

References

(1) Council of Ontario Medical Officers of Health (COMOH) of the Association of Local Public Health Agencies (alpha). Childhood obesity surveillance proposal. Toronto, ON: Queen's Printer for Ontario; 2008 [cited 2013 Jun 26]. Available from: http://c.ymcdn.com/sites/www.alphaweb.org/resource/collection/C9DE3C10-BC69-4A49-9A9B-B5F146B34B38/COMOH_ChildObesity_Surveillance_Proposal_2008.pdf

Chapter 4: Prevention Literature Search Methods

Literature Search Strategy

A librarian-assisted literature search was conducted in March/April 2012. The search included only secondary research articles (systematic reviews and/or meta-analysis) published in English, from January 2009 to March 2012.

The search strategy to identify relevant peer-reviewed articles was completed by searching the following electronic databases: Ovid MEDLINE, EMBASE, Database of Abstracts of Reviews of Effects (DARE), NHS Economic Evaluation Database, Health Technology Assessments, PsychINFO, CINAHL, Cochrane Database of Systematic Reviews, healthevidence.ca and Campbell Collaborative. The following grey literature sources were also searched: Clinical Preventive Services, Guide to Community Preventive Services, Effective Public Health Practice Project, NICE Guidelines and Healthevidence.ca.

The search of electronic databases combined four concepts (child, obesity, effectiveness and interventions that focused on prevention) to address the research question. The grey literature search strategy used a varying number of concepts and keywords depending on the source being searched.

MEDLINE (Ovid)

1 exp Child/ or exp Infant/ or Adolescent/ or Child Development/ or Child Behavior/ or Pediatrics/ or Child Health Services/ or Child Nutrition Sciences/ or Child Nutrition Disorders/
2 exp Obesity/ or Overnutrition/ or Overweight/ or Body Mass Index/ or Body Size/ or Body Weight/ or exp Body Weight Changes/ or Weight Gain/ or Ideal Body Weight/ or Waist Circumference/ or Sedentary Lifestyle
3 Public Health/ or Public Health Practice/ or Preventive Medicine/ or Primary Prevention/ or Nutrition Policy/ or Health Policy/ or Health Planning/ or Policy/ or Social Control Policies/ or Organizational Policy/ or Public Policy/ or Policy Making/ or Health Education/ or exp Education/ or Health Promotion/ or Health Communication/ or Mass Media/ or Social Marketing/ or Life Style/ or Diet/ or Fruit/ or Vegetables/ or Dietary Fats/ or Dietary Sucrose/ or Dietary Carbohydrates/ or Child Nutritional Physiological Phenomena/ or Adolescent Nutritional Physiological Phenomena/ or Infant Nutritional Physiological Phenomena/ or exp Exercise/ or "Physical Education and Training"/ or Motor Activity/ or Overnutrition/pc or exp Obesity/pc or Body Weight/pc or Overweight/pc or Feeding Behavior/ or Food Habits/ or Food Preferences/ or (physical adj1 activity).mp. or (physical adj1 inactivity).mp. or (health$ adj1 (food$ or eating)).mp. or Environment Design/ or City Planning/ or Environment/ or Residence Characteristics/ or Legislation, Food/ or Legislation as Topic/ or Taxes/ or Marketing/lj or Marketing/st or Food Industry/es or Food Industry/lj or Food Industry/og or Food Industry/st or exp Food Packaging/es or exp Food Packaging/lj or exp Food Packaging/st or School Health Services/ or Schools/ or (school adj1 health).mp.
4 (effective$ or ineffec$ or efficien$ or inefficien$ or efficacy or evaluat$ or assess$ or apprais$ or valid$ or performance$ or utility or useful$ or outcome$).tw. or result$.ti.
5 (synthes$ or pooled or ((literature or systematic or evidence or quantitativ$ or integrativ$ or research$ or critical) adj5 (review$ or overview$)) or (integrative$ adj3 research$) or meta-analy$ or metaanaly$ or (meta adj1 analy$) or metanaly$).tw.
6 (extract$ or (search$ adj5 (medline or embase or cinahl or psycinfo or psychinfo or Cochrane or (science adj1 citation) or (web adj2 science) or (web adj2 knowledge) or scopus)) or handsearch$ or (hand adj1 search$) or (manual adj1 search) or bibliography or bibliographies or (reference adj1 list$)).ab.
7 5 or 6
8 1 and 2 and 3 and 4 and 7
9 limit 8 to yr="2005 -Current"

EMBASE (Ovid)

1 exp Child/ or exp Newborn/ or exp Adolescent/ or Child Development/ or Child Behavior/ or Pediatrics/ or Child Health Care/ or Child Nutrition/
2 Obesity/ or Body Weight Disorder/ or

Overnutrition/ or Abdominal Obesity/ or Diabetic Obesity/ or Metabolic Syndrome X/ or Morbid Obesity/ or Overnutrition/ or Body Mass/ or Body Weight/ or Lean Body Weight/ or Liveweight Gain/ or Weight Change/ or Weight Control/ or Weight Fluctuation/ or Weight Gain/ or Weight Reduction/ or Body Weight Disorder/ or Body Size/ or Waist Circumference/ or Adipose Tissue/ or Sedentary Lifestyle/ or Body Fat/

3 Public Health/ or Social Medicine/ or Public Health Service/ or Preventive Medicine/ or Primary Prevention/ or Prevention/ or Prevention Study/ or exp Policy/ or Health Care Policy/ or Health Care Planning/ or Social Control / or exp Education/ or Health Promotion/ or Mass Medium/ or Mass Communication/ or Social Media/ or Social Marketing/ or Advertizing/ or Marketing/ or Lifestyle/ or Lifestyle Modification/ or exp Diet/ or Fruit/ or Vegetable/ or Dietary Intake/ or Caloric Density/ or Carbohydrate Intake/ or Fat Intake/ or Food Deprivation/ or Sugar Intake/ or Carbohydrate Intake/ or exp Exercise/ or exp Physical Activity/ or Motor Activity/ or Physical Education/ or Overnutrition/pc or exp Obesity/ pc or Body Weight/pc or Feeding Behavior/ or Eating Habit/ or Food Preference/ or (physical adj1 inactivity).mp. or (health$ adj1 (food$ or eating)).mp. or Environmental Planning/ or City Planning/ or Demography/ or Environment/ or exp Legal Aspect/ or Tax/ or Food Industry/ or Food Packaging/ or School Health Service/ or School/ or (school adj1 health).mp.

4 (effective$ or ineffec$ or efficien$ or inefficien$ or efficacy or evaluat$ or assess$ or apprais$ or valid$ or performance$ or utility or useful$ or outcome$).tw. or result$.ti.

5 (synthes$ or pooled or ((literature or systematic or evidence or quantitativ$ or integrativ$ or research$ or critical) adj5 (review$ or overview$)) or (integrative$ adj3 research$) or meta-analy$ or metaanaly$ or (meta adj1 analy$) or metanaly$).tw.

6 (extract$ or (search$ adj5 (medline or embase or cinahl or psycinfo or psychinfo or Cochrane or (science adj1 citation) or (web adj2 science) or (web adj2 knowledge) or scopus)) or handsearch$ or (hand adj1 search$) or (manual adj1 search) or bibliography or bibliographies or (reference adj1 list$)).ab.

7 5 or 6

8 1 and 2 and 3 and 4 and 7

9 limit 8 to yr="2000 -Current"

10 limit 9 to exclude medline journals

CINAHL (EBSCO)

1 (MH "Child Nutrition") OR (MH "Child Nutrition Disorders") OR (MH "Child Health Services") OR (MH "Adolescent Health Services") OR (MH "Pediatrics+") OR (MH "Child Behavior+") OR (MH "Child Development") OR (MH "Adolescence") OR (MH "Child+") OR (MH "Infant+")

2 (MH "Obesity+") OR (MH "Weight Gain") OR (MH "Body Weight Changes") OR (MH "Hyperphagia") OR (MH "Body Mass Index") OR (MH "Body Size") OR (MH "Body Weight") OR (MH "Weight Control") OR (MH "Life Style, Sedentary") OR (MH "Waist Circumference")

3 (MH "Public Health+") OR (MH "Preventive Health Care+") OR (MH "Nutrition Policy+") OR (MH "Health Policy+") OR (MH "Health and Welfare Planning+") OR (MH "Public Policy+") OR (MH "Policy Making") OR (MH "Policy Studies+") OR (MH "Social Control+") OR (MH "Organizational Policies+") OR (MH "Education+") OR (MH "Health Education+") OR (MH "Health Promotion+") OR (MH "Communications Media+") OR (MH "Social Marketing") OR (MH "Life Style+") OR (MH "Life Style Changes") OR (MH "Diet+") OR (MH "Fruit+") OR (MH "Vegetables+") OR (MH "Dietary Fats+") OR (MH "Dietary Sucrose") OR (MH "Dietary Carbohydrates+") OR (MH "Child Nutritional Physiology+") OR (MH "Adolescent Nutritional Physiology") OR (MH "Infant Nutritional Physiology+") OR (MH "Exercise+") OR (MH "Physical Education and Training+") OR (MH "Motor Activity+") OR (MH "Hyperphagia/ PC") OR (MH "Obesity+/PC") OR (MH "Eating Behavior+") OR (MH "Food Habits") OR (MH "Food Preferences") OR (MH "Urban Areas") OR (MH "Environment+") OR (MH "Environment, Controlled+") OR (MH "Public Accommodation+") OR (MH "Residence Characteristics+") OR (MH "Legislation+") OR (MH "Taxes+") OR (MH "Marketing+") OR (MH "Food Industry+") OR (MH "Food Packaging+") OR (MH "Schools+") OR (MH "School Health") OR (MH "School Health Services+") OR (MH "School Health Nursing") OR (MH "School Health Education") OR (MH "Student Health Education") OR (physical N1 activity) OR (physical N1 inactivity) OR (health* N1 food*) OR (health* N1 eating) OR (school N1 health)

4 TX effective* OR ineffec* OR efficien* OR inefficien* OR efficacy OR evaluat* OR assess* OR apprais* OR valid* OR performance* OR utility OR useful* OR outcome*

5 TI result*
6 4 or 5
7 TX synthes* OR pooled OR (literature N5 review) OR (literature N5 overview) OR (systematic N5 review) OR (systematic N5 overview) OR (evidence N5 review) OR (evidence N5 overview) OR (quantitativ* N5 review) OR (quantitativ* N5 overview) OR (integrativ* N5 review) OR (integrativ* N5 overview) OR (research* N5 review) OR (research* N5 overview) OR (critical N5 review) OR (critical N5 overview) OR (integrative* N3 research*) OR meta-analy* OR metaanaly* OR (meta N1 analy*) OR metanaly*
8 AB (search* N5 medline) OR (search* N5 embase) OR (search* N5 cinahl) OR (search* N5 psycinfo) OR (search* N5 psychinfo) OR (search* N5 cochrane) OR (search* N5 scopus) OR (search* N1 citation) OR (search* N1 web) or extract* OR handsearch* OR (hand N1 search*) OR (manual N1 search) OR bibliography OR bibliographies OR (reference N1 list*)
9 7 or 8
10 1 and 2 and 3 and 6 and 9
11 Limit 1 and 2 and 3 and 6 and 9 to published date: 20050101-20121231

PsychINFO (Ovid)

1 Pediatrics/ or exp Childhood Development/ or exp Preschool Students/ or exp Elementary School Students or High School Students/ or Junior High School Students/ or Kindergarten Students/ or Neonatal Period/ or exp Adolescent Development/ or (child$ or youth$ or teen$ or preteen$ or tween$ or adolescent$ or infant$ (young adj1 person$) or (young adj1 people) or preschool$ or pre-school$ or toddler or baby or babies or pediatric$ or paediatric$).mp.
2 Obesity/ or Body Weight/ or Body Size/ or Overweight/ or Weight Gain/ or Weight Loss/ or Body Fat/ or Body Mass Index/ or Weight Control/ or Metabolic Syndrome/ or Hyperphagia/
3 Prevention/ or Public Health/ or Health Screening/ or Public Health Services/ or Preventive Medicine/ or Health Promotion/ or Public Service Announcements/ or Health Education/ or Social Marketing/ or exp Communications Media/ or exp Marketing/ or exp Advertising/
4 Diets/ or exp Eating Behavior/ or Health Behavior/ or Lifestyle Changes/ or Lifestyle/ or Nutrition/ or Food Intake/ or Appetite/ or Dietary Restraint/ or Calories/ or Carbohydrates/ or Sugars/ or Food Deprivation/ or Food Preferences/ or (health$ adj1 (food$ or eating)).mp.
5 Exercise/ or Physical Activity/ or Activity Level/ or Physical Fitness/ or Energy Expenditure/ or (physical adj1 inactivity).mp.
6 exp Architecture/ or Urban Planning/ or Environmental Planning/ or Built Environment/ or Community Development/ or Community Facilities/ or Environment/ or exp Recreation Areas/ or Urban Environments/ or Environmental Policy/ or Facility Environment/ or Learning Environment/ or Neighborhoods/ or Demographic Characteristics/
7 Schools/ or Elementary Schools/ or High Schools/ or Junior High Schools/ or Kindergartens/ or Middle Schools/ or Nursery Schools/ or School Environment/ or School Facilities/ or School Based Intervention/ or Curriculum/ or Physical Education/ or Education/ or exp Client Education/ or (school adj1 health).mp.
8 exp Government Policy Making/ or Health Care Policy/ or Policy Making/ or Social Control/ or Laws/ or Taxation/ or (Food/ and Product Design/) or Consumer Behavior/ or Consumer Research/
9 3 or 4 or 5 or 6 or 7 or 8
10 (effective$ or ineffec$ or efficien$ or inefficien$ or efficacy or evaluat$ or assess$ or apprais$ or valid$ or performance$ or utility or useful$ or outcome$).tw. or result$.ti.
11 (synthes$ or pooled or ((literature or systematic or evidence or quantitativ$ or integrativ$ or research$ or critical) adj5 (review$ or overview$)) or (integrative$ adj3 research$) or meta-analy$ or metaanaly$ or (meta adj1 analy$) or metanaly$).tw.
12 (extract$ or (search$ adj5 (medline or embase or cinahl or psycinfo or psychinfo or Cochrane or (science adj1 citation) or (web adj2 science) or (web adj2 knowledge) or scopus)) or handsearch$ or (hand adj1 search$) or (manual adj1 search) or bibliography or bibliographies or (reference adj1 list$)).ab.
13 5 or 6
14 1 and 2 and 9 and 10 and 13
15 limit 8 to yr="2005 -Current"

Database of Abstracts of Reviews of Effects; NHS Economic Evaluation Database; Health Technology Assessments (EBSCO)

1 child*
2 infant
3 baby OR babies
4 toddler
5 pre-school* OR preschool*
6 youth
7 Adolescent
8 teenage*
9 "school age"
10 "young people" OR "young person"
11 obes*
12 overweight
13 weight* N2 healthy
14 weight* N2 gain*
15 BMI
16 "body mass"
17 "body weight"
18 Overnutrition
19 Weight
20 pediatr*
21 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 20
22 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
23 21 and 22
24 Limit 21 and 22 to date abstract published from: 2005-2011

Cochrane Database of Systematic Reviews (EBSCO)

1 (body mass):ti,ab,kw or (weight):ti,ab,kw or (obesity):ti,ab,kw in Cochrane Reviews
2 (child*):ti,ab,kw or (adolescen*):ti,ab,kw or (school):ti,ab,kw or (infant):ti,ab,kw or (preschool*):ti,ab,kw
3 (#1 AND #2)
4 (prevention):ti,ab,kw or (intervention):ti,ab,kw or (control):ti,ab,kw or (treatment):ti,ab,kw
5 (#3 AND #4), from 2000 to 2012
6 (#5)
7 MeSH descriptor Obesity explode all trees
8 MeSH descriptor Child explode all trees
9 MeSH descriptor Adolescent explode all trees
10 MeSH descriptor Child, Preschool explode all trees
11 MeSH descriptor Overweight explode all trees
12 MeSH descriptor Body Weight explode all trees
13 (#7 OR #11 OR #12), from 2000 to 2012
14 (#2 OR #8 OR #9 OR #10)
15 (#13 AND #14)
16 (#15), from 2000 to 2012

Campbell Collaboration

Obesity OR weight OR BMI OR body mass

Effective Public Health Practice Project

Scan of both the current and archive pages on Systematic Reviews and Summary Statements

Guide to Clinical Preventive Services

A scan of results in the guide specific to children

Guide to Community Preventive Services

A scan of results in the guide

NICE

Keywords searched on the entire NICE site: Obesity, Weight; Child/Childhood; Prevention, Treatment. Obesity and weight were individually searched as terms on their own and in combination with the concepts of child and prevention/treatment.

Healthevidence.ca

Global search of obes*. Search limited four times, each time limited by one of the available childhood age categories: Adolescents (13-19), Grade-school aged (5-12), Preschool aged (1-4) and Infants (0-1). From the results, all articles pertaining to control or prevention of obesity or of weight control in general were selected.

Study Selection

Two reviewers independently screened titles and abstracts against inclusion and exclusion criteria. Results from these independent screens were compared. Any discrepancies between the two reviewers were resolved.

Inclusion and Exclusion Criteria for Prevention Interventions

	Inclusion criteria	Exclusion criteria
Type of study	▪ Secondary study, which combines results of several studies (e.g., systematic reviews and/or meta-analysis)	▪ Primary study
Content	▪ Interventions for the prevention of childhood obesity/overweight	▪ No intervention described ▪ Intervention described was for the prevention of childhood obesity
Population	▪ Children (0-19 years)	▪ Populations outside the 0 to 19 age range (e.g., adults, mothers, developing fetuses, seniors)
Anthropometric outcome measure	▪ Anthropometric outcome measure (weight, BMI, % change in weight or BMI, prevalence of overweight or obesity, waist-circumference, skinfold thickness, % body fat, etc.) reported	▪ No anthropometric outcome measure reported
Year of publication	▪ Published 2009 onwards	▪ Published before 2009
Geography and language	▪ Developed countries (e.g., Canada, United States, Australia, New Zealand and/or northwestern Europe) ▪ English language	▪ Developing countries ▪ Non-English language

Quality Assessment

For all studies that met the inclusion criteria, the quality of each review was rated independently by two reviewers using the AMSTAR tool. Agreement between the two reviewers has 94 per cent of total items. In cases of disagreement, the two reviewers consulted and resolved differences. Detailed results of the final quality rating of each review are provided in below.

Data Extraction

For data extraction purposes, a standardized table with the following headings was created:

- Reference and type of study (e.g., systematic review, meta-analysis, review of reviews)
- Review quality score
- Population: age, socioeconomic status (SES), ethnicity, weight status
- Study objectives
- Number and type of studies (e.g., Randomized Controlled Trial [RCT], non-randomized controlled trial, pre/post study or quasi-experimental)
- Type of interventions (including description)
- Setting
- Primary outcome (e.g., weight, body mass index [BMI] or BMI z-score)
- Secondary outcomes (behavioural risk factors)
- Comments on other outcomes (if any), study limitations, cost effectiveness (if provided), further research and/or feasibility

Two reviewers independently extracted key findings from each of the studies to populate tables. Completed data extraction tables were compared, consolidated and discrepancies were resolved. A tabular summary of the 40 reviews are provided in Appendix 5.

Study Quality (AMSTAR ratings)

REVIEW	'A priori' design	Duplicate study selection and data extraction	Comprehensive literature search	Status of publication (e.g. grey literature) used as an inclusion criterion	List of studies (included and excluded)	Characteristics of the included studies	Quality of the included studies assessed and documented	Quality of the included studies used in formulating conclusions	Appropriate methods to combine the findings of studies	Assessed likelihood of publication bias	Conflict of interest stated	Total Yes/Total points possible
An et al, 2009 (1)	Yes	C/A	Yes	No	No	Yes	No	Yes	Yes	No	No	5/11
Ayliffe and Glanville, 2009 (2)	Yes	No	No	No	No	No	No	Yes	No	No	No	2/11
Bond et al, 2009 (3)	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	No	5/11
Bond et al, 2009 (4)	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	7/11
Branscum et al, 2009 (5)	Yes	C/A	No	No	No	Yes	No	No	No	No	No	2/11
Brown et al, 2009 (6)	Yes	No	No	No	No	Yes	No	No	Yes	No	No	3/11
Ciampa et al, 2009 (7)	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	7/11
Cook-Cottone et al, 2009 (8)	Yes	C/A	No	No	No	Yes	No	No	Yes	No	No	2/11
De Bourdeauhuij et al, 2009 (9)	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	7/11
Dobbins et al, 2009 (10)	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	No	7/11
D'Onise et al, 2009 (11)	Yes	C/A	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	7/11
Froschl et al, 2009 (12)	Yes	C/A	No	No	No	No	No	No	No	No	No	1/11
Gerards et al, 2009 (13)	Yes	Yes	No	No	No	Yes	No	No	Yes	No	No	4/11
Golley et al, 2009 (14)	Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes	No	No	7/11
Gonzalez-Suarez et al, 2009 (15)	Yes	C/A	No	No	Yes	Yes	No	No	Yes	No	No	4/11
Hamel et al, 2009 (16)	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	No	No	6/11
Harris et al, 2009 (17)	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	8/11
Hesketh and Campbell, 2009 (18)	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	No	6/11
Ickes and Sharma, 2009 (19)	Yes	C/A	No	No	No	Yes	No	No	Yes	No	No	3/11
Kanekar and Sharma, 2009 (20)	Yes	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No	7/11
Katz, 2009 (21)	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	No	6/11

Study Quality (AMSTAR ratings) – Cont'd

REVIEW	'A priori' design	Duplicate study selection and data extraction	Comprehensive literature search	Status of publication (e.g. grey literature) used as an inclusion criterion	List of studies (included and excluded)	Characteristics of the included studies	Quality of the included studies assessed and documented	Quality of the included studies used in formulating conclusions	Appropriate methods to combine the findings of studies	Assessed likelihood of publication bias	Conflict of interest stated	Total Yes/Total points possible
Kesten et al, 2009 (22)	Yes	C/A	No	No	No	Yes	No	No	Yes	No	No	3/11
Kitzman-Ulrich et al, 2009 (23)	Yes	C/A	No	No	No	Yes	No	No	No	No	No	2/11
Larson et al, 2009 (24)	Yes	C/A	No	Yes	No	Yes	No	No	No	No	No	3/11
Lytle and Hearst, 2009 (25)	Yes	C/A	No	No	No	Yes	Yes	Yes	Yes	No	No	5/11
Mayer, 2009 (26)	C/A	C/A	No	No	No	Yes	No	No	No	No	No	1/11
Monasta et al, 2011 (27)	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	Yes	7/11
Nguyen et al, 2009 (28)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	8/11
Reichert et al, 2009 (29)	Yes	C/A	No	No	No	Yes	Yes	Yes	Yes	Yes	No	6/11
Roseman et al, 2009 (30)	Yes	C/A	No	No	No	Yes	No	No	No	No	No	2/11
Safron et al, 2009 (31)	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No	4/11
Seo and Sa, 2009 (32)	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No	No	6/11
Staniford Brown, 2009 (33)	Yes	C/A	No	No	No	Yes	No	No	No	No	No	2/11
Stevens, 2009 (34)	Yes	C/A	No	No	No	Yes	No	No	No	No	No	2/11
Van Cauwenberghe et al, 2009 (35)	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	No	7/11
Wahi et al, 2009 (36)	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	No	8/11
Waters et al, 2009 (37)	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No	9/11
Wilks et al, 2009 (38)	Yes	Yes	No	No	No	Yes	No	No	Yes	No	No	4/11
Wilson, 2009 (39)	Yes	C/A	No	No	No	Yes	No	No	No	No	No	2/11
Zenzen and Kridli, 2009 (40)	Yes	Yes	No	No	No	Yes	Yes	No	No	No	No	4/11

Note: N/A means that the AMSTAR item is not applicable, whereas C/A denotes that from the published article, the AMSTAR question cannot be answered.

References

(1) An JY, Hayman LL, Park YS, Dusaj TK, Ayres CG. Web-based weight management programs for children and adolescents: a systematic review of randomized controlled trial studies. ANS Adv Nurs Sci. 2009;32(3):222-40.

(2) Ayliffe B, Glanville NT. Achieving healthy body weight in teenagers: evidence-based practice guidelines for community nutrition interventions. Can J Diet Pract Res. 2010;71(4):e78-86.

(3) Bond M, Wyatt K, Lloyd J, Taylor R. Systematic review of the effectiveness of weight management schemes for the under fives. Obes Rev. 2011;12(4):242-53.

(4) Bond M, Wyatt K, Lloyd J, Welch K, Taylor R. Systematic review of the effectiveness and cost-effectiveness of weight management schemes for the under fives: a short report. Health Technol Assess. 2009;13(61):1-75, iii.

(5) Branscum P, Sharma M. A systematic analysis of childhood obesity prevention interventions targeting Hispanic children: lessons learned from the previous decade. Obes Rev. 2011;12(5):e151-8.

(6) Brown T, Summerbell C. Systematic review of school-based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. Obes Rev. 2009;10(1):110-141.

(7) Ciampa PJ, Kumar D, Barkin SL, Sanders LM, Yin HS, Perrin EM, et al. Interventions aimed at decreasing obesity in children younger than 2 years: a systematic review. Arch Pediatr Adolesc Med. 2010;164(12):1098-1104.

(8) Cook-Cottone C, Casey CM, Feeley TH. A meta-analytic review of obesity prevention in the schools: 1997-2008. Psychology in the Schools 2009;46(Sep):695-719.

(9) De Bourdeaudhuij I, Van Cauwenberghe E, Spittaels H, Oppert JM, Rostami C, Brug J, et al. School-based interventions promoting both physical activity and healthy eating in Europe: a systematic review within the HOPE project. Obes Rev. 2011;12(3):205-216.

(10) Dobbins M, De Corby K, Robeson P, Husson H, Tirilis D. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6-18. Cochrane Database Syst Rev. 2009;(1):CD007651.

(11) D'Onise K, Lynch JW, Sawyer MG, McDermott RA. Can preschool improve child health outcomes? A systematic review. Soc Sci Med. 2010;70(9):1423-1440.

(12) Froschl B, Wirl C, Haas S. Overweight prevention in adolescents and children (behavioural and environmental prevention). GMS Health Technol Assess. 2009 [cited 2013 Jun 26];5(1-10). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3011287/pdf/HTA-05-05.pdf

(13) Gerards SM, Sleddens EF, Dagnelie PC, de Vries NK, Kremers SP. Interventions addressing general parenting to prevent or treat childhood obesity. Int J Pediatr Obes. 2011;6(2-2):e28-45.

(14) Golley RK, Hendrie GA, Slater A, Corsini N. Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns - what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness? Obes Rev. 2011;12(2):114-130.

(15) Gonzalez-Suarez C, Worley A, Grimmer-Somers K, Dones V. School-based interventions on childhood obesity: a meta-analysis. Am J Prev Med. 2009;37(5):418-427.

(16) Hamel LM, Robbins LB, Wilbur J. Computer- and web-based interventions to increase preadolescent and adolescent physical activity: a systematic review. J Adv Nurs. 2011;67(2):251-268.

(17) Harris KC, Kuramoto LK, Schulzer M, Retallack JE. Effect of school-based physical activity interventions on body mass index in children: a meta-analysis. CMAJ. 2009 [cited 2013 Jun 26] ;180(7):719-726. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2659836/pdf/20090331s00019p719.pdf

(18) Hesketh KD, Campbell KJ. Interventions to prevent obesity in 0-5 year olds: an updated systematic review of the literature. Obesity (Silver Spring). 2010;18(Suppl 1):S27-S35.

(19) Ickes MJ, Sharma M. A review of childhood obesity prevention interventions targeting African American children. Vulnerable Child Youth Stud. 2011;6(1):103-123.

(20) Kanekar A, Sharma M. Meta-analysis of school-based childhood obesity interventions in the U.K. and U.S. Int Q Community Health Educ. 2008;29(3):241-256.

(21) Katz DL. School-based interventions for health promotion and weight control: not just waiting on the world to change. Annu Rev Public Health. 2009;30:253-272.

(22) Kesten JM, Griffiths PL, Cameron N. A systematic review to determine the effectiveness of interventions designed to prevent overweight and obesity in pre-adolescent girls. Obes Rev. 2011;12(12):997-1021.

(23) Kitzman-Ulrich H, Wilson DK, St George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clin Child Fam Psychol Rev. 2010 [cited 2013 Jun 26];13(3):231-53. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3293190/pdf/nihms357806.pdf

(24) Larson N, Ward DS, Neelon SB, Story M. What role can child-care settings play in obesity prevention? A review of the evidence and call for research efforts. J Am Diet Assoc. 2011;111(9):1343-1362.

(25) Lytle LA, Heart MO. Examining the state of the science of prevention of childhood obesity. Curr Nutr Food Sci. 2009;5(2):134-148.

(26) Mayer K. Childhood obesity prevention: focusing on the community food environment. Fam Community Health. 2009;32(3):257-270.

(27) Monasta L, Batty GD, Macaluso A, Ronfani L, Lutje V, Bavcar A, et al. Interventions for the prevention of overweight and obesity in preschool children: a systematic review of randomized controlled trials. Obes Rev. 2011;12(5):e107-18.

(28) Nguyen B, Kornman KP, Baur LA. A review of electronic interventions for prevention and treatment of overweight and obesity in young people. Obes Rev. 2011;12(5):e298-314.

(29) Reichert FF, Baptista Menezes AM, Wells JC, Carvalho Dumith S, Hallal PC. Physical activity as a predictor of adolescent body fatness: a systematic review. Sports Med. 2009;39(4):279-294.

(30) Roseman MG, Riddell MC, Haynes JN. A content analysis of kindergarten-12th grade school-based nutrition interventions: taking advantage of past learning. J Nutr Educ Behav. 2011;43(1):2-18.

(31) Safron M, Cislak A, Gaspar T, Luszczynska A. Effects of school-based interventions targeting obesity-related behaviors and body weight change: a systematic umbrella review. Behav Med. 2011;37(1):15-25.

(32) Seo DC, Sa J. A meta-analysis of obesity interventions among U.S. minority children. J Adolesc Health. 2010;46(4):309-323.

(33) Standiford Brown A. Promoting physical activity amongst adolescent girls. Issues Compr Pediatr Nurs. 2009;32(2):49-64.

(34) Stevens CJ. Obesity prevention interventions for middle school-age children of ethnic minority: a review of the literature. J Spec Pediatr Nurs. 2010;15(3):233-243.

(35) Van Cauwenberghe E, Maes L, Spittaels H, van Lenthe FJ, Brug J, Oppert JM, et al. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. Br J Nutr. 2010;103(6):781-797.

(36) Wahi G, Parkin PC, Beyene J, Uleryk EM, Birken CS. Effectiveness of interventions aimed at reducing screen time in children: a systematic review and meta-analysis of randomized controlled trials. Arch Pediatr Adolesc Med. 2011;165(11):979-986.

(37) Waters E, de Silva-Sanigorski A, Hall BJ, Brown T, Campbell KJ, Gao Y, et al. Interventions for preventing obesity in children. Cochrane Database Syst Rev. 2011;(12):CD001871.

(38) Wilks DC, Besson H, Lindroos AK, Ekelund U. Objectively measured physical activity and obesity prevention in children, adolescents and adults: a systematic review of prospective studies. Obes Rev. 2011;12(5):e119-29.

(39) Wilson DK. New perspectives on health disparities and obesity interventions in youth. J Pediatr Psychol. 2009 [cited 2013 Jun 26];34(3):231-44. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2722129/pdf/jsn137.pdf

(40) Zenzen W, Kridli S. Integrative review of school-based childhood obesity prevention programs. J Pediatr Health Care. 2009;23(4):242-58.

Chapter 5: Treatment Literature Search Methods

Literature Search Strategy

A librarian-assisted literature search was conducted in March/April 2012. The scope of the search included secondary research articles (i.e., systematic reviews and/or meta-analysis) published in English, from January 2005 to March 2012.

Relevant peer-reviewed articles were identified by searching the following electronic databases: Ovid MEDLINE, EMBASE, Database of Abstracts of Reviews of Effects (DARE), NHS Economic Evaluation Database, Health Technology Assessments, PsychINFO, CINAHL, Cochrane Database of Systematic Reviews and Campbell Collaborative. The following grey literature sources were also searched: Clinical Preventive Services, Guide to Community Preventive Services, Effective Public Health Practice Project, NICE Guidelines and Healthevidence.ca.

The search of electronic databases combined four concepts (child, obesity, effectiveness and interventions that focused on treatment) to address the research question. The grey literature search strategy used a varying number of concepts and keywords depending on the source being searched.

MEDLINE (Ovid)

1 exp Child/ or exp Infant/ or Adolescent/ or Child Development/ or Child Behavior/ or Pediatrics/ or Child Health Services/ or Child Nutrition Sciences/ or Child Nutrition Disorders/
2 exp Obesity/ or Overnutrition/ or Overweight/ or Body Mass Index/ or Body Size/ or Body Weight/ or exp Body Weight Changes/ or Weight Gain/ or Ideal Body Weight/ or Waist Circumference/ or Sedentary Lifestyle/
3 Obesity/dh, dt, rh, su, th, px or Overweight/dh, dt, rh, su, th, px or Overnutrition/dh, dt, th, px or Treatment Outcome/ or Weight Reduction Programs/
4 exp Drug Therapy/ or exp Anti-Obesity Agents/ or Drug Prescriptions/ or Drug Utilization/ or Body Weight/de or Energy Intake/de or Body Size/de or Waist Circumference/de or Weight Loss/de or Weight Gain/de or Hypoglycemic Agents/ad, tu, pd or Antidepressive Agents, Second-Generation/ ad, tu, pd or Bupropion/ad, tu, pd or Lactones/ad, tu, pd or Metformin/ad, tu, pd or Naltrexone/ad, tu, pd or Islet Amyloid Polypeptide/ad, tu, pd or Narcotic Antagonists/ad, tu, pd or Peptides/ad, tu, pd or Sympathomimetics/ad, tu, pd or Venoms/ad, tu, pd or Appetite Depressants/ad, tu, pd
5 exp Surgical Procedures, Operative/ or Gastroplasty/ or Gastrectomy/ or Gastric Bypass/ or Bariatric Surgery/
6 Exercise Therapy/ or Behavior Therapy/ or Behavior Control/ or Nutrition Therapy/ or Diet Therapy/ or Diet, Carbohydrate-Restricted/ or Diet, Fat-Restricted/ or Diet, Reducing/ or Caloric Restriction/ or Appetite Regulation/
7 Counseling/ or Directive Counseling/ or exp Psychotherapy/ or exp Psychology, Applied/ or Parenting/ or Parent-Child Relations/ or Parents/px or Social Support/ or (peer$ adj3 support).mp.
8 3 or 4 or 5 or 6 or 7
9 (effective$ or ineffec$ or efficien$ or inefficien$ or efficacy or evaluat$ or assess$ or apprais$ or valid$ or performance$ or utility or useful$ or outcome$).tw. or result$.ti.
10 (synthes$ or pooled or ((literature or systematic or evidence or quantitativ$ or integrativ$ or research$ or critical) adj5 (review$ or overview$)) or (integrative$ adj3 research$) or meta-analy$ or metaanaly$ or (meta adj1 analy$) or metanaly$).tw.
11 (extract$ or (search$ adj5 (medline or embase or cinahl or psycinfo or psychinfo or Cochrane or (science adj1 citation) or (web adj2 science) or (web adj2 knowledge) or scopus)) or handsearch$ or (hand adj1 search$) or (manual adj1 search) or bibliography or bibliographies or (reference adj1 list$)).ab.
12 10 or 11
13 1 and 2 and 8 and 9 and 12
14 limit 13 to yr="2005 -Current"

EMBASE (Ovid)

1 exp Child/ or exp Newborn/ or exp Adolescent/ or Child Development/ or Child Behavior/ or Pediatrics/ or Child Health Care/ or Child Nutrition/
2 Obesity/ or Body Weight Disorder/ or

Overnutrition/ or Abdominal Obesity/ or Diabetic Obesity/ or Metabolic Syndrome X/ or Morbid Obesity/ or Overnutrition/ or Body Mass/ or Body Weight/ or Lean Body Weight/ or Liveweight Gain/ or Weight Change/ or Weight Control/ or Weight Fluctuation/ or Weight Gain/ or Weight Reduction/ or Body Weight Disorder/ or Body Size/ or Waist Circumference/ or Adipose Tissue/ or Sedentary Lifestyle/ or Body Fat/

3 Obesity/dm, dt, rt, rh, su, th or Overnutrition/dm, dt, su, th or Treatment Outcome/ or exp Primary Health Care/

4 exp Therapy or exp Drug Therapy/ or Drug Efficacy/ or exp Antiobesity Agent/ or Prescription/ or Prescription Drug/ or Drug/ or Drug Utilization/ or Body Weight/Dt, Su, Th or Weight Reduction/Th or exp Antidiabetic Agent/ or Amfebutamone/ or Metformin/ or Naltrexone/ or Amylin/ or Narcotic Antagonist/ or Peptide/ or Adrenergic Receptor Stimulating Agent/ or exp Anorexigenic Agent/ or Venom/ or Dose Response/ or Drug Cost/ or Drug Dose Comparison/ or Drug Dose Regimen/ or Sibutramine/ or Tetrahydrolipstatin/ or 2,4 Dinitrophenol/ or Amfebutamone/ or Aminorex/ or Amphetamine Derivative/ or Anticonvulsive Agent/ or Caffeine/ or Dexfenfluramine/ or Ephedrine/ or Fenfluramine/ or Fluoxetine/ or Hydroxymethylglutaryl Coenzyme A Reductase Inhibitor/ or Leptin/ or Mazindol/ or Methamphetamine/ or Phentermine/ or Phenylpropanolamine/ or Recombinant Ciliary Neurotrophic Factor/ or Rimonabant/ or Serotonin Uptake Inhibitor/ or Sibutramine/ or Simvastatin/ or Tetrahydrolipstatin/ or Thyroid Hormone/ or Topiramate/ or Zonisamide/ or Tetrahydrolipstatin/ or Tolperisone/ or Lipid/

5 Gastroplasty/ or exp Gastrectomy/ or Bariatric Surgery/ or exp Surgery/ or Stomach Bypass/

6 exp Kinesiotherapy/ or Behavior Therapy/ or Behavior Change/ or Behavior Control/ or exp Diet Therapy/ or Caloric Restriction/ or Low Calory Diet/ or Low Carbohydrate Diet/ or Low Fat Diet/ or exp Diet Restriction/ or Food Intake/ or Energy Consumption/ or Portion Size/

7 exp Counseling/ or exp Psychiatric Treatment/ or exp Psychology/ or Psychological Aspect/ or exp Child Parent Relation/ or Parental Behavior/ or Social Support/ or Support Group/ or (peer$ adj3 support).mp.

8 3 or 4 or 5 or 6 or 7

9 (effective$ or ineffec$ or efficien$ or inefficien$ or efficacy or evaluat$ or assess$ or apprais$ or valid$ or performance$ or utility or useful$ or outcome$).tw. or result$.ti.

10 (synthes$ or pooled or ((literature or systematic or evidence or quantitativ$ or integrativ$ or research$ or critical) adj5 (review$ or overview$)) or (integrative$ adj3 research$) or meta-analy$ or metaanaly$ or (meta adj1 analy$) or metanaly$).tw.

11 (extract$ or (search$ adj5 (medline or embase or cinahl or psycinfo or psychinfo or Cochrane or (science adj1 citation) or (web adj2 science) or (web adj2 knowledge) or scopus)) or handsearch$ or (hand adj1 search$) or (manual adj1 search) or bibliography or bibliographies or (reference adj1 list$)).ab.

12 10 or 11

13 1 and 2 and 8 and 9 and 12

14 limit 13 to yr="2005 -Current"

15 limit 14 to exclude medline journals

PsychINFO (Ovid)

1 Pediatrics/ or exp Childhood Development/ or exp Preschool Students/ or exp Elementary School Students or High School Students/ or Junior High School Students/ or Kindergarten Students/ or Child Psychiatry/ or Child Psychology/ or Neonatal Period/ or exp Adolescent Psychology/ or exp Adolescent Development/ or exp Adolescent Psychiatry/ or Child Psychiatry/ or Child Psychology/ or (child$ or youth$ or teen$ or preteen$ or tween$ or adolescent$ or infant$ (young adj1 person$) or (young adj1 people) or preschool$ or pre-school$ or toddler or baby or babies or pediatric$ or paediatric$).mp.

2 Obesity/ or Body Weight/ or Body Size/ or Overweight/ or Weight Gain/ or Weight Loss/ or Body Fat/ or Body Mass Index/ or Weight Control/ or Metabolic Syndrome/ or Hyperphagia/

3 Treatment/ or Disease Management/ or Primary Health Care/ or Health Care Services/ or "Medical Treatment (General)"/ or Alternative Medicine/ or Computer Assisted Therapy/ or Creative Arts Therapy/ or exp Cross Cultural Treatment/ or Interdisciplinary Treatment Approach/ or Multimodal Treatment Approach/ or Online Therapy/ or exp Physical Treatment Methods/ or Acupuncture/ or Outpatient Treatment/ or Partial Hospitalization/ or Personal Therapy/ or Relaxation Therapy/ or exp Sociotherapy/ or Treatment Guidelines/ or Early Intervention/ or exp Self Help Techniques/ or Therapeutic Processes/ or Therapeutic Social Clubs/ or Treatment Compliance/ or Treatment Duration/ or Treatment

Effectiveness Evaluation/ or Treatment Facilities/ or Treatment Outcomes/
4 exp Drug Therapy/ or exp Prescribing (Drugs)/ or exp Drugs/
5 Surgery/ or Bariatric Surgery/
6 exp Cognitive Behavior Therapy/ or exp Behavior Therapy/ or Behavior Modification/ or exp Cognitive Techniques/ or Movement Therapy/
7 exp Psychotherapy/ or exp Adolescent Psychiatry/ or exp Adolescent Psychology/ or exp Counseling/ or exp Psychiatry/ or Psychoeducation/ or exp Psychotherapeutic Techniques/ or exp Psychotherapy/ or exp Peers/ or exp Social Support/ or exp Support Groups/ or exp Peer Counseling/ or Social Networks/ or (peer$ adj3 support$).mp.
8 exp Parent Child Relations/ or Parent Child Communication/ or exp Parenting/ or Authoritative Parenting/ or Parental Characteristics/ or Parental Involvement/
9 3 or 4 or 5 or 6 or 7 or 8
10 (effective$ or ineffec$ or efficien$ or inefficien$ or efficacy or evaluat$ or assess$ or apprais$ or valid$ or performance$ or utility or useful$ or outcome$).tw. or result$.ti.
11 (synthes$ or pooled or ((literature or systematic or evidence or quantitativ$ or integrativ$ or research$ or critical) adj5 (review$ or overview$)) or (integrative$ adj3 research$) or meta-analy$ or metaanaly$ or (meta adj1 analy$) or metanaly$).tw.
12 (extract$ or (search$ adj5 (medline or embase or cinahl or psycinfo or psychinfo or Cochrane or (science adj1 citation) or (web adj2 science) or (web adj2 knowledge) or scopus)) or handsearch$ or (hand adj1 search$) or (manual adj1 search) or bibliography or bibliographies or (reference adj1 list$)).ab.
13 5 or 6
14 1 and 2 and 9 and 10 and 13
15 limit 8 to yr="2005 -Current"

CINAHL (EBSCO)

1 (MH "Child Nutrition") OR (MH "Child Nutrition Disorders") OR (MH "Child Health Services") OR (MH "Adolescent Health Services") OR (MH "Pediatrics+") OR (MH "Child Behavior+") OR (MH "Child Development") OR (MH "Adolescence") OR (MH "Child+") OR (MH "Infant+")
2 (MH "Obesity+") OR (MH "Weight Gain") OR (MH "Body Weight Changes") OR (MH "Hyperphagia") OR (MH "Body Mass Index") OR (MH "Body Size") OR (MH "Body Weight") OR (MH "Weight Control") OR (MH "Life Style, Sedentary") OR (MH "Waist Circumference")
3 (MH "Obesity+/DH/DT/RH/SU/TH/PF") OR (MH "Hyperphagia/DH/DT/PF/RH/SU/TH") OR (MH "Therapeutics+") OR (MH "Early Intervention") OR (MH "Patient Care") OR (MH "Treatment Outcomes") OR (MH "Weight Reduction Programs") OR (MH "Primary Health Care")
4 (MH "Surgery, Operative+") OR (MH "Gastroplasty") OR (MH "Gastrectomy") OR (MH "Gastric Bypass") OR (MH "Bariatric Surgery+")
5 (MH "Therapeutic Exercise+") OR (MH "Behavior Therapy+") OR (MH "Behavior Modification+") OR (MH "Diet Therapy+") OR (MH "Diet, Fat-Restricted") OR (MH "Diet, Low Carbohydrate") OR (MH "Diet, Reducing") OR (MH "Self Regulation")
6 (MH "Counseling+") OR (MH "Psychotherapy+") OR (MH "Cognitive Therapy") OR (MH "Psychology, Applied+") OR (MH "Child Psychology") OR (MH "Psychology") OR (MH "Adolescent Psychology") OR (MH "Psychiatry") OR (MH "Adolescent Psychiatry") OR (MH "Child Psychiatry") OR (MH "Psychoanalysis") OR (MH "Parenting") OR (MH "Parental Behavior") OR (MH "Parent-Child Relations") OR (MH "Parents+") OR (MH "Support, Psychosocial") OR (MH "Peer Counseling") OR (peer* N3 support*)
7 (MH "Drug Therapy+") OR (MH "Antiobesity Agents+") OR (MH "Prescriptions, Drug") OR (MH "Drugs, Prescription") OR (MH "Drugs, Non-Prescription") OR (MH "Prescriptions, Non-Drug") OR (MH "Drug Utilization") OR (MH "Body Weight+/DE") OR (MH "Energy Intake/DE") OR (MH "Food Intake+/DE") OR (MH "Weight Gain+/DE") OR (MH "Weight Loss+/DE")
8 3 or 4 or 5 or 6 or 7
9 TX effective* OR ineffec* OR efficien* OR inefficien* OR efficacy OR evaluat* OR assess* OR apprais* OR valid* OR performance* OR utility OR useful* OR outcome*
10 TI result*
11 9 or 10
12 TX synthes* OR pooled OR (literature N5 review) OR (literature N5 overview) OR (systematic N5 review) OR (systematic N5 overview) OR (evidence N5 review) OR (evidence N5 overview) OR (quantitativ* N5 review) OR (quantitativ* N5 overview) OR (integrativ* N5 review) OR (integrativ* N5 overview) OR (research* N5 review) OR (research* N5 overview) OR (critical N5 review) OR (critical N5 overview) OR (integrative*

N3 research*) OR meta-analy* OR metaanaly* OR (meta N1 analy*) OR metanaly*
13 AB (search* N5 medline) OR (search* N5 embase) OR (search* N5 cinahl) OR (search* N5 psycinfo) OR (search* N5 psychinfo) OR (search* N5 cochrane) OR (search* N5 scopus) OR (search* N1 citation) OR (search* N1 web) or extract* OR handsearch* OR (hand N1 search*) OR (manual N1 search) OR bibliography OR bibliographies OR (reference N1 list*)
12 or 13
14 (1 and 2 and 8 and 11 and 14)
15 (1 and 2 and 8 and 11 and 14)

Database of Abstracts of Reviews of Effects; NHS Economic Evaluation Database; Health Technology Assessments (EBSCO)

25 child*
26 infant
27 baby OR babies
28 toddler
29 pre-school* OR preschool*
30 youth
31 Adolescent
32 teenage*
33 "school age"
34 "young people" OR "young person"
35 obes*
36 overweight
37 weight* N2 healthy
38 weight* N2 gain*
39 BMI
40 "body mass"
41 "body weight"
42 Overnutrition
43 Weight
44 pediatr*
45 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 20
46 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
47 21 and 22
48 Limit 21 and 22 to date abstract published from: 2005-2011

Cochrane Database of Systematic Reviews (EBSCO)

17 (body mass):ti,ab,kw or (weight):ti,ab,kw or (obesity):ti,ab,kw in Cochrane Reviews
18 (child*):ti,ab,kw or (adolescen*):ti,ab,kw or (school):ti,ab,kw or (infant):ti,ab,kw or (preschool*):ti,ab,kw
19 (#1 AND #2)
20 (prevention):ti,ab,kw or (intervention):ti,ab,kw or (control):ti,ab,kw or (treatment):ti,ab,kw
21 (#3 AND #4), from 2000 to 2012
22 (#5)
23 MeSH descriptor **Obesity** explode all trees
24 MeSH descriptor **Child** explode all trees
25 MeSH descriptor **Adolescent** explode all trees
26 MeSH descriptor **Child, Preschool** explode all trees
27 MeSH descriptor **Overweight** explode all trees
28 MeSH descriptor **Body Weight** explode all trees
29 (#7 OR #11 OR #12), from 2000 to 2012
30 (#2 OR #8 OR #9 OR #10)
31 (#13 AND #14)
32 (#15), from 2000 to 2012

Campbell Collaboration

Obesity OR weight OR BMI OR body mass

Effective Public Health Practice Project

Scan of both the current and archive pages on Systematic Reviews and Summary Statements

Guide to Clinical Preventive Services

A scan of results in the guide specific to children

Guide to Community Preventive Services

A scan of results in the guide

NICE

Keywords searched on the entire NICE site: Obesity, Weight; Child/Childhood; Prevention, Treatment. Obesity and weight were individually searched as terms on their own and in combination with the concepts of child and prevention/treatment.

Healthevidence.ca

Global search of obes*. Search limited four times, each time limited by one of the available childhood age categories: adolescents (13-19), grade school-aged (5-12), preschool-aged (1-4) and Infants (0-1). From the results, all articles pertaining to control or prevention of obesity or of weight control in general were selected.

Study Selection

Eligibility for inclusion into the review of reviews was independently determined by two reviewers. The inclusion and exclusion criteria used to screen abstracts, and full-text articles are listed below. Results from these independent screens were compared, and any discrepancies between the two reviewers were resolved.

Inclusion and Exclusion Criteria for Treatment Approaches

	Inclusion criteria	Exclusion criteria
Type of study	▪ Secondary study, which combines results of several studies (e.g., systematic reviews and/or meta-analysis)	▪ Primary study
Content	▪ Interventions for the prevention of childhood obesity/overweight	▪ No intervention described ▪ Intervention described was for the prevention of childhood obesity
Population	▪ Children (0-19 years)	▪ Populations outside the 0 to 19 age range (e.g., adults, mothers, developing fetuses, seniors)
Anthropometric outcome measure	▪ Anthropometric outcome measure (weight, BMI, % change in weight or BMI, prevalence of overweight or obesity, waist-circumference, skinfold thickness, % body fat, etc.) reported	▪ No anthropometric outcome measure reported
Year of publication	▪ Published 2009 onwards	▪ Published before 2009
Geography and language	▪ Developed countries (e.g., Canada, United States, Australia, New Zealand and/or northwestern Europe) ▪ English language	▪ Developing countries ▪ Non-English language

Quality Assessment

Methodological quality of the included reviews was evaluated independently by two reviewers with AMSTAR, a measurement tool created to assess the methodological quality of systematic reviews (41). This 11-item tool has been validated and been shown to have good agreement, reliability, face and construct validity, and feasibility (42,43). AMSTAR ratings can range from 1 to 11, with 11 denoting the highest quality. Discrepancies between reviewers were resolved by consensus. Overall AMSTAR ratings and score per AMSTAR items are shown below.

Data Extraction

For data extraction purposes, a standardized table with the following headings was created:

- Reference, type of study
- Population (age, SES, ethnicity, weight status)
- Study objectives
- Treatment approach
- Primary outcome (weight/BMI), Secondary outcome (behavioural risk factors)
- Study limitations and future research

Two reviewers independently extracted key findings from each of the studies to populate this table. Completed data extraction tables were compared, consolidated, and discrepancies were resolved by consensus. The data extraction table is provided in Appendix 5.

Study Quality (AMSTAR ratings)

REVIEW	'A priori' design	Duplicate study selection and data extraction	Comprehensive literature search	Status of publication (e.g. grey literature) used as an inclusion criterion	List of studies (included and excluded)	Characteristics of the included studies	Quality of the included studies assessed and documented	Quality of the included studies used in formulating conclusions	Appropriate methods to combine the findings of studies	Assessed likelihood of publication bias	Conflict of interest stated	Total Yes/Total points possible
An et al., 2009 (1)	Yes	C/A	Yes	No	No	Yes	No	Yes	Yes	No	No	5/11
Ayliffe and Glanville, 2010 (2)	Yes	No	No	No	No	No	No	Yes	No	No	No	2/11
Czernichow et al., 2010 (3)	Yes	C/A	Yes	No	No	Yes	Yes	Yes	Yes	Yes	No	7/11
Garcia et al., 2011 (4)	Yes	C/A	Yes	No	No	Yes	Yes	Yes	Yes	No	No	6/11
Ickes and Sharma, 2011 (5)	Yes	C/A	No	No	No	Yes	No	No	Yes	No	No	3/11
Kelly and Kirschenbaum, 2011 (6)	Yes	C/A	No	No	No	Yes	No	No	No	No	No	2/11
Kitzmann et al., 2010 (7)	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes	No	6/11
Kitzman-Ulrich et al., 2010 (8)	Yes	C/A	No	No	No	Yes	No	No	No	No	No	2/11
Lambiase 2008 (9)	Yes	C/A	No	No	No	Yes	No	No	No	No	No	2/11
Nguyen,B et al., 2011 (10)	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	No	7/11
Oude et al., 2009 (Cochrane) (11)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11/11
Padwal et al., 2011 (12)	Yes	Yes	Yes	No	No	Yes	Yes	Yes	N/A	No	No	6/10
Park et al., 2009 (13)	Yes	C/A	No	No	No	Yes	No	No	Yes	No	No	3/11
Sargent et al., 2011 (14)	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	No	No	6/11
Viner et al., 2010 (15)	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Yes	No	6/11

Note: N/A means that the AMSTAR item is not applicable, whereas C/A denotes that from the published article, the AMSTAR question cannot be answered.

References

(1) An JY, Hayman LL, Park YS, Dusaj TK, Ayres CG. Web-based weight management programs for children and adolescents: a systematic review of randomized controlled trial studies. ANS Adv Nurs Sci. 2009;32(3):222-240.

(2) Ayliffe B, Glanville NT. Achieving healthy body weight in teenagers: evidence-based practice guidelines for community nutrition interventions. Can J Diet Pract Res. 2010;71(4):e78-86.

(3) Czernichow S, Lee CM, Barzi F, Greenfield JR, Baur LA, Chalmers J, Woodward M, Huxley RR. Efficacy of weight loss drugs on obesity and cardiovascular risk factors in obese adolescents: a meta-analysis of randomized controlled trials. Obes Rev. 2010;11(2):150-158.

(4) Garcia Diaz E, Martin Folgueras T. Systematic review of the clinical efficacy of sibutramine and orlistat in weight loss, quality of life and its adverse effects in obese adolescents. Nutr Hosp. 2011;26(3):451-457.

(5) Ickes MJ, Sharma M. A review of childhood obesity prevention interventions targeting African American children. Vulnerable Children and Youth. 2011;6(1):103-123.

(6) Kelly KP, Kirschenbaum DS. Immersion treatment of childhood and adolescent obesity: the first review of a promising intervention. Obes Rev 2011 [cited 2013 Jun 26];12(1):37-49. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2009.00710.x/pdf

(7) Kitzmann KM, Dalton WT,3rd, Stanley CM, Beech BM, Reeves TP, Buscemi J, et al. Lifestyle interventions for youth who are overweight: a meta-analytic review. Health Psychol. 2010;29(1):91-101.

(8) Kitzman-Ulrich H, Wilson DK, St George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clin Child Fam Psychol Rev. 2010;13(3):231-253.

(9) Lambiase M. Treating pediatric overweight through reductions in sedentary behavior: a review of the literature. J Pediatr Health Care. 2009;23(1):29-36.

(10) Nguyen B, Kornman KP, Baur LA. A review of electronic interventions for prevention and treatment of overweight and obesity in young people. Obes Rev 2011 [cited 2013 Jun 26];12(5):e298-314. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2010.00830.x/pdf

(11) Oude Luttikhuis H, Baur L, Jansen H, Shrewsbury VA, O'Malley C, Stolk RP, et al. Interventions for treating obesity in children. Cochrane Database Syst Rev. 2009;(1)(1):CD001872.

(12) Padwal R, Klarenbach S, Wiebe N, Hazel M, Birch D, Karmali S, et al. Bariatric surgery: a systematic review of the clinical and economic evidence. J Gen Intern Med. 2011;26(10):1183-1194.

(13) Park MH, Kinra S, Ward KJ, White B, Viner RM. Metformin for obesity in children and adolescents: a systematic review. Diabetes Care. 2009;32(9):1743-1745.

(14) Sargent GM, Pilotto LS, Baur LA. Components of primary care interventions to treat childhood overweight and obesity: a systematic review of effect. Obes Rev 2011 [cited 2013 Jun 26];12(5):e219-35. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2010.00777.x/pdf

(15) Viner RM, Hsia Y, Tomsic T, Wong IC. Efficacy and safety of anti-obesity drugs in children and adolescents: systematic review and meta-analysis. Obes Rev. 2010;11(8):593-602.

Chapter 6: Cost-Effectiveness Literature Search Methods

Literature Search Strategy

A librarian-assisted systematic literature search was conducted in May 2012. The scope of the search was limited to articles published between January 2000 and April 2012.The following electronic databases were searched for peer-reviewed literature: MEDLINE, EMBASE, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects (DARE), NHS Economic Evaluation Database, Health Technology Assessments and EconLit. Each electronic database was searched with the same general search strategy, with keywords combining three concepts: child, obesity and cost. Additionally, related grey literature and Health Technology Assessments from the Canadian Agency for Drugs and Technology in Health (CADTH) website were searched, and reference lists of included studies were manually searched.

MEDLINE (Ovid)

1 exp Child/ or exp Infant/ or Adolescent/ or Child Development/ or Child Behavior/ or exp Pediatrics/ or exp Child Health Services/exp Obesity/ or Overnutrition/ or Overweight/ or Body Mass Index/ or Body Size/ or Body Weight/ or exp Body Weight Changes/ or Weight Gain/ or Ideal Body Weight/ or Waist Circumference/ or Sedentary Lifestyle
2 exp Obesity/ or Overnutrition/ or Overweight/ or Body Mass Index/ or Body Size/ or Body Weight/ or exp Body Weight Changes/ or Ideal Body Weight/ or Waist Circumference/ or Sedentary Lifestyle/ or Adiposity/ or Skinfold Thickness/ or Waist-Hip Ratio/ or Body Fat Distribution/
3 Economics/ or Resource Allocation/ or Health Care Rationing/ or "Costs and Cost Analysis"/ or Cost Allocation/ or "Cost-Benefit Analysis"/ or Cost Control/ or Cost Savings/ or "Cost of Illness"/ or Health Care Costs/ or Direct Service Costs/ or Drug Costs/ or Employer Health Costs/ or Hospital Costs/ or Health Expenditures/ or Capital Expenditures/ or "Economics, Behavioral"/ or "Economics, Hospital"/ or Hospital Charges/ or Hospital Costs/ or exp "Economics, Medical"/ or "Economics, Nursing"/ or "Economics, Pharmaceutical"/ or "Fees and Charges"/ or "Fees, Medical"/ or "Fees, Pharmaceutical"/ or Prescription Fees/ or Hospital Charges/ or Prescription Fees/ or "Financing, Organized"/ or exp "Financing, Government"/ or Health Care Sector/ or Investments/ or exp Taxes/ or exp Models, Economic/ or exp Obesity/ec or Overweight/ec or (cost adj1 effectiv$).mp.
4 1 and 2 and 3
5 limit 4 to yr="2000 -Current"
6 (child$ or youth$ or teen$ or preteen$ or tween$ or adolescent$ or infant$ or (young adj1 person$) or (young adj1 people) or preschool$ or pre-school$ or student$ or (school adj1 age$) or toddler$ or baby or babies or pediatric$ or paediatric$).mp.
7 (obes$ or overweight or overnutrition$ or inactiv$ or sedentary or (weight adj1 loss$) or (weight adj1 reduc$) or (body adj1 weight$) or (body adj1 mass$) or bmi or adipos$).ab. /freq=2
8 (cost$ or economic$ or expenditure$ or burden or invest$ or (value adj3 money) or (value adj3 dollar$) or afford$ or QALY or DALY).ab. /freq=2
9 6 and 7 and 8
10 limit 9 to ("in data review" or in process or "pubmed not medline")
11 limit 10 to yr="2000 -Current"
12 5 or 11

EMBASE (Ovid)

1 (child$ or youth$ or teen$ or preteen$ or tween$ or adolescent$ or infant$ or (young adj1 person$) or (young adj1 people) or preschool$ or pre-school$ or student$ or (school adj1 age$) or toddler$ or baby or babies or pediatric$ or paediatric$).mp.
2 (obes$ or overweight or overnutrition$ or inactiv$ or sedentary or (weight adj1 loss$) or (weight adj1 reduc$) or (body adj1 weight$) or (body adj1 mass$) or bmi or adipos$).ab. /freq=2
3 (cost$ or economic$ or expenditure$ or burden or invest$ or (value adj3 money) or (value adj3 dollar$) or afford$ or QALY or DALY).ab. /freq=2
4 exp "child"/ or exp "newborn"/ or exp "adolescent"/ or "child development"/ or "child behavior"/ or "pediatrics"/ or "child health care"/

5 "obesity"/ or "body weight disorder"/ or "overnutrition"/ or "abdominal obesity"/ or "diabetic obesity"/ or "metabolic syndrome x"/ or "morbid obesity"/ or "overnutrition"/ or "body mass"/ or "body weight"/ or "lean body weight"/ or "liveweight gain"/ or "weight change"/ or "weight control"/ or "weight fluctuation"/ or "weight gain"/ or "weight reduction"/ or "body weight disorder"/ or "body size"/ or "waist circumference"/ or "adipose tissue"/ or "sedentary lifestyle"/ or "body fat"/
6 behavioral economics/ or cost benefit analysis/ or cost control/ or cost effectiveness analysis/ or cost minimization analysis/ or "cost of illness"/ or cost utility analysis/ or cost/ or drug cost/ or economic aspect/ or economic evaluation/ or economics/ or fee/ or funding/ or "health care cost"/ or "health care financing"/ or "health economics"/ or "hospital billing"/ or "hospital charge"/ or "hospital cost"/ or "hospital finance"/ or "hospitalization cost"/ or "insurance"/ or "investment"/ or "medical fee"/ or "nursing cost"/ or "pharmacoeconomics"/ or "resource allocation"/ or "resource management"/ or "tax"/ or exp "health insurance"/ or pharmacoeconomics. fs. or (cost adj1 effectiv$).mp.
7 (1 or 4) and (2 or 5) and (3 or 6)
8 limit 7 to exclude medline journals
9 limit 8 to yr="2000 -Current"

Cochrane Database of Systematic Reviews; Database of Abstracts of Reviews of Effects; NHS Economic Evaluation Database; Health Technology Assessments (EBSCO)

1 (child* OR youth* OR teen* OR preteen* OR tween* OR adolescent* OR infant* OR (young N1 person*) OR (young N1 people) OR preschool* OR pre-school* OR student* OR (school N1 age*) OR toddler* OR baby OR babies OR pediatric* OR paediatric*)
2 (obes* or overweight or overnutrition* or inactiv* or sedentary or (weight N1 loss*) or (weight N1 reduc*) or (body N1 weight*) or (body N1 mass*) or bmi or adipos*) baby OR babies
3 (cost* or economic* or expenditure* or burden or invest* or (value adj3 money) or (value adj3 dollar*) or afford* or QALY or DALY)
4 1 and 2 and 3

EconLit

1 all(child* OR youth* OR teen* OR preteen* OR tween* OR adolescent* OR infant* OR (young N1 person*) OR (young N/1 people) OR preschool* OR pre-school* OR student* OR (school N/1 age*) OR toddler* OR baby OR babies OR pediatric* OR paediatric*)
2 all(obes* or overweight or overnutrition* or inactiv* or sedentary or (weight N1 loss*) or (weight N1 reduc*) or (body N/1 weight*) or (body N/1 mass*) or bmi or adipos*)
3 all(cost* or economic* or expenditure* or burden or invest* or (value N/1 money) or (value N/3 dollar*) or afford* or QALY or DALY)
4 AND 2 AND 3
5 Limit 4 to 2000-current

Canadian Agency for Drugs and Technology in Health (CADTH)

Hand-searched http://cadth.ca/en/products/health-technology-assessment and hand-searched sources identified in http://cadth.ca/en/resources/grey-matters

Selection of Literature Results

Specific inclusion and exclusion criteria for screening of relevant titles and abstracts are listed below. One reviewer independently screened titles and abstracts against these inclusion and exclusion criteria, and a second reviewer validated these results.

Inclusion and Exclusion Criteria for Cost-Effectiveness Review

	Inclusion criteria	Exclusion criteria
Type of study	▪ Primary study	▪ Commentary or secondary study
Population	▪ Children and youth (0-19 years)	▪ Populations outside the 0 to 19 age range (e.g., adults, mothers, developing fetuses, seniors)
Intervention	▪ Interventions for the prevention or treatment of childhood obesity/overweight	▪ No intervention
Comparison	▪ Study compares the intervention to an alternative intervention	▪ No comparison group
Outcome	▪ Reports the results of an economic evaluation ▪ Measures or models intervention effectiveness with anthropometric outcome	▪ No economic evaluation ▪ Did not measure intervention effectiveness with anthropometric outcome
Geography and language	▪ Developed countries (e.g. Canada, US, UK, Australia, New Zealand and/or northwestern Europe) ▪ English language	▪ Developing countries ▪ Non-English language

Quality Assessment

For all studies that met the inclusion criteria, one reviewer independently assessed studies for their overall methodological quality. Quality was assessed with a critical appraisal checklist for economic evaluations, as outlined in *Methods for the Economic Evaluation of Health Care Programmes 2nd Edition* (55). The checklist is a series of 10 questions, and each publication was assessed for the presence of each of these items. Results from this quality assessment were then subsequently validated by a second reviewer.

Quality checklist questions:

1. Was a well-defined question posed in an answerable form?
2. Was a comprehensive description of the competing alternatives given?
3. Was the effectiveness of the programs or services established?
4. Were all the important and relevant costs and consequences for each alternative identified?
5. Were costs and consequences measured accurately in appropriate physical units?
6. Were costs and consequences valued credibly?
7. Were costs and consequences adjusted for differential timing?
8. Was an incremental analysis of costs and consequences of alternatives performed?
9. Was allowance made for uncertainty in the estimates of costs and consequences?
10. Did the presentation and discussion of study results include all issues of concern to users?

Data Extraction

To ensure standardized extraction of important information from the each economic evaluation, a table with the following headings was created:

- Program name/Reference/Quality assessment
- County/Population
- Intervention/Alternative intervention/Duration
- Perspective/Time horizon/Year of costing/ Currency/Discount rate
- Costs/Incremental cost
- Types of costs included
- Effects/ Other comments

One reviewer independently extracted key findings from each study to populate the table. The completed data extraction table was subsequently validated by a second reviewer and is provided in Appendix 5.

Chapter 7: Jurisdictional Scan Literature Search Methods

Jurisdictional Scan Approach

A jurisdictional scan was completed through both general and targeted Internet searches in April and May 2012. The scan focused on government strategies and/or jurisdiction-wide initiatives targeting obesity. Books, news articles, commercial sites and social media sources were excluded.

The *general search strategy* to identify relevant strategies/initiatives was completed using the following keyword search terms in Google: child (childhood), obesity (obese), prevention, effectiveness (effective). The first 100 records were examined. No searches on synonyms were performed.

The targeted search strategy involved in-depth reviews of selected websites identified through two targeted searches. *Targeted search strategy #1* used the following search terms: '(obes* OR overweigh* OR overnutrition) AND (child* OR adolescen* OR babies OR baby OR infant OR infancy OR "young people" OR youth OR pediatr*)'. The organizational websites that were included in this search are listed below.

The first 100 records were examined. *Targeted search strategy #2* used the following search terms: "(child OR teen OR youth) AND (obesity OR overweight OR "healthy weight") AND (strategy OR action plan OR framework)." The organizational websites that were included in this search are listed below. The first 30 records were examined.

A "pearl-growing" technique was also used to leverage the content and cited references of already-identified relevant reports. The technique involved the following process: (1) a relevant report was identified through the general or targeted search strategy; (2) strategies/initiatives and/or jurisdictions of interest cited by the original relevant report were extracted; (3) newly identified strategies/initiatives and/or jurisdictions of interest were used as search terms to find other relevant reports via Google.

Study Selection of Literature Results

Specific inclusion and exclusion criteria for screening of relevant reports are listed below.

Inclusion and Exclusion Criteria

	Inclusion criteria	Exclusion criteria
Type of report	▪ Government strategies jurisdiction-wide initiatives targeting obesity	▪ Books, news articles, commercial sites and social media sources
Jurisdictions of focus	▪ Region, country, state or province level	▪ City or county level
Year of release	▪ Year 2000 onwards	▪ Before year 2000
Language	▪ English or French-language publication	▪ Non-English language publication

As listed below 135 initial reports were identified by library services. After the second targeted search and screening for relevance against inclusion criteria, 28 reports were included in this scan.

Search Results

Inclusion and Exclusion Criteria for Cost-Effectiveness Review

Sources	No. of reports identified	No. of relevant documents
General search strategy (to identify jurisdictions of interest)	50	–
Targeted search strategy #1 (to identify jurisdictions of interest)	85	–
Targeted search strategy #2 (relevant documents for review)	–	21
Additional documents from "pearl growing" technique	–	7
TOTAL	**135**	**28***

Note: *these 28 documents were included in the review

Data Extraction

For data extraction purposes, a standardized table with the following headings was created:

- Reference, Name of Initiative, Type of Initiative
- Population: age, SES, ethnicity, weight status
- Goals, objectives, principles
- Life stage: (infant, early childhood, children and youth, parents, all)
- Environment for intervention
  - Food and beverage environment
  - Physical activity environment
  - Community environment
  - Daycare, school and after-school environments
  - Health care and/or work environments
  - Message environment

Within each intervention environment, strategies and activities were further classified into the following subcategories: policy and environmental changes, social and behavioural programs/initiatives, and communication and informational initiatives. As most of the information and communication initiatives were subsequently identified within the message environment, this category was later removed. An additional section of the data extraction table focused on key enabling strategies/activities identified within jurisdictional reports, which included:

- Leadership
- Measurement
- Monitoring and evaluation
- Research
- Knowledge translation and exchange
- Capacity-building

One reviewer independently extracted key findings from each of the relevant reports to populate these tables. Completed data extraction tables were subsequently validated by a second reviewer.

Data Syntheses

The table below presents details of the 28 documents that were included from the environmental scan, which included 17 government strategy reports and nine initiative reports. Among the reports describing government strategies, nine targeted the whole population, while eight focused on children. However, many of the strategies with a whole-population approach targeted children and youth or identified them as priority populations. In addition, there was variation in how the obesity prevention strategies were framed. For example, in Nova Scotia, these initiatives are described as obesity prevention strategies, while in Ontario they are labelled as an action plans for "healthy eating and active living." In both cases, the goal is to prevent childhood obesity or decrease its prevalence.

Included Reports

Jurisdiction	Report title	Report type	Year of publication	Target population
Canada	Actions taken and future directions 2011 - Curbing childhood obesity: A federal, provincial and territorial framework for action to promote healthy weights	Government strategy	2011	Children and youth
Alberta	Backgrounder: Alberta Health Services Obesity Initiative - First-year highlights of obesity prevention and management initiative	Government strategy	2011	Whole population
British Columbia	A strategy for combatting childhood obesity and physical inactivity in British Columbia	Government strategy	2006	Children and youth
Ontario	Ontario's action plan for healthy eating and active living	Government strategy	2006	Whole population
Newfoundland and Labrador	Eating healthier in Newfoundland and Labrador: Provincial food and nutrition framework and action plan	Government strategy	2006	Whole population
Nova Scotia	Growing up healthy: Discussion framework for a childhood obesity prevention strategy	Government strategy	2011	Children and youth
Quebec	Plan d'action gouvernemental de promotion des saines habitudes de vie et de prévention des problèmes reliés au poids, Investir pour l'avenir	Government strategy	2006	Children and youth (and family)
Australia	Australia: The healthiest country by 2020 – National Preventative Health Strategy – Overview	Government strategy	2009	Whole population
Australia	Healthy weights 2008, Australia's future: The national action agenda for children and young people and their families	Government strategy	2003	Children and youth
New South Wales, Australia	NSW government plan for preventing overweight and obesity in children, young people and their families: 2009-2011	Government strategy	2009	Children and youth (and family)
New Zealand	Healthy Eating – Healthy Action. Oranga Kai – Oranga Pumau: A strategic framework	Government strategy	2003	Whole population
United States and Canada	The CATCH Programs	Initiative	2012	Children and youth
United States and Canada	Healthy Habits are Easy to Catch! (Coordinated Approach to Child Health)	Initiative	2010	Children and youth
United States	Child Nutrition Reauthorization: Healthy, Hunger-Free Kids Act of 2010	Initiative	2010	Children and youth
United States	Solving the problem of childhood obesity within a generation: White House Task Force on Childhood Obesity Report to the President	Government strategy	2010	Children and youth
United States	We Can! Progress report: Curriculum implementations by the intensive sites	Initiative	2007	Children and youth
Arkansas, U.S.	Year seven evaluation: Arkansas Act 1220 of 2003 to combat childhood obesity	Initiative	2011	Children and youth
Arkansas, U.S.	Arkansas Act 1220 of 2003 to reduce childhood obesity: its implementation and impact on child and adolescent body mass index	Initiative	2009	Children and youth
Europe	EPODE: 5 Ans deja et un pari reussi	Initiative	2010	Children and youth
Europe	Prevalence of overweight and obesity in serial cross-sectional surveys of the Ensemble, Prevenons l'Obesite des Enfants (EPODE) campaign	Initiative	2009	Children and youth
Europe	EPODE approach for childhood obesity prevention: methods, progress and international development	Initiative	2012	Children and youth

Included Reports – Cont'd

Jurisdiction	Report title	Report type	Year of publication	Target population
Denmark	National action plan against obesity: Recommendations and perspectives - Short version	Government strategy	2003	Whole population
England	Healthy lives, healthy people: A call to action on obesity in England	Government strategy	2011	Whole population
England	Healthy weight, healthy lives: A cross-government strategy for England	Government strategy	2008	Children and youth
England	Change4Life: Three-year social marketing strategy	Initiative	2011	Whole population
England	Change4Life: One year on	Initiative	2010	Whole population
Scotland	Preventing overweight and obesity in Scotland: A route map towards healthy weight	Government strategy	2012	Whole population
Spain	Spanish strategy for nutrition, physical activity and prevention of obesity (NAOS)	Government strategy	2005	Whole population

Websites Included in Targeted Search Strategy #2

Jurisdiction	Organizations Searched	Web Link
Arkansas	Department of Health	www.healthy.arkansas.gov
Australia	Department of Health and Aging	www.health.gov.au
Canada	Public Health Agency of Canada	www.phac-aspc.gc.ca
Alberta	Alberta Health Services	www.albertahealthservices.ca
British Columbia	BC Ministry of Health Legislative Assembly of British Columbia: Select Standing Committee on Health	www.gov.bc.ca/health www.leg.bc.ca/cmt/39thparl/session-4/health/index.htm
Saskatchewan	Government of Saskatchewan	www.health.gov.sk.ca
Manitoba	Manitoba Health	www.gov.mb.ca/health/
Yukon	Yukon Health and Social Services	www.hss.gov.yk.ca/nutrition.php
NW Territories		
Nunavut	Government of Nunavut	www.gov.nu.ca/en/
Quebec	Institut national de santé publique du Québec (INSPQ)	www.inspq.qc.ca/english/default.asp
New Brunswick	Government of New Brunswick	www2.gnb.ca
Nova Scotia	Government of Nova Scotia	www.novascotia.ca
PEI	Government of Prince Edward Island	www.gov.pe.ca
Newfoundland and Labrador	Government of Newfoundland and Labrador	www.gov.nl.ca/
Ontario	Ministry of Health and Long-Term Care	www.health.gov.on.ca/en/public/
Denmark	Danish Health and Medicines Authority	www.sst.dk/English.aspx
England	Department of Health	www.dh.gov.uk/en/index.htm
Europe	EPODE European Network	www.epode-european-network.com
France	Santé et solidarité	www.gouvernement.fr/gouvernement/sante-et-solidarite
New South Wales	NSW Ministry of Health	www.health.nsw.gov.au
New Zealand	Ministry of Health	www.health.govt.nz
Norway	Ministry of Health and Care Services	www.regjeringen.no/en/dep/hod.html?id=421
Portugal	Ministry for Health	www.portugal.gov.pt/en/the-ministries/ministry-of-health.aspx
Scotland	The Scottish Government	www.home.scotland.gov.uk/home
Spain	Ministry of Health, Social Services and Equality	www.msps.gob.es
Sweden	Ministry of Health and Social Affairs	www.sweden.gov.se/sb/d/2061
The Netherlands	Ministry of Health, Welfare and Sport	www.government.nl/ministries/vws
United Kingdom	Government of the United Kingdom	http://www.direct.gov.uk/en/index.htm
United States	Government of the United States	http://www.usa.gov/
West Virginia	Government of West Virginia	http://www.wv.gov/Pages/default.aspx

Appendix 5: Data Extraction Tables

Chapter 4: Prevention Data Extraction Table

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
An JY, Hayman LL, Park YS, Dusaj TK, Ayres CG. Web-based weight management programs for children and adolescents: a systematic review of randomized controlled trial studies. ANS Adv Nurs Sci. 2009 Jul-Sep;32(3):222-240. (1) **Type:** Systematic Review	▪ To review evidence regarding effectiveness of web-based weight management for overweight children and adolescents	▪ **Age:** 8-18 Ethnicity: 3 unselected, 1 specific to African-American girls ▪ **Gender:** 2 unselected and 2 specific to girls ▪ **Weight:** 3 unselected and 1 selected for overweight or obese ▪ **SES:** Unselected	▪ **Target:** PA & Combination (Diet and PA) ▪ **Number of Studies:** Of 8 studies, 4 relevant ▪ **Type of Studies:** RCTs ▪ **Quality of Studies:** Not described ▪ **Duration:** 2 weeks to 2 years ▪ **Follow-up:** From baseline to end of intervention ▪ **Settings:** Community (summer camp) Schools Home ▪ **Activities:** All interventions delivered via Internet Behaviour change counselling/ education on physical activity and nutrition Parental engagement	▪ Of 4 studies that were not focused upon obese children/ youth, 3 reported on anthropometric outcomes; 1 2-week study only reported weight at baseline ▪ One study of overweight 12 to 18 years olds reported reduction in BMI z-score for intervention group. Study of 7th and 8th-graders reported significant difference in BMI and z-scores at 1 and 2 years but only for girls and when parents were involved ▪ Remaining study of 4-week summer camp and 8-week home Internet program reported no significant change in BMI at either 4 or 12 weeks	▪ One study reported change in PA self-efficacy and intentions, but self-reported activity increased only in the print (compared to the Internet) group ▪ Another study reported increase in healthy eating and PA cognitive behavioural skills, reduced consumption of high-fat foods and reduced stress	**Limitation** ▪ Limited evidence on the effectiveness of Internet-based interventions, particularly as all studies were conducted in the United States and two focused on overweight (but not necessarily obese) children/youth ▪ **Further Research** Internet-based approaches
Ayliffe B, Glanville NT. Achieving healthy body weight in teenagers: evidence-based practice guidelines for community nutrition interventions. Can J Diet Pract Res. 2010;71(4):e78-86. (2)	▪ To identify community interventions effective in either primary or secondary obesity prevention in non-overweight youth (12-18) or weight reduction/ stabilization	▪ **Age:** 12-18 ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected but mixed studies	▪ **Target:** Diet, PA & Combination ▪ **Number of Studies:** 41 out of 63 were prevention ▪ **Type of Studies:** Interventions; no restriction on study design ▪ **Quality of Studies:** Studies were rated but quality not reported ▪ **Duration:** Not described ▪ **Follow-up:** Not described	▪ Effect sizes not described. Based on review and expert feedback, authors state there is strong evidence for school-based prevention interventions that are comprehensive and address social and environmental influences, including:	▪ Not analyzed	▪ Internet & screen-based media & technology influence food knowledge/decisions. High-quality review excludes a lot of literature

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Type: Systematic Review	appropriate for growth in overweight youth (including looking at risk factors and moderator & mediator variables)		▪ **Settings:** School, Community ▪ **Activities:** Education (e.g., curriculum on nutrition, computer/technology-based nutrition education); Lifestyle (e.g. PA); Environment (e.g., food modification)	nutrition education and physical activity, and use schools as a health promotion delivery venue ▪ Computer- or technology- based and peer-modelling strategies are promising, developmentally appropriate approaches		
Bond M, Wyatt K, Lloyd J, Taylor R. Systematic review of the effectiveness of weight management schemes for the under fives. Obes Rev. 2011;12(4):242-253. (3) **Type:** Systematic Review	▪ To review the effectiveness and cost-effectiveness of weight management schemes for the under fives, restricting the inclusion criteria to controlled trials with objective measures.	▪ **Age:** <5 ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Diet, PA and Combination ▪ **Number of Studies:** 7 ▪ **Types of Studies:** 4 RCTs ▪ **Quality of Studies:** 1 study lacked key quality indicators ▪ **Duration:** 14 to 24 weeks ▪ **Follow-up:** 15 weeks to 5 years ▪ **Setting:** Preschool/ kindergarten, home or combination ▪ **Activities:** Classroom-based education; Preschool-based exercise/activity; Parental education/ engagement	▪ All 4 studies reported anthropometric outcomes, but there was heterogeneity in methods and how measurements were made ▪ Favourable trends in all studies, but only 1 (Hip-Hop Jr in Latino study) showed significant difference	▪ Two studies reported physical activity or sedentary behaviour outcomes, and both showed beneficial effect ▪ No nutrition measures reported	▪ No cost or cost-effectiveness data reported. 1 study commented on the need for training staff on physical activity components and active engagement of parents/carers
Bond M, Wyatt K, Lloyd J, Welch K, Taylor R. Systematic review of the effectiveness and cost-effectiveness of weight management schemes for the under fives: a short report. Health Technol Assess. 2009;13(61):1-75, iii. (4) **Type:** Systematic Review	▪ To study effectiveness & cost-effectiveness of weight management schemes for under five years	▪ **Age:** <5 ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** PA, Combined PA and Diet ▪ **Number of Studies:** 22 ▪ **Type of Studies:** 16 systematic reviews, 6 RCTs reporting on 3 trials ▪ **Quality of Studies:** Quality rated for RTs; all met majority of quality criteria, but none reported whether randomization was adequate ▪ **Duration:** 14 to 24 weeks ▪ **Follow-up:** 16 weeks to 5 years ▪ **Setting:** Home; Combination preschool/nursery school and home ▪ **Activities:** PA at preschool/ nursery school; Parent education	▪ Hip-Hop Jr program reported significant differences in BMI at 1- and 2-year follow-up at African-American but not Latino sites ▪ Harvey-Berino and Rourke's Aboriginal mother/child dyad program found a non-significant increase in weight in the control group after 16 weeks ▪ Trends in BMI and weight favoured intervention groups	▪ Accelerometer results did not show evidence of effect on PA	▪ No studies were found to provide full cost-effectiveness, cost-utility, cost-benefit or cost-consequence analyses

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Branscum P, Sharma M. A systematic analysis of childhood obesity prevention interventions targeting Hispanic children: lessons learned from the previous decade. Obes Rev. 2011;12(5):e151-8. (5) **Type:** Systematic Review	▪ To systematically analyze and summarize findings for health education and promotion interventions aimed at the prevention of childhood overweight and obesity among primarily Hispanic children.	▪ **Age:** 3-12 ▪ **Ethnicity:** Hispanic ▪ **Gender:** 2 studies female-only ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Combination diet and PA ▪ **Number of Studies:** 9 ▪ **Types of Studies:** 5 RCTs and 4 quasi-experimental or pilot ▪ **Quality of Studies:** Not evaluated ▪ **Duration:** 2 days to 3 years ▪ **Follow-up:** 3 and 6 months (2 studies) ▪ **Setting:** Schools and combination schools and homes ▪ **Activities:** Classroom-based education; School-based exercise; Modification school environment; Parental education/engagement	▪ All 5 RCTs showed some form of benefit in weight measures but heterogeneity in measures used ▪ Of 4 quasi-experimental studies, 2 reported beneficial outcomes and 2 did not report **Factors of Successful Interventions** ▪ Parental components ▪ Dedicated intervention staff ▪ Older children ▪ Longer duration ▪ Theory-based ▪ Participants at high risk of obesity	▪ Of 5 RCTs, 2 reported PA outcomes and they found no difference. Of 4 quasi-experimental studies, 2 reported PA benefit and 1 reduction in sedentary behaviour	**Heterogeneity** ▪ Methodological rigour ▪ Measurements
Brown T, Summerbell C. Systematic review of school-based interventions that focus on changing dietary intake and PA levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. Obes Rev. 2009;10(1):110-141. (6) **Type:** Systematic Review	▪ To determine the effectiveness of interventions that focus on improving diet and physical activity (PA) behaviours in schoolchildren ▪ To identify study characteristics that may affect outcome such as gender, age, socioeconomic status, setting, process indicators and contextual factors	▪ **Age:** 5–18 ▪ **Location:** US, UK, Australia, Europe ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Diet (3), PA (5) and Combination (20) ▪ **Number of Studies:** 38 ▪ **Type of Studies:** RCTs, controlled trials ▪ **Quality of Studies:** Not described ▪ **Duration:** > 12 weeks (12 wks - 22 yrs) ▪ **Follow-up:** 22 < 1 yr, 9 1-2 yrs, 4 3-5 yrs, 2 >5 yrs ▪ **Setting:** School (23 primary, 15 secondary, 2 kindergarten/ preschool ▪ **Activities:** Education of children; School environment modification; Modified physical education	▪ One of three (33%) diet studies, five of 15 (33%) PA studies and nine of 20 (45%) combined diet and PA studies demonstrated significant differences between intervention and control for BMI **Factors of Successful Interventions** ▪ Combined diet and PA in long term ▪ Dietary interventions such as providing breakfast for adolescents and PA interventions, particularly in girls in primary schools in the short term ▪ PA interventions may be more successful in younger children and in girls	▪ Not analyzed	**Process Evaluation** ▪ May be better implemented if built into the curriculum ▪ May be too expensive and unsustainable as it was delivered by non-school personnel ▪ School nurses experienced difficulty counselling girls who lacked places, resources and social support for engaging in PA ▪ Some girls expressed that their parents discouraged PA at home because of the noise and the low importance placed on being physically active as compared with doing homework or chores **Limitation** ▪ None of the included

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
				Insufficient Evidence Outcomes ▪ Family involvement ▪ Combined diet and PA school-based interventions to prevent obesity are equivocal ▪ No consistent pattern between significant effect and the size and duration of the study ▪ Unclear whether it is more effective to target single or multiple behaviour change outcomes (energy restriction and increased PA) ▪ Gender (age 10-14)		studies assessed weight by SES ▪ Weaknesses in assessment measures ▪ Short term **Heterogeneity** ▪ Design ▪ Participants ▪ Interventions ▪ Outcomes
Ciampa PJ, Kumar D, Barkin SL, Sanders LM, Yin HS, Perrin EM, et al. Interventions aimed at decreasing obesity in children younger than 2 years: a systematic review. Arch Pediatr Adolesc Med. 2010;164(12):1098-1104. (7) **Type:** Systematic Review	▪ To assess the evidence for interventions designed to prevent or reduce overweight and obesity in children younger than 2 years.	▪ **Age:** <2 ▪ **Ethnicity:** Aboriginal and African-American-specific ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Diet (8), Combination (2) and 1 study targeted maternal diet and PA ▪ **Number of Studies:** 10 ▪ **Type of Studies:** 3 RCTs (described in 5 articles), 2 pre/post, 2 quasi-experimental, 3 cohort ▪ **Quality of Studies:** 5 fair, 7 poor ▪ **Duration:** 8 weeks to 3 years; most <6 months ▪ **Follow-up:** End of intervention ▪ **Setting:** Home (2), Clinic (3), School (4), Combination (1) ▪ **Activities:** Dietary/ nutrition education (2); Combination of education and guided PA (2)	▪ Only 5 articles measured maternal BMI or change in children's weight status. One small cohort study reported proportion overweight was significantly lower in intervention group compared to control (1.28% vs. 25.5%), but study quality was poor ▪ The Harvey-Berino and Rourke study was the only other study (pre/post) that reported weight measures and it found child BMI–for- age increased	▪ Only 1 study reported increase in mother/child PA, and study was short-term ▪ Five studies showed positive nutrition effects	▪ Six studies reported improvements in process measures such as parental knowledge of healthy nutritional behaviours and parental attitudes ▪ Non-randomized studies were of poor quality and randomized only fair ▪ Most studies had significant dropout rates **Heterogeneity** ▪ Populations ▪ Types of intervention ▪ Duration
Cook Cottone C, Casey CM, Feeley TH, Baran J. A meta-analytic review of obesity prevention in the schools: 1997-2008. Psychology in the Schools. 2009;46:695-719. (8) **Type:** Meta-Analysis	▪ To determine factors and effect sizes in school-based obesity prevention studies published between 1997 and 2008.	▪ **Age:** Preschool to grade 12 ▪ **Ethnicity:** Asian, African-American, Hispanic or Aboriginal ▪ **Gender:** 36 both; 4 studies	▪ **Target:** PA, Diet and Combination ▪ **Number of Studies:** 40 ▪ **Type of Studies:** RCTs and controlled trials ▪ **Quality of Studies:** Not described ▪ **Duration:** Not described ▪ **Follow-up:** Not described	**Factors of Successful Interventions:** Universal Interventions: ▪ (k =37, r =.07) ▪ Conducted in elementary schools (k =41, r =.06) ▪ Implemented collaboratively (k =19, r =.12)	▪ Not analyzed	

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
		restricted to girls ▪ **Weight:** Obesity treatment articles excluded; interventions were unselected (universal) or targeted to high-risk populations (overweight or risk factors for becoming overweight) ▪ **SES:** Unselected	▪ **Setting:** School (including before and after school) ▪ **Activities:** Classroom-based education of children; Behaviour change/ modification strategies; Sedentary behaviour-reducing strategies; Modification of school environment; After-school and/or recess programs	▪ Children of Asian ethnicity (k =5, r =.30) ▪ Encouraged nutritional change (k =28, r =.13) ▪ Sought to reduce sedentary behaviours (k =17, r =.15) **Factors of Unsuccessful Interventions** ▪ Short duration interventions (k =11, r =−.04) ▪ Implemented system-wide changes in nutrition (k =15, r =−.03)		
De Bourdeaudhuij I, Van Cauwenberghe E, Spittaels H, Oppert JM, Rostami C, Brug J, et al. School-based interventions promoting both physical activity and healthy eating in Europe: a systematic review within the HOPE project. Obes Rev. 2011;12(3):205-216. (9) **Type:** Systematic Review	▪ To review the evidence of school-based interventions targeting diet and PA in primary and secondary school children in Europe.	▪ **Age:** 6-18 ▪ **Location:** Europe ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Combination (Diet and PA) ▪ **Number of Studies:** 11 ▪ **Type of Studies:** 7 RCTs, 4 non-randomized controlled ▪ **Quality of Studies:** 10 moderate, 1 weak, none strong ▪ **Duration:** 8 weeks to 20 months ▪ **Follow-up:** < 3 months to 10 years ▪ **Setting:** School ▪ **Activities:** Education; Environment or policy-based; Education and environment/ policy-based	▪ Results analyzed separately for children (6-12 yrs) and adolescents (13-18 yrs) ▪ Of 6 studies in children, 1 reported smaller increase in BMI and skinfolds and 1 decrease in % overweight for girls ▪ Of 5 interventions among adolescents, 1 education intervention reported smaller increase in BMI; 1 combined education and environment intervention reported effect in skinfolds for girls but no effect on BMI for either boys or girls, while another combined intervention showed smaller increase in BMI in girls at 2 yrs but no effect for boys	▪ Educational interventions had limited effect on diet and PA. Increase in nutrition and PA knowledge ▪ Combined education & environmental interventions showed limited effectiveness among adolescent females	**Heterogeneity:** ▪ Duration ▪ Follow-up ▪ Outcome measures

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Dobbins.M, DeCorby K., Robeson P, Husson H, Tirilis D. School-based PA programs for promoting PA and fitness in children and adolescents aged 6-18. Cochrane Database Syst Rev. 2009;(1):CD007651. (10) **Type:** Systematic Review	▪ To summarize the evidence of the effectiveness of school-based interventions in promoting PA and fitness in children and adolescents.	▪ **Age:** 6-18 ▪ **Location:** Australia, South America, Europe, North America ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** PA, Diet, and Combination ▪ **Number of Studies:** 26 but only 14 had an anthropometric outcome ▪ **Type of Studies:** RCTs ▪ **Quality of Studies:** Of 104, 4 were strong methodological quality, 22 were of moderate, and 78 were weak ▪ **Duration:** Varied ▪ **Follow-up:** For BMI, all studies post-intervention ▪ **Setting:** School (primarily); Home; Community ▪ **Activities:** Lifestyle (e.g., increasing PA during school); Modifications to the school curriculum (e.g., teacher PA training sessions, changes to the format of the school day); Environmental (e.g., modifications to cafeteria food; accessibility to exercise equipment); Classroom-based education of children; Community-based strategies; Audiovisual materials; Counselling and support groups; Parent education/engagement	▪ Out of 14 studies, 4 reported statistically significant positive effect in terms of smaller increase in BMI from baseline to follow-up for intervention vs. control group ▪ The 10 non-significant studies used similar combination of interventions implemented by similar combinations of providers for similar lengths of time ▪ Of the 4 effective studies, 2 had an intervention of 9 months, 1 study of 2 yrs, and another of 3 yrs. All 4 used community-based strategies (3), educational session (2), support groups, audiovisual materials, counselling ▪ Two studies were delivered by teachers only, 2 by multiple providers. One study included parents as providers, and another also used physicians, nurses and social workers	▪ There is good evidence that school-based PA interventions have a positive impact on: duration of PA, television viewing, VO2 max and blood cholesterol ▪ Although, generally, school-based interventions had no effect on leisure-time PA rates, systolic and diastolic blood pressure, body mass index and pulse rate ▪ At a minimum, a combination of printed educational materials and changes to the school curriculum that promote PA result in positive effects	**Adverse Effects:** ▪ *Stigmatization*: Can occur when unfit students must engage in rigorous PA in front of their peers ▪ *Clothing*: Having to change clothes to engage in PA may be stressful for overweight and obese students ▪ *'Forcing' PA*: Forcing students to engage in rigorous activity when they do not want to could produce the opposite effect or having very negative perceptions of PA. This may result in worse outcomes with respect to activity levels. ▪ *Grading*: A reward system such as grading, causes loss of the intrinsic motivation to engage in an activity that was previously viewed as fun ▪ *Injuries*: Soft-tissue injuries might occur among students associated with the increased rigorous PA.
D'Onise K, Lynch JW, Sawyer MG, McDermott RA. Can preschool improve child health outcomes? A systematic review. Soc Sci Med. 2010;70(9):1423-40 (11) **Type:** Systematic Review	▪ To examine the evidence for child health effects of centre-based preschool intervention programs for 4 year olds, beyond preschool years	▪ **Age:** Preschool age (3-4) children at risk of school failure (76% of study pops) ▪ **Ethnicity:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Multiple/not described (Head Start) ▪ **Number of Studies:** 37 ▪ **Type of Studies:** 2 cohort studies of 1 program ▪ **Quality of Studies:** Moderate risk bias ▪ **Duration:** 1 school yr ▪ **Follow-up:** 5 and 7 years ▪ **Settings:** Preschool, Health services, Family ▪ **Activities:** Head Start	▪ Two studies of moderate quality found beneficial effect of Head Start participation on measured overweight and obesity at ages 8-10 yr with higher quality	▪ Not analyzed	▪ Study looked at wide variety of interventions and thus there was little focus on weight. Only 1 intervention (Head Start) was studied although 2 studies were included

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Froschl B, Wirl C, Haas S. Overweight prevention in adolescents and children (behavioural and environmental prevention). GMS Health Technol Assess. 2009 [cited 2013 Jun 26];5(1-10). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3011287/pdf/HTA-05-05.pdf (12) **Type:** Systematic Review	▪ To determine the effectiveness and efficiency of behavioural and environmental interventions for the primary prevention of adiposity in children and adolescents	▪ **Age:** Not specified ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** PA, Diet and Combination ▪ **Number of Studies:** 10 studies (7 interventions and 19 reviews) ▪ **Type of Studies:** RCTs ▪ **Quality of Studies:** Not described ▪ **Duration:** > 1 yr ▪ **Follow-up:** Not described ▪ **Settings:** Schools ▪ **Activities:** Modification of school nutrition environment; Modification of school PA program; Classroom-based education of children; Parent education/engagement	▪ Of the 7 interventions, none showed evidence of effect in subgroups; 3 reported no change, and 4 reported an impact in mostly obese girls ▪ None showed an effect in boys of normal weight	▪ Not analyzed	**Limitations:** ▪ Socioeconomically disadvantaged groups are specifically under-represented. Study did not give sufficient information to discern which types of interventions are more effective ▪ Authors report a significant correlation between adiposity and socioeconomic deprivation, but few interventions target this population **Recommendations** ▪ To combine measures geared toward changing environmental and living conditions and toward specific population groups
Gerards SM, Sleddens EF, Dagnelie PC, de Vries NK, Kremers SP. Interventions addressing general parenting to prevent or treat childhood obesity. Int J Pediatr Obes. 2011;6(2-2):e28-45. (13) **Type:** Systematic Review	▪ To review effects of interventions which address general parenting in order to prevent or treat obesity in youth.	▪ **Age:** 0-18 ▪ **Ethnicity:** Unselected, except 1 study specific to North American Aboriginals ▪ **Gender:** Unselected ▪ **Weight:** 6 studies all children overweight or obese; 1 included normal weight children ▪ **SES:** Unselected	▪ **Target:** Parenting style, Diet and/or PA ▪ **Number of Studies:** 7 ▪ **Type of Studies:** 6 RCTs, 1 pre/post ▪ **Quality of Studies:** Not evaluated ▪ **Duration:** 9 weeks to monthly or annual follow-up ▪ **Follow-up:** End of intervention to 3 years ▪ **Settings:** Family ▪ **Activities:** Education of children; Education of parents; Combined education of children & parents	▪ All studies showed significant small to moderate effect size on weight loss, but 2 studies lacked appropriate control group.	▪ Four studies assessed lifestyle behaviours of physical activity, sedentary behaviour and/or nutrition, and all found at least 1 significant positive effect ▪ 4 studies that assessed general parenting described positive effect on parenting style	**Heterogeneity:** ▪ Methods ▪ Study quality ▪ Outcomes measures **Limitation:** ▪ Limited number of studies ▪ Self-reported outcomes

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Golley RK, Hendrie GA, Slater A, Corsini N. Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns - what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness? Obes Rev. 2011;12(2):114-130. (14) **Type:** Systematic Review	▪ To determine effectiveness of targeting food and activity behaviours using behaviour-change techniques employed in family-targeted interventions	▪ **Age:** 1-18 ▪ **Ethnicity:** Unselected except 1 study specific to African-Americans ▪ **Gender:** Unselected except 2 studies were girls only ▪ **Weight:** Unselected, except 3 studies were for overweight children ▪ **SES:** Unselected	▪ **Target:** Diet, PA and Combination with behaviour-change component ▪ **Number of Studies:** 17 ▪ **Type of Studies:** 16 controlled trials and 1 pre/post ▪ **Quality of Studies:** 2 strong, 10 moderate, 5 weak ▪ **Duration:** 5 visits to 12 months ▪ **Follow-up:** End of intervention to 3 years ▪ **Setting:** Family, Clinical/ research setting ▪ **Activities:** Education of children; Education of parents; Combined education of parents & children; Behaviour-change interventions	▪ Of 6 interventions with an obesity prevention focus, 3 reported beneficial anthropometric outcomes	▪ Various nutrition outcomes were measured, but 10 showed intervention effect while 3 showed no effect. 6 studies included a measure of physical activity; 1 reported significant change in activity level ▪ 4 studies used television viewing time as outcome, and none showed significant effect. Increases reported in parent nutrition knowledge and change in feeding practices	**Heterogeneity:** ▪ Types of interventions ▪ Populations ▪ Follow-up **Limitation:** ▪ Few studies had long follow-up periods
Gonzalez-Suarez C, Worley A, Grimmer-Somers K, Dones V. School-based interventions on childhood obesity: a meta-analysis. Am J Prev Med. 2009;37(5):418-427. (15) **Type:** Meta-Analysis	▪ To evaluate the effectiveness of school-based programs in the prevention and management of childhood obesity.	▪ **Age:** School-aged ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Not described	▪ **Target:** PA, Diet, Sedentary Behaviour, and Combination ▪ **Number of Studies:** 19 ▪ **Type of Studies:** RCTs and controlled trials ▪ **Quality of studies:** High methodological quality rating of >60%; studies of poor quality excluded ▪ **Duration:** <6 months to >2 yrs ▪ **Follow-up:** Not described ▪ **Setting:** School ▪ **Activities:** Classroom education on nutrition and PA; More vigorous activity in PE classes; Environmental change (foods in school); Parental education/ engagement	▪ Meta-analysis showed that the odds of participants' being overweight and obese in the school-based interventions compared with the control arm were significantly protective in the short term (OR=0.74, 95% CI=0.60, 0.92) ▪ Interventions that were conducted for more than 1 year had a higher OR of decreasing the prevalence of obesity ▪ However, interventions were not effective in decreasing BMI compared with control treatments, with a weighted mean difference of -0.62 (95% CI= -1.39, 0.14)	▪ Not analyzed	▪ Small number of papers and low power of individual papers means sub-group analyses may not be robust

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Hamel LM, Robbins LB, Wilbur J. Computer- and web-based interventions to increase preadolescent and adolescent physical activity: a systematic review. J Adv Nurs. 2011;67(2):251-268. (16) **Type:** Systematic Review	▪ To determine effectiveness of computer- or web-based interventions on increasing physical activity and improving PA-related health outcomes in pre-adolescents and adolescents.	▪ **Age:** 8-18 ▪ **Ethnicity:** Unselected, except 2 specific to African-American girls ▪ **Gender:** Unselected, except 1 male-only and 1 female-only ▪ **Weight:** Unselected, except 1 selected for overweight ▪ **SES:** Unselected	▪ **Target:** PA (8), Combination PA and Diet or other health outcome (6) ▪ **Number of Studies:** 14 ▪ **Type of Studies:** 7 RCTs, 5 quasi-experiment, 1 repeated measure, 1 pre/post-test ▪ **Quality of Studies:** 3 had focused research question, baseline comparability groups, considered confounding factors & minimized bias; 5 had power calculation and 1 post-hoc power calculation ▪ **Duration:** 1 months to 2 years ▪ **Follow-up:** End of intervention to 2 years ▪ **Settings:** Home, summer camp, scout troop or combination ▪ **Activities:** Education; Behaviour change; Delivery via web (8) or computer (6)	▪ Five studies reported anthropometric outcomes; 1 reported significant decrease in BMI, 1 among girls a significant decrease in mean body fat, and 1 significant reduction in BMI z-score for girls but not boys	▪ Seven studies reported significant increase in PA; another showed increase in light-intensity PA for girls but decrease for boys.	**Heterogeneity:** ▪ Study designs ▪ Samples ▪ Settings ▪ Hypotheses **Limitation:** ▪ Most studies had short follow-up periods; the study with the longest follow-up (2 yrs) reported both intervention and control groups regained all weight lost
Harris KC, Kuramoto LK, Schulzer M, Retallack JE. Effect of school-based PA interventions on body mass index in children: a meta-analysis. CMAJ. 2009 [cited 2013 Jun 26] ;180(7):719-726. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2659836/pdf/20090331s000 19p719.pdf (17) **Type:** Meta-analysis & Systematic Review	▪ To determine the effect of school-based PA interventions on the BMI of children	▪ **Age:** 5-18 (primarily grades 3-6) ▪ **Ethnicity:** 7 studies were primarily Caucasian population ▪ **Location:** US, Canada, Australia, Chile, Sweden ▪ **Gender:** 11 studies were both, 6 studies were girls only, and 1 study was boys only ▪ **Weight:** Unselected, except for 1 selected children	▪ **Target:** PA (3) and Combination (PA and Education or Family Involvement (15)) ▪ **Number of Studies:** ▪ **Systematic Review:** 23 articles and 18 studies ▪ **Meta-Analysis:** 15 studies ▪ **Type of Studies:** 13 RCTs; 5 Controlled trials ▪ **Quality of Studies:** Mostly good quality ▪ **Duration:** 6 months to 3 years ▪ **Follow-up:** Not described ▪ **Setting:** School ▪ **Activities:** School-based PA program to affect duration or frequency of PA; Classroom-based nutrition or health education; Parent education/ engagement	▪ Meta-Analysis 15 studies had no evidence of effect for school-based PA intervention (weighted mean difference in BMI for intervention group -0.05 kg/m2; 95% CI = -0.19, 0.10). No evidence of publication bias, and results remained non-significant when limited to only RCTs, studies that lasted > 1 yr, high-quality studies, studies with a co-intervention or gender	▪ Not analyzed	**Limitation:** ▪ Lack of assessment of adherence to study protocols, both at the school level and at the individual level ▪ Lack of objective assessment of the "dose" of PA achieved with such interventions

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
		with BMI>75 percentile, 1 study only obese children ▪ **SES:** Unselected				
Hesketh KD, Campbell KJ. Interventions to prevent obesity in 0-5 year olds: an updated systematic review of the literature. Obesity (Silver Spring). 2010;18(Suppl 1):S27-35. (18) **Type:** Systematic Review	▪ To assess effectiveness of interventions designed to prevent obesity, promote healthy eating, promote physical activity and/or reduce sedentary behaviours in 0-5 yr olds.	▪ **Age:** 0-5 ▪ **Location:** Half in US ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Half targeted disadvantaged children	▪ **Target:** Diet, PA & Combination ▪ **Number of Studies:** 23 ▪ **Type of Studies:** 7 RCTs, 6 clusters RCTs, 1 Pilot RCT, 5 non-RCTs, 3 Controlled Trials, 1 Pre-Post ▪ **Quality of studies:** Not described ▪ **Duration:** 2 days to 3 years ▪ **Follow-up:** 6 months to 7 years ▪ **Setting:** 9 Preschool/ Child care, 8 Home, 2 Primary Care, 2 Mixed Setting, 2 Group Setting ▪ **Activities:** Education; Lifestyle (e.g., exercise programs)	▪ Five of 9 preschool-based studies reported anthropometric outcomes, and none showed an effect ▪ None of the home, group, primary care or mixed-settings studies collected anthropometric data.	▪ Not analyzed	▪ Interventions that showed evidence of success were designed to impact not only on knowledge but also on skills and competencies suggesting a social behavioural theory underpinning ▪ Because of heterogeneity, could not pool data.
Ickes MJ, Sharm M. A review of childhood obesity prevention interventions targeting African American children. Vulnerable Child Youth Stud. 2011;6(1):103-123. (19) **Type:** Literature Review	▪ To review childhood obesity prevention interventions targeting African-American children and adolescents published between 2005 and 2010.	▪ **Age:** 5-17 yrs; 6 elementary age, 7 adolescents, 4 combination of ages ▪ **Ethnicity:** >35% African-American ▪ **Gender:** 5 gender-specific ▪ **Weight:** Of 18 studies, 7 targeted overweight & obese participants, of which 2 were specifically obese ▪ **SES:** 3 studies targeted lower-middle and	▪ **Target:** PA, Diet and Combination ▪ **Number of Studies:** 18 ▪ **Type of Studies:** 4 RCTs, 5 randomized, 3 experimental, 2 not described, 1 each of controlled prospective non-randomized, secondary data analysis, single group repeated measures and pre/ post-test ▪ **Quality of Studies:** Not described ▪ **Duration:** 10-days to 2.5 yrs (5>1 yr) ▪ **Follow-up:** Most did not report ▪ **Setting:** After-school program (6), home (4, 2 in combination with Internet program), community (4), health care/ medical setting (2), individual therapy (1)	▪ Of 11 prevention studies that did not select by weight, 5 did not report anthropometric outcomes ▪ Of 6 remaining studies, 5 reported positive effect on >1 weight measure (2 elementary-aged children, 2 adolescents); 1) LIFESTEPS program among 13-17 yr olds reported significant difference in weight & BMI. 2) FitKids program among 3rd-graded (PA and diet). In 1 after-school program, effect was more pronounced in overweight/obese participants (p<.001) ▪ Of 5 studies among	▪ Positive nutrition benefits in programs conducted among groups unselected by weight included increase in fruit and vegetable consumption (reported by 3 studies), decrease in snack/dessert consumption and among overweight and obese, decrease in calories from high-fat foods ▪ 1 study reported increase in PA. In studies conducted among overweight and obese (but not solely obese) children, 1 study reported reduction in dietary fat consumption and increase in PA self-efficacy and 1 increase in steps measured by pedometers	▪ Heterogeneity in interventions. Family involvement and higher utilization of inter-based program associated with more positive outcomes

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
		lower SES or at-risk children	▪ **Activities:** Education of children, parents, and combined children and parents; After-school or school-based physical activity Internet-based programs; Parental engagement (3)	overweight participants 4 reported some weight benefits; 1 study had yet to report results		
Kanekar A, Sharma M. Meta-analysis of school-based childhood obesity interventions in the UK and US. Int Q Community Health Educ. 2008;29(3):241-56. (20) **Type:** Meta-Analysis	▪ Meta-analysis of school-based childhood obesity interventions in UK and US.	▪ **Age:** School-age ▪ **Location:** US, UK ▪ **Ethnicity:** Diverse ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** PA (1), Nutrition (1) and Combination (3) ▪ **Number of Studies:** 5 ▪ **Type of Studies:** Not described ▪ **Quality of Studies:** Not described ▪ **Duration:** 3 months to 3 years ▪ **Follow-up:** 4 weeks to annual ▪ **Setting:** School ▪ **Activities:** Classroom-based education of children; Modification of school nutrition environment; Parent education/ engagement; After-school PA	▪ Pooled estimate showed no evidence of effect on outcome measures of BMI at p<.05 for both fixed effect (-0.0649, CI -0.29, 0.16) or random effect (0.129, CI -0.38, 0.72)	▪ Not analyzed	
Katz DL. School-based interventions for health promotion and weight control: not just waiting on the world to change. Annu Rev Public Health. 2009;30:253-272. (56) **Type:** Literature review reporting results of a meta-analysis	▪ To examine the evidence on school-based interventions in influencing obesity.	▪ **Age:** 3-18 Location: US and other ▪ **Ethnicity**: Unselected ▪ **Gender:** Unselected, except 1 study was girls only ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** PA, Diet, TV viewing or Combination ▪ **Number of Studies:** 13 out of 21 articles (with 19 studies) were prevention ▪ **Type of Studies:** 14 RCTs; 5 non-RCTs ▪ **Quality of Studies:** Poor methodological studies were excluded ▪ **Duration:** Not described ▪ **Follow-up:** At least 6 months ▪ **Settings:** Schools: 13 in elementary, 3 in middle schools, 3 in high school ▪ **Activities:** All studies incorporated multiple strategies - Parent education/ engagement; Environment modification in school (e.g., provision of new PE equipment); Classroom-based education of children on	▪ Meta-Analysis Combination interventions, single nutrition and TV reduction significantly reduced body weight in children, with pooled standardized mean difference of -.029 (95% CI -0.45, -0.14) ▪ When looking at only studies with a parent/ family component, magnitude of the SMD decreased (-.016, 95% CI =0.32, 0.0) ▪ No difference between effect of TV reduction intervention (-0.35, 95% CI -0.63, -0. 06), nutrition-only intervention (-0.39, 95% CI -0.56, -0.23)	▪ Not analyzed	▪ Schools may be part of the solution but cannot, in isolation, reverse societal health trends

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
			nutrition/PA; Skill-building activities for children; Modification to duration, frequency or intensity of PE activities	or combination interventions (-0.29, 95% CI -0.45, -0.14) ▪ PA studies showed significantly better weight reduction in girls (-0.38, 95% CI -0.74, -0.02) than boys (0.14, 95% CI -0.17, 0.44) ▪ Compared to PA interventions, combined interventions had no significant effect among girls (-.053, 95% CI -1.37, 0.30 vs. -0.38, 95% CI -0.74, -0.02) ▪ Among boys, combined interventions had effect (-0.22, 95% CI -0.32, -0.12) but physical activities did not (0.14, 95% CI -0.17, 0.44)		
Kesten JM, Griffiths PL, Cameron N. A systematic review to determine the effectiveness of interventions designed to prevent overweight and obesity in pre-adolescent girls. Obes Rev. 2011;12(12):997-1021. (22) **Type:** Systematic Review	▪ To determine the effectiveness of interventions designed to prevent overweight and obesity in pre-adolescent girls.	▪ **Age:** 7-11 yrs ▪ **Ethnicity:** Diverse ▪ **Gender:** Girls only ▪ **Weight status:** Unselected ▪ **SES:** Unselected	▪ **Target:** Combination diet and PA ▪ **Number of Studies:** 30 ▪ **Type of Studies:** 4 cluster RCTs, 14 RCTs, 11 controlled trials, 1 cohort pre/post ▪ **Quality of studies:** 4 weak, 11 moderate, 15 strong ▪ **Duration:** > 12 weeks ▪ **Follow-up:** 11<12 mos; 19 >12 mos ▪ **Settings:** School, Family, Community ▪ **Activities:** Classroom-based education; Parental education/ engagement; Modification of school environment	▪ Of 30 studies, 5 long-term and 3 short-term studies reported significant effect on BMI ▪ Effective interventions associated with reducing sedentary behaviour, modifying school food environment and adapting materials to be culturally appropriate	▪ In 12 of 17 studies reported on PA, significant improvements were reported. In 2 studies, time spent in screen behaviour was reduced ▪ Of 23 studies reporting nutrition outcomes, 7 reported significant benefits	▪ Heterogeneity in interventions and outcomes measures, limiting the ability to pool data. No information given on how to adapt materials for girls, particularly in minority populations; no information on cost or cost-effectiveness

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Kitzman-Ulrich H, Wilson DK, St. George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clin Child Fam Psychol Rev. 2010 [cited 2013 Jun 26];13(3):231-53. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3293190/pdf/nihms357806.pdf (23) **Type:** Systematic Review	▪ To provide a family systems theory framework for evaluating family-level variables in weight loss, physical activity and dietary approaches in youth.	▪ **Age:** Elementary to late adolescence (not specified) ▪ **Ethnicity:** Mostly Caucasian families ▪ **Gender:** Unselected ▪ **Weight:** Unselected	▪ **Target:** Diet, PA & Combination ▪ **Number of Studies:** 25 out of 46 studies were prevention ▪ **Type of Studies:** 19 RCTs ▪ **Quality of Studies:** Not described ▪ **Duration:** 4 sessions to 16 weeks, some with 6-month follow-up ▪ **Follow-up:** End of intervention to 6 months. ▪ **Setting:** Family, School, Community ▪ **Activities:** Education; Parenting style & skills; child management skill; family functioning; Family Activities	▪ Of 16 studies conducted in school setting that included a family component, 3 demonstrated reduction in BMI	**Physical activity and/or nutrition**: ▪ 16 studies conducted in school setting that included a family component reported positive nutrition or physical activity knowledge and/or behaviour benefits	**Limitation:** ▪ Limited information on ethnic minority families; majority of studies conducted with Caucasian families ▪ None of studies reviewed included components to target parenting style, child management or family functioning.
Larson N, Ward DS, Neelon SB, Story M. What role can child-care settings play in obesity prevention? A review of the evidence and call for research efforts. J Am Diet Assoc. 2011;111(9):1343-1362. (24) **Type:** Literature Review	▪ To study the effect of state regulations, practices, policies & interventions for promoting healthy eating & physical activity and prevention obesity in preschool-aged children in child-care.	▪ **Age:** 2-5 ▪ **Location:** U.S. ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Diet (4), PA (7) and Combination (7) ▪ **Number of Studies:** 18 ▪ **Type of Studies:** Observational studies ▪ **Quality of studies:** Not described ▪ **Duration:** Not described ▪ **Follow-up:** Not described ▪ **Setting:** Preschool/Child care ▪ **Activities:** State regulation; Education of children (classroom-based); Education/ engagement of parents; Environmental modification	▪ Five of 18 interventions looked at weight status, 2 of which showed evidence of reducing risk factors for obesity ▪ Effective interventions tended to include multiple components to address nutrition, physical activity and sedentary behaviours	▪ Four interventions evaluated dietary behaviours, and all found positive effect for > 1 measure. 10 interventions assessed physical activity or sedentary activity and 7 reported positive effects ▪ Effective interventions tended to include 1 or more of: integrating additional opportunities for activity into classroom curriculum, modifying food-service practices, providing classroom-based nutrition education and engaging parents through education newsletters or activities	▪ Four interventions evaluated influence of interventions on child-care practices and policy, and all found evidence of a positive effect. Results are encouraging but need to determine whether interventions studied in small settings can be generalized and the feasibility of institutionalizing programs over long term

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Lytle LA, Hearst MO. Examining the state of the science of prevention of childhood obesity. Curr Nutr Food Sci. 2009;5(2):134-48. (25) **Type:** Review of Reviews	▪ To examine and critique recently publish review articles on childhood obesity prevention.	▪ **Age:** 0-18 ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** PA, Diet and Combination ▪ **Number of Studies:** 9 reviews ▪ **Type of Studies:** Mostly RCTs, controlled trials and pre/post assessments ▪ **Quality of Studies:** 5 of 9 reviews had serious design flaws ▪ **Duration:** 2 months to 3 years ▪ **Follow-up:** End of intervention to 2 years ▪ **Setting:** School ▪ **Activities:** Increasing PA in PE classes; Modification to school nutrition environment; Classroom-based education of children; Parental education/ engagement	▪ Majority of articles reported no statistically significant differences between control and intervention conditions on anthropometric outcomes	▪ No evidence of effect for most evaluations of levels of PA; a few reports of treatment effect on selected dietary variables	▪ Most articles confirmed there is limited evidence to suggest effective strategies to prevent overweight/ obesity in youth
Mayer K. Childhood obesity prevention: focusing on the community food environment. Fam Community Health. 2009;32(3):257-270. (26) **Type:** Literature Review	▪ To describe evidence concerning environmental nutrition interventions on childhood obesity prevention.	▪ **Age:** Preschool to university ▪ **Location:** U.S., Canada, Europe ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Diet ▪ **Number of Studies:** 12 ▪ **Type of Studies:** 9 RCTs, 3 pre/post ▪ **Quality of studies:** Not described ▪ **Duration:** 28 days to 3 years ▪ **Follow-up:** 13 days to 3 years ▪ **Setting:** Schools (8), home (1), child-care centre (1), university (1), combined school, home and community (1) ▪ **Activities:** Environment modification of nutrition in school; Environment modification of PA in school; Education of children; Education/engagement of parents; Environment modification in the community (e.g., cost, quality and accessibility of food)	▪ Only 4 studies reported anthropometric outcomes, of which 2 reported significant decrease in BMI and 1 reported a decrease in waist-hip ratio	▪ Ten studies reported greater than 1 nutrition or drink outcome measure (most self-reported) of which 9 reported beneficial effect ▪ Effects were small and outcome measures diverse ▪ One study reported increase in light PA in boys ($p<.001$) but not for girls ▪ Changing the food environment by increasing food convenience, decreasing food cost and/or increasing food quality, contributed to positive physical and nutritional outcomes at the community level	**Heterogeneity:** ▪ Measures used

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Monasta L, Batty GD, Macaluso A, Ronfani L, Lutje V, Bavcar A, et al. Interventions for the prevention of overweight and obesity in children under 5 years of age. Obes Rev. 2011;12(5):e107-18. (27) **Type:** Systematic Review	▪ To analyze interventions for the prevention of overweight and obesity in children under 5 years of age.	▪ **Age:** <5 yrs ▪ **Ethnicity:** Diverse; 3 in Europe, 1 in Asia, 1 specific to North American Aboriginal ▪ **Gender:** Both ▪ **Weight:** Only 1 study selected overweight ▪ **SES:** Not described	▪ **Target:** Breastfeeding, PA ▪ **Number of Studies:** 7 ▪ **Type of Studies:** 7 RCTs (described in 17 papers) ▪ **Quality of Studies:** Evaluated but results not given ▪ **Duration:** 10 weeks to 13 years; 5 were 10-30 weeks, 1 12-16 months, and 1 13 years ▪ **Follow-up:** End of intervention to 13 years ▪ **Setting:** Preschool, Family, Hospital ▪ **Activities:** Education of children; Education of parents (including breastfeeding); Combined child and parent education; Behaviour-change counselling; child care-based physical activity/exercise program	▪ Breastfeeding program showed no effect on anthropometric measures of children at 6.5 yrs. Of other 6 interventions, only 1 (Hip-Hop Jr) showed effect and only among African-American (but not Latino) sites	▪ One study reduced television viewing, but none increased physical activity ▪ 2 studies reported nutrition outcomes, and 1 showed significant effect (STRIP) and 1 trends but no significant effect (Harvey-Berino study among Aboriginal mother/child dyads)	▪ Results limited by study design flaws and choice of outcome measures (e.g., BMI may not be appropriate measure for children <5) ▪ More rigorous research on social and environmental determinants in early years needed
Nguyen B, Kornman KP, Baur LA. A review of electronic interventions for prevention and treatment of overweight and obesity in young people. Obes Rev. 2011;12(5):e298-314. (49) **Type:** Systematic Review	▪ To determine the effectiveness of interactive electronic media to prevent or treat obesity and/ or obesity-related behaviours in children & adolescents.	▪ **Age:** 0-18 ▪ **Ethnicity:** Multi-racial American settings, 2 European and 1 Taiwan study ▪ **Gender:** Unselected except 2 studies were girls only ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Combination Diet and PA ▪ **Number of Studies:** 15 ▪ **Type of Studies:** 3 in children (2 RCTs, 1 pre/post) and 12 in adolescents (5 RCTs, 3 non-randomized controlled, 3 quasi-experimental, 1 feasibility) ▪ **Quality of Studies:** Average study design quality score 45% ▪ **Duration:** 2 weeks to 2 years ▪ **Follow-up:** End of intervention to 2 yrs ▪ **Setting:** School, Home, Community (Scout troop) ▪ **Activities:** Education of children, Delivered by computer	▪ Of 3 studies in children 1 school-based intervention reported significant reduction for BMI z-score and % body fat at end of intervention ▪ Of 12 studies in adolescents, 3 school-based interventions reported significant reductions in BMI and 2 in BMI z-score	▪ Of 3 studies in children, 2 showed some benefit for PA and 1 for nutrition ▪ Among 12 studies in adolescents, 4 showed some benefit for physical activity and 1 for nutrition (fruit/vegetable consumptions)	▪ One school- and home-based intervention on risk of eating disorder or being overweight reported over half of at-risk participants chose to receive recommended targeted curricula and showed significant improvement in weight and shape concerns ▪ 1 school- and home-based intervention on risk of eating disorder or being overweight reported over half of at-risk participants chose to receive recommended targeted curricula and showed significant improvement in weight and shape concerns

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Reichert FF, Baptista Menezes AM, Wells JC, Carvalho Dumith S, Hallal PC. PA as a predictor of adolescent body fatness: a systematic review. Sports Med 2009;39(4):279-294. (29) **Type:** Systematic Review	▪ To systematically review the literature on the effect of PA, specifically motion aspect, on subsequent levels of adiposity in adolescents.	▪ **Age:** 6-19 ▪ **Location:** US, Europe, Israel, Singapore, Canada, UK ▪ **Gender:** Unselected, except 3 studies were girls only ▪ **Weight:** Unselected, except 9 studies on overweight or obese children ▪ **SES:** Unselected	▪ **Target:** PA, Diet and Combination ▪ **Number of Studies:** 24 ▪ **Type of Studies:** 13 observational, 5 experimental and 6 quasi-experimental ▪ **Quality of Studies:** 16.4 (2.1) out of 24 for observational studies, 17.2 (2.7) out of 28 for experimental studies ▪ **Duration:** Not described ▪ **Follow-up:** 3 months to 9 years ▪ **Setting:** Schools, Family ▪ **Activities:** School-based physical activity interventions, Family-based, multi-component programs, Nutrition education/ intervention, Parental education/ engagement	▪ Only 2 of 11 experimental & quasi-experimental studies were among general population ▪ Of these 2, 1 study showed effect in girls but not boys, and another reported exercise group had smaller gains in skinfold thickness than control group ▪ All 13 observational studies were conducted among general population ▪ Of these 11 reported negative relationships between PA and body weight indicator and 2 had no relationship	▪ Not analyzed	
Roseman MG, Riddell MC, Haynes JN. A content analysis of kindergarten-12th grade school-based nutrition interventions: taking advantage of past learning. J Nutr Educ Behav. 2011;43(1):2-18. (30) **Type:** Literature Review	▪ To determine the extent to which school-based nutrition interventions incorporate the 10 proposed recommendations for school-based interventions based on 12 prior content analyses	▪ **Age:** 4-17 yrs ▪ **Ethnicity:** Diverse, 3 studies specific to African-Americans and 1 to North American Aboriginal ▪ **Gender:** Both ▪ **Weight status:** Most unselected except Aboriginal study ▪ **SES:** Not described	▪ **Target:** Diet ▪ **Number of Studies:** 26 ▪ **Type of Studies:** 17 RCTs, 24 controlled, 4 matched pairs; 17 elementary, 6 middle, and 3 secondary schools ▪ **Quality of studies:** Not evaluated ▪ **Duration:** 5 wks to 3 yrs; 42% >6 mos ▪ **Follow-up:** End of intervention ▪ **Settings:** School, Combined school and family ▪ **Activities:** Education of children, Behaviour-change interventions, Combination of education and behaviour-change interventions (85% of interventions), Education/ engagement of parents, Environmental modification (school food service; student/ family incentive)	▪ Anthropometric outcomes given for only 4/7 studies that reported them; 3 found significant effects for school-based programs	▪ 3 studies showed improvements in PA and most for at least one indicator of diet (fruit/ vegetable consumption, calcium-rich food consumption).	▪ Study suggests that many of the recommendations for obesity prevention are underutilized (e.g., only 15% of interventions included community involvement) ▪ Aim of the study was to provide guidance on the components needed for school-based interventions, but it is not clear if findings are generalizable to the Canadian setting and may need to look at more recent studies for multimedia interventions

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Safron M, Cislak A, Gaspar T, Luszczynska A. Effects of school-based interventions targeting obesity-related behaviours and body weight change: A systematic umbrella review. Behav Med. 2011;37(1):15-25. (31) **Type:** Review of Reviews	▪ To examine Effectiveness of school-based interventions in changing weight-related behaviours, as well as moderating or mediating effects	▪ **Age:** 5-19 ▪ **Location:** US, EU ▪ **Ethnicity:** Diverse ▪ **Gender:** Unselected but some separate results given ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Diet, PA & Combination ▪ **Number of Studies:** 17 Systematic Reviews = 196 Studies ▪ **Type of Studies:** RCTs, cluster RCTs, quasi-experimental, non-RCTs (5 of which included meta-analysis) ▪ **Quality of Studies:** Minimal to moderate flaws ▪ **Duration:** 2 to 36 months ▪ **Follow-up:** Rare ▪ **Setting:** School, Combined school & family ▪ **Activities:** Education (e.g., school curriculum), environment, behaviour modification	▪ For BMI, 35.7% of interventions were effective, 35.6% reported reduction of obesity or overweight prevalence, 27.3% reduction of other anthropometric indices (skinfold thickness, waist-hip ratio, body fat)	▪ 57.3% shows increase in PA or reduction of sedentary behaviour ▪ 96% showed some improvement in dietary outcome	**Factors of Successful Interventions:** ▪ Gender: greater effect on girls compared to boys ▪ Age: greater effect on children rather than adolescents ▪ Multi-component ▪ Parental involvement ▪ Longer duration (lasted at least 3 months)
Seo DC, Sa J. A meta-analysis of obesity interventions among U.S. minority children. J Adolesc Health. 2010; 46(4):309-323. (32) **Type:** Meta-Analysis	▪ To determine which intervention components/ strategies are most efficacious in reducing body anthropometric outcome among multi-ethnic & minority U.S. children & adolescents	▪ **Age:** 6-19 ▪ **Location:** US ▪ **Ethnicity:** Selected so >20% minority population ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Combination Diet, PA & Parental Involvement ▪ **Number of Studies:** 40 ▪ **Type of Studies:** 31 RCTs, 7 Pre-Post, 1 Quasi-experimental, 1 Non-RTC ▪ **Quality of Studies:** 21 Highest (5/5), 8 High (4/5), 6 Moderate (3/5), 5 Low (2/5) ▪ **Duration:** 1.25 to 24 months ▪ **Follow-up:** Not described ▪ **Setting:** 16 Clinic, 12 School, 7 Community, 5 Family ▪ **Activities:** Education, lifestyle change strategies, counselling	▪ BMI or BMI z-score used a as outcome measure for all studies ▪ Despite exceptions among non-control trials, 1- and 2-component programs demonstrated limited effect ▪ Of 3-component interventions, 10 were controlled trials and produced mean effect size of d=.33 ▪ Number of components appears to have greater impact upon effect size than program duration ▪ Interventions with parental involvement and lifestyle interventions showed a higher mean effect size than those without; culturally tailored interventions had larger effect size than those without ▪ Among uncontrolled trials, 2-component	▪ Not analyzed	**Factors of Success:** ▪ Interventions addressing more components had larger effect size than those with only 1-2 components **Heterogeneity** ▪ Populations

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
				interventions had d=.86 and 3-component intervention d=.96. Of 12 school-based interventions, only 3 showed decrease in z-BMI or BMI (less efficacious than clinic-, community- or family-based interventions)		
Standiford Brown A. Promoting PA amongst adolescent girls. Issues Compr Pediatr Nurs. 2009; 32(2):49-64. (33) **Type:** Literature Review	▪ To examine recent studies investigating physical activity interventions designed specifically for adolescent girls and makes recommendation for future research and practice.	▪ **Age:** 9-19, primarily 12-17 ▪ **Ethnicity:** Unselected, except 1 study on African-Americans ▪ **Gender:** Girls only ▪ **Weight:** Unselected, except 8 targeted obese, urban or sedentary girls ▪ **SES:** Unselected	▪ **Target:** PA ▪ **Number of Studies:** 14 ▪ **Type of Studies:** Quantitative experimental or quasi-experimental ▪ **Quality of Studies:** Not described ▪ **Duration:** 5 weeks to 8 months ▪ **Follow-up:** Not described ▪ **Setting:** School (12), Church (1), Home and Community (1) ▪ **Activities:** Modified PE curriculum Education	▪ Of 14 studies, only 2 reported decrease in mean body fat % (p>.05)	▪ Only 3 of 14 interventions increased PA, 2 studies reported increased muscle mass, endurance or aerobic capacity although they did not report increase in PA	**Limitations:** ▪ Few interventions address the unique needs of adolescent girls
Stevens CJ. Obesity prevention interventions for middle school-age children of ethnic minority: a review of the literature. J Spec Pediatr Nurs. 2010;15(3):233-243. (34) **Type:** Literature Review	▪ To determine the ability of multi-component (programs that include both diet and physical activity) programs to prevent obesity among children 10-14 and which may be appropriate for use with ethnic children.	▪ **Age:** 10-14 ▪ **Location:** US, Australia, Belgium, Chile ▪ **Ethnicity:** Unselected ▪ **Gender:** 1 study African-American mother/ daughter dyads ▪ **Weight:** Unselected ▪ **SES:** 1 study specific to disadvantaged populations	▪ **Target:** Combined Diet & PA ▪ **Number of Studies:** 8 ▪ **Type of Studies:** 5 RCTs, 2 Pre-post, 1 Quasi-experimental, 1 Longitudinal ▪ **Quality of Studies:** Not described ▪ **Duration:** 8 weeks to 2 year ▪ **Follow-up:** Not described ▪ **Settings:** School, Family, Clinic, Computer-based ▪ **Activities:** Education (e.g., health curricula), personal factors (e.g., knowledge, self-esteem and motivation), behavioural strategies (e.g., goal-setting, problem-solving and stimulus control), environmental (e.g., neighbourhood, built environment)	▪ Two of 4 school-based programs reported anthropometric benefit ▪ One study reported a short-term decrease in obesity among girls, although no decrease among boys (African-American girls had largest decrease, although Hispanic not significant) ▪ One longitudinal study in Chile showed improvement for boys but no change for girls ▪ No evidence of benefit for clinic and community centre studies.	▪ In 2 school-based studies and in clinic-based study, increase in PA reported ▪ Improvements report by 4 school-based studies, as well as clinic-based studies in nutrition.	**Factors of Successful Interventions:** ▪ Multiple components, personal factors including gender (girls respond more), nutrition education in the health curriculum, behavioural strategies, limited to studies, clinic and community studies had small samples (n=117 and 65 pairs) **Other Comments:** ▪ Only 1 study commented on neighbourhood safety or built environment issues ▪ Heterogeneity ▪ Settings

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Van Cauwenberghe E, Maes L, Spittaels H, van Lenthe FJ, Brug J, Oppert JM, et al. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. Br J Nutr. 2010;103(6):781-797. (35) **Type:** Systematic Review	▪ To summarize the existing European published and 'grey' literature on the effectiveness of school-based interventions to promote a healthy diet in children (6–12 years old) and adolescents (13–18 years old).	▪ **Age:** 6-18 ▪ **Location:** EU ▪ **Ethnicity:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Diet only ▪ **Number of Studies:** 42 ▪ **Type of Studies:** RCTs, Observational, Experimental ▪ **Quality of studies:** 5 strong, 28 moderate, 29 weak ▪ **Duration:** 1 week - 5 years ▪ **Follow-up:** 0-5 years ▪ **Setting:** School ▪ **Activities:** Educational (e.g. classroom-based activities), environmental modifications, multi-component interventions (e.g., school-wide nutrition policy, incentives, screening & feedback, teacher involvement, peer leader involvement, family involvement, school staff involvement and/or community involvement)	**Children:** ▪ Of 4 studies that reported on anthropometric effects, 1 reported no effect, 1 improvement and 1 deterioration of BMI and prevalence of overweight/obesity, and 1 different effects according to definition of overweight/ obesity and by sex and age ▪ Of 7 school fruit and vegetables schemes targeting obesity reduction, only one study had positive impact on BMI ▪ Limited evidence of effect was found for nutrition education-only programs or programs that only focused on environmental change **Adolescents:** ▪ Inconclusive evidence of effect was found on anthropometrics (e.g., 1 educational and 1 multi-component) both produced inconclusive findings	**Children:** ▪ Strong evidence that multi-component interventions that combine improved availability of fruit and vegetables with a nutrition education curriculum delivered by the teacher and at least some parent involvement can alter intake of fruit and vegetables ▪ Limited evidence of effect for educational interventions on behaviour and for environmental interventions on fruit and vegetable intakes ▪ Inconclusive evidence of effect on dietary behaviour for environmental initiatives that targeted breakfast habit or studies targeting children from low socioeconomic backgrounds or ethnic minority groups **Adolescents:** ▪ Limited evidence of effect for multi-component programs on dietary behaviour ▪ Environmental part of multi-component trials consisted of adapting or increasing availability of healthy food ▪ Over half of the interventions had a parental component, which appeared to help improve dietary behaviour	▪ Evidence for effectiveness on anthropometrical obesity-related measures is lacking. Outcomes were dietary behaviour or on anthropometrics ▪ Consensus on best measures for diets ▪ Measures only food intake at school ▪ Short follow-up ▪ Did not include physical activity ▪ Included grey literature

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Wahi G, Parkin PC, Beyene J, Uleryk EM, Birken CS. Effectiveness of interventions aimed at reducing screen time in children: a systematic review and meta-analysis of randomized controlled trials. Arch Pediatr Adolesc Med. 2011; 165(11):979-986. (36) **Type:** Meta-Analysis and Systematic Review	▪ To evaluated the impact of interventions to reduce screen time in children <18 yrs.	▪ **Age:** <18 ▪ **Location:** US, UK, NZ ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Screen time (sedentary behaviour) ▪ **Number and Type of Studies:** Meta-analysis: 6 RCTs; Systematic review: 13 RCTs (5 cluster & 8 parallel-group) ▪ **Quality of Studies:** For meta-analysis, quality of evidence concerning BMI was graded as low; for screen time, very low. ▪ **Duration:** 1 to 24 months ▪ **Follow-up:** Not described ▪ **Setting:** Schools (5), Family (7), Clinic (1) ▪ **Activities:** Classroom-based education, parental engagement/ counselling, automated monitor controlling screen time	▪ In meta-analysis, pooled mean change in BMI was -0.10 (0.28 to 0.09) ▪ Eleven of 13 studies included in systematic review had anthropometric outcomes: 2 classroom-based interventions and 1 individual counselling showed effect ▪ No effect for any of the 3 interventions involving automated monitors to control screen time or the clinic-based program	▪ In meta-analysis, pooled mean change in screen time was -0.90 (95% CI -3.47 to 1.66) ▪ In the systematic review, 9 studies showed small but insignificant decrease in screen time favouring the intervention group, but there was high heterogeneity and more effect among preschool (2 trials) than older children)	▪ No support for the hypothesis that reducing screen time has a beneficial impact upon weight ▪ Only 3 trials commented on the potential adverse effects of weight-focused interventions among children (body shape dissatisfaction and extreme dieting).
Waters E, de Silva-Sanigorski A, Hall BJ, Brown T, Campbell KJ, Gao Y, et al. Interventions for preventing obesity in children. Cochrane Database Syst Rev. 2011;(12):CD001871. (37) **Type:** Meta-Analysis and Systematic Review	▪ To update a previous Cochrane review of effectiveness of interventions that focus on diet, physical activity and/ or lifestyle support in order to prevent obesity/further weight gain in children. ▪ To identify the characteristics of the interventions that is related to the reported outcomes.	▪ **Age:** 0-18 ▪ **Ethnicity:** Unselected (50 of 55 studies set in high-income countries) ▪ **Gender:** Unselected ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** Diet and Combination of Diet and PA ▪ **Number and Type of Studies:** 37 trials for meta-analysis and total of 55 controlled trials for systematic review (controlled with or without randomization) ▪ **Quality of Studies:** 30 studies had high risk of bias for one or more rated domains ▪ **Duration:** >12 weeks, most <12 months ▪ **Follow-up:** End of intervention to 12 mos. ▪ **Settings:** School, Family, Community or Combination ▪ **Activities:** Education of children Environmental modification Behavioural or socioecological interventions	▪ In the meta-analysis, children in the intervention group had a decrease in standardized mean BMI of zBMI of -0.15 kg/m2 (95% CI -0.21 to -0.09) ▪ Intervention effects on BMI by age subgroups were: 0-5 yrs -0.26 kg/m2 (-0.53 to 0.00), 6-12 yrs -0.15 kg/m2 (-0.23 to -0.08) and 13-18 yrs -0.09 kg/m2 (-0.20 to 0.03) ▪ Summary also given of 55 individual studies by age group ▪ Majority of studies, and strongest evidence of effectiveness was for 6-12 yr age group; interventions were predominantly based on behaviour change theories and implemented in schools	▪ Not analyzed	▪ High level of heterogeneity in effects, which could not be explained by randomization status or type, duration or intervention setting ▪ Few studies reported post-intervention follow-up or discussed equity implications ▪ 8 studies looked for adverse effects, and none found any increase in unhealthy dieting practice or prevalence of underweight or body image sensitivities ▪ Components that appeared to contribute most to beneficial effects included: 1) school curriculum that includes healthy eating, physical activity and body image, 2) increased school

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
				▪ Promising findings for 0-5 yr-olds for interventions conducted in home or health care setting		sessions for physical activity and the development of movement skills, 3) modifying environment and cultural practice to support healthy eating and being active, 4) support for teachers and staff in implementing health promotion programs, 5) parent support and home activities that encourage children to be more active, eat more nutritious foods and spend less screen time
Wilks DC, Besson H, Lindroos AK, Ekelund U. Objectively measured physical activity and obesity prevention in children, adolescents and adults: a systematic review of prospective studies. Obes Rev. 2011;12(5):e119-29. (38) **Type:** Systematic Review	▪ To determine whether higher levels of baseline PA prevent excess gain in fat mass.	▪ **Age:** 3-19 ▪ **Ethnicity:** Unselected, except 1 restricted to African-American girls and 1 to Hispanic families and 1 to North American Aboriginal mother/child dyads ▪ **Gender:** Unselected, except 1 restricted to African-American girls ▪ **Weight:** Unselected ▪ **SES:** Unselected	▪ **Target:** PA ▪ **Number and Type of Studies:** 4 interventions (excludes 10 observational studies) ▪ **Quality of Studies:** Not described ▪ **Duration:** 6 months to 2 years ▪ **Follow-up:** End of intervention (6 months to 2 years) ▪ **Setting:** Preschool, Community, Home, Schools ▪ **Activities:** Classroom-based education for children; School- or preschool-based physical activity intervention; Community-based physical activity session/lesson; Parent education/engagement; Combination of exercise sessions and parental education/engagement	▪ Three of 4 studies reported no effect on BMI ▪ Of the 10 observational studies, 5 reported no relationship between physical activities and weight measures, 4 a positive relationship and 1 mixed findings	▪ Of 4 interventional studies, only community- and school-based program focusing on non-curricular activities showed effect on activity	

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
Wilson DK. New perspectives on health disparities and obesity interventions in youth. J Pediatr Psychol. 2009 [cited 2013 Jun 26];34(3):231-44. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2722129/pdf/jsn137.pdf (39) **Type:** Literature Review	▪ To review interventions that address health disparities and the increasing rate of obesity in minority youth ▪ The review focuses on interventions that target obesity-related behaviours (diet, physical activity, sedentary behaviours) and adiposity outcomes (body mass index) in minority children and adolescents	▪ **Age:** 0-18 ▪ **Ethnicity:** US African-American, Hispanic or Native American ▪ **Gender:** 4 both; 3 girls only ▪ **Weight:** Unselected ▪ **SES:** 1 study of Hispanic children in low-income neighbourhood	▪ **Target:** PA, Diet and Combination ▪ **Number of Studies:** 8 ▪ **Type of Studies:** 6 RCTs, 1 quasi-experimental, 1 not described ▪ **Quality of Studies:** Not described ▪ **Duration:** 4 to 12 weeks ▪ **Follow-up:** Not described ▪ **Setting:** School, Community ▪ **Activities:** Classroom-based nutrition and PA education PA program/class, Internet and video-based activities, Parent education/ engagement, Behavioural skills training	▪ Few intervention studies focused on adiposity outcomes have been conducted in minority youth ▪ Four studies were successful at decreasing BMI or body fat measures **Factors of Successful Interventions:** ▪ Incorporating culturally relevant intervention components related to diet, PA and family involvement in minority youth tailored at more 'deep structures' in the ethnic minority youth, ▪ Intervention that includes improving both PA and diet **Specifically Younger Children:** ▪ The largest effects on health behaviours included a parental involvement component ▪ Younger children benefitted from programs that focused on developing specific behavioural-change skills	▪ Positive effects reported for most of 7 studies in PA and/or nutrition outcome	▪ Further research needed to test effective ways of integrating culturally appropriate components at group and individual levels for reducing obesity in minority youth ▪ More community-level research to develop interventions addressing barriers and needs of a target population ▪ Ecological approaches combined with behavioural and motivational approaches may hold promise if moulded to the cultural needs of the target community ▪ Focusing solely on individual differences in cognitive beliefs and motivational readiness unlikely to provide meaningful insights into the complex process of behaviour change over time ▪ Need to tailor to individual needs and broader cultural groups/ traditions
Zenzen W, Kridli S. Integrative review of school-based childhood obesity prevention programs. J Pediatr Health Care. 2009;23(4):242-258. (40) **Type:** Literature Review	▪ To describe variability in the methodological approaches and theoretical frameworks of school-based obesity prevention programs utilizing >1 of dietary, physical activity,	▪ **Age:** 4-18 ▪ **Location:** US, Europe ▪ **Ethnicity:** Unselected ▪ **Gender:** Unselected, except 1 study girls only (for PE) ▪ **Weight:** Unselected,	▪ **Target:** Diet (1), PA (2), or Combination (13) ▪ **Number of Studies:** 16 ▪ **Type of Studies:** 5 Quasi-experimental, 9 Individual experimental ▪ **Quality of Studies:** Not described ▪ **Duration:** 5 weeks to 8 years ▪ **Follow-up:** Not described ▪ **Settings:** School ▪ **Activities:** Classroom-based	▪ Nine of 16 studies that evaluated the effect of their intervention on BMI ▪ Only 1 study (nutrition intervention aimed at reducing carbonated beverage consumption and increasing water consumption) reported any significant effect (0.2% reduction in BMI	▪ Despite the multiple approaches, there was very little change in physical activity patterns among any of the studies ▪ Interestingly, when this cohort is broken down further into peer-led activity intervention versus Internet and video-only intervention, the peer-led activity group	

Reference/ Type of review	Study objectives	Population	Interventions	Primary weight outcomes	Risk factor behaviour (diet or physical activity) outcomes	Comments
	healthy lifestyle education and/ or parental involvement ▪ To examine the variations in duration, theoretical framework, strength of evidence supporting studies, and reduction in BMI or weight	except 1 study with overweight/ obese children (for PE) ▪ **SES:** Unselected	nutritional education sessions, PA-based ranging from broad-spectrum basic PA to tailored programs, Healthy lifestyle education (e.g., video sessions, poster collages quizzes, computer-tailored model of intervention), Education/ engagement of parents (e.g., newsletters home, meetings, dietary questionnaires)	in intervention vs. 7.5% increase in control group), but this was among the overweight/ obese children **Factors of Successful Interventions:** ▪ Parental involvement ▪ Duration	actually increased their total physical activity ▪ This finding suggests that while healthy lifestyle education and dietary modification alone may slow or decrease activity level, a more hands-on approach to physical activity modification is required to increase activity	

References

(1) An JY, Hayman LL, Park YS, Dusaj TK, Ayres CG. Web-based weight management programs for children and adolescents: a systematic review of randomized controlled trial studies. ANS Adv Nurs Sci. 2009;32(3):222-240.

(2) Ayliffe B, Glanville NT. Achieving healthy body weight in teenagers: evidence-based practice guidelines for community nutrition interventions. Can J Diet Pract Res. 2010;71(4):e78-86.

(3) Bond M, Wyatt K, Lloyd J, Taylor R. Systematic review of the effectiveness of weight management schemes for the under fives. Obes Rev. 2011;12(4):242-253.

(4) Bond M, Wyatt K, Lloyd J, Welch K, Taylor R. Systematic review of the effectiveness and cost-effectiveness of weight management schemes for the under fives: a short report. Health Technol Assess. 2009;13(61):1-75, iii.

(5) Branscum P, Sharma M. A systematic analysis of childhood obesity prevention interventions targeting Hispanic children: lessons learned from the previous decade. Obes Rev. 2011;12(5):e151-8.

(6) Brown T, Summerbell C. Systematic review of school-based interventions that focus on changing dietary intake and physical activity levels to prevent childhood obesity: an update to the obesity guidance produced by the National Institute for Health and Clinical Excellence. Obes Rev. 2009;10(1):110-141.

(7) Ciampa PJ, Kumar D, Barkin SL, Sanders LM, Yin HS, Perrin EM, Rothman RL. Interventions aimed at decreasing obesity in children younger than 2 years: a systematic review. Arch Pediatr Adolesc Med. 2010;164(12):1098-1104.

(8) Cook-Cottone C, Casey CM, Feeley TH. A meta-analytic review of obesity prevention in the schools: 1997-2008. Psychology in the Schools. 2009;46(Sep):695-719.

(9) De Bourdeaudhuij I, Van Cauwenberghe E, Spittaels H, Oppert JM, Rostami C, Brug J, et al. School-based interventions promoting both physical activity and healthy eating in Europe: a systematic review within the HOPE project. Obes Rev. 2011;12(3):205-216.

(10) Dobbins M, De Corby K, Robeson P, Husson H, Tirilis D. School-based physical activity programs for promoting physical activity and fitness in children and adolescents aged 6-18. Cochrane Database Syst Rev. 2009;(1):CD007651.

(11) D'Onise K, Lynch JW, Sawyer MG, McDermott RA. Can preschool improve child health outcomes? a systematic review. Soc Sci Med. 2010;70(9):1423-1440.

(12) Froschl B, Wirl C, Haas S. Overweight prevention in adolescents and children (behavioural and environmental prevention). GMS Health Technol Assess. 2009 [cited 2013 Jun 26];5(1-10). Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3011287/pdf/HTA-05-05.pdf

(13) Gerards SM, Sleddens EF, Dagnelie PC, de Vries NK, Kremers SP. Interventions addressing general parenting to prevent or treat childhood obesity. Int J Pediatr Obes. 2011;6(2-2):e28-45.

(14) Golley RK, Hendrie GA, Slater A, Corsini N. Interventions that involve parents to improve children's weight-related nutrition intake and activity patterns - what nutrition and activity targets and behaviour change techniques are associated with intervention effectiveness? Obes Rev. 2011;12(2):114-130.

(15) Gonzalez-Suarez C, Worley A, Grimmer-Somers K, Dones V. School-based interventions on childhood obesity: a meta-analysis. Am J Prev Med. 2009;37(5):418-427.

(16) Hamel LM, Robbins LB, Wilbur J. Computer- and web-based interventions to increase preadolescent and adolescent physical activity: a systematic review. J Adv Nurs. 2011;67(2):251-268.

(17) Harris KC, Kuramoto LK, Schulzer M, Retallack JE. Effect of school-based physical activity interventions on body mass index in children: a meta-analysis. CMAJ. 2009 [cited 2013 Jun 26] ;180(7):719-726. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2659836/pdf/20090331s00019p719.pdf

(18) Hesketh KD, Campbell KJ. Interventions to prevent obesity in 0-5 year olds: an updated systematic review of the literature. Obesity (Silver Spring). 2010;18(Suppl 1):S27-S35.

(19) Ickes MJ, Sharma M. A review of childhood obesity prevention interventions targeting African American children. Vulnerable Child Youth Stud. 2011;6(1):103-123.

(20) Kanekar A, Sharma M. Meta-analysis of school-based childhood obesity interventions in the U.K. and U.S. Int Q Community Health Educ. 2008;29(3):241-256.

(21) Katz DL. School-based interventions for health promotion and weight control: not just waiting on the world to change. Annu Rev Public Health. 2009;30:253-272.

(22) Kesten JM, Griffiths PL, Cameron N. A systematic review to determine the effectiveness of interventions designed to prevent overweight and obesity in pre-adolescent girls. Obes Rev. 2011;12(12):997-1021.

(23) Kitzman-Ulrich H, Wilson DK, St George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clin Child Fam Psychol Rev. 2010 [cited 2013 Jun 26];13(3):231-53. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3293190/pdf/nihms357806.pdf

(24) Larson N, Ward DS, Neelon SB, Story M. What role can child-care settings play in obesity prevention? a review of the evidence and call for research efforts. J Am Diet Assoc. 2011;111(9):1343-1362.

(25) Lytle LA, Heart MO. Examining the state of the science of prevention of childhood obesity. Curr Nutr Food Sci. 2009;5(2):134-148.

(26) Mayer K. Childhood obesity prevention: focusing on the community food environment. Fam Community Health. 2009;32(3):257-270.

(27) Monasta L, Batty GD, Macaluso A, Ronfani L, Lutje V, Bavcar A, et al. Interventions for the prevention of overweight and obesity in preschool children: a systematic review of randomized controlled trials. Obes Rev. 2011;12(5):e107-18.

(28) Nguyen B, Kornman KP, Baur LA. A review of electronic interventions for prevention and treatment of overweight and obesity in young people. Obes Rev. 2011;12(5):e298-314.

(29) Reichert FF, Baptista Menezes AM, Wells JC, Carvalho Dumith S, Hallal PC. Physical activity as a predictor of adolescent body fatness: a systematic review. Sports Med. 2009;39(4):279-294.

(30) Roseman MG, Riddell MC, Haynes JN. A content analysis of kindergarten-12th grade school-based nutrition interventions: taking advantage of past learning. J Nutr Educ Behav. 2011;43(1):2-18.

(31) Safron M, Cislak A, Gaspar T, Luszczynska A. Effects of school-based interventions targeting obesity-related behaviors and body weight change: a systematic umbrella review. Behav Med. 2011;37(1):15-25.

(32) Seo DC, Sa J. A meta-analysis of obesity interventions among U.S. minority children. J Adolesc Health. 2010;46(4):309-323.

(33) Standiford Brown A. Promoting physical activity amongst adolescent girls. Issues Compr Pediatr Nurs. 2009;32(2):49-64.

(34) Stevens CJ. Obesity prevention interventions for middle school-age children of ethnic minority: a review of the literature. J Spec Pediatr Nurs. 2010;15(3):233-243.

(35) Van Cauwenberghe E, Maes L, Spittaels H, van Lenthe FJ, Brug J, Oppert JM, et al.. Effectiveness of school-based interventions in Europe to promote healthy nutrition in children and adolescents: systematic review of published and 'grey' literature. Br J Nutr. 2010;103(6):781-797.

(36) Wahi G, Parkin PC, Beyene J, Uleryk EM, Birken CS. Effectiveness of interventions aimed at reducing screen time in children: a systematic review and meta-analysis of randomized controlled trials. Arch Pediatr Adolesc Med. 2011;165(11):979-986.

(37) Waters E, de Silva-Sanigorski A, Hall BJ, Brown T, Campbell KJ, Gao Y, Armstrong R, et al. Interventions for preventing obesity in children. Cochrane Database Syst Rev. 2011;(12):CD001871.

(38) Wilks DC, Besson H, Lindroos AK, Ekelund U. Objectively measured physical activity and obesity prevention in children, adolescents and adults: a systematic review of prospective studies. Obes Rev. 2011;12(5):e119-29.

(39) Wilson DK. New perspectives on health disparities and obesity interventions in youth. J Pediatr Psychol. 2009 [cited 2013 Jun 26];34(3):231-44. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2722129/pdf/jsn137.pdf

(40) Zenzen W, Kridli S. Integrative review of school-based childhood obesity prevention programs. J Pediatr Health Care. 2009;23(4):242-258.

Chapter 5: Treatment Data Extraction Table

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
COCHRANE REVIEW (LIFESTYLE, PHARMACEUTICAL, SURGICAL APPROACHES)					
Oude Luttikhuis H, Baur L, Jansen H, Shrewsbury VA, O'Malley C, Stolk RP, et al. Interventions for treating obesity in children. Cochrane Database Syst Rev. 2009(1):001872. (1) **Type:** Systematic review and Meta-analysis	**Population:** ▪ Ages: 3-21 ▪ ill and secondary or syndromic obesity **Sample Size:** ▪ N= 5230 (3806 lifestyle, 1424 drug) ▪ Range: Lifestyle: 16-218 Drug: 4-539	To assess the efficacy of **interventions** designed to treat obesity in children and youth.	**Number and Type:** ▪ 64 RCTs ▪ 54 lifestyle ▪ 10 drug ▪ 0 surgical **Duration:** Lifestyle: ▪ 1-24 months (usually 6 months or longer) Drug: ▪ 3-6 months ->Follow-up: 6, 9, 12, 24 months **Intervention:** Lifestyle: ▪ 6 diet ▪ 12 physical activity ▪ 36 behavioural (family therapy, CBT, problem-solving approaches and multi-component) ▪ Many studies target the family or child with parent Drug: ▪ 5 Sibutramine ▪ 3 Orlistat ▪ 2 metformin ▪ 2 drug trials had lifestyle component Control: ▪ Compared to standard of care or self-help **Setting(s):** Medical, Outpatient clinic (often of a children's or university hospital), Inpatient, GP/ pediatrician, School, Community, University/ research centre **Quality of included studies:** None fulfilled all quality criteria set out by Cochrane Handbook	Meta-analysis only pooled studies that met quality criteria **Lifestyle- Under 12 years** **Dietary** ▪ Not pooled, but some evidence for beneficial effect and effect on child adiposity **Physical activity** ▪ Study designs/interventions not comparable, so not pooled ▪ Some beneficial effects on adiposity at 6 months , but not significant difference, with exception of 1 study **Behavioural** ▪ Small favourable effect of -0.06 (95% CI: ▪ -0.12 to -0.01) in BMI-SDS in the parent-focused behavioural group intervention over standard care (Z=2.14, p=0.03) ▪ No additional beneficial effect of a parent-focused behavioural group intervention over standard care was found on BMI-SDS at 12 months follow-up **Lifestyle- Over 12 years** **Dietary** ▪ Only one study had ITT data-> favourable effect on BMI and fat mass with low Glycemic Index diet **Physical activity** ▪ 1/3 met quality criteria, but no significant changes at end of follow-up **Behavioural (over standard of care of control)** 6months ▪ Effect on BMI-SDS was -0.14 (95% CI: -0.17. to -0.12, Z=11.51, p <0.00001.)	**Limitations** ▪ Allocation concealment and blinding was unclear ▪ Small sample sizes ▪ Little accounting for missing data ▪ Publication bias ▪ High attrition ▪ Possible problems with randomization ▪ Studies varied in intervention design, outcome measurements and methodological quality **Future Research** ▪ Studies in preschool children ▪ Lifestyle interventions in youth ▪ Larger studies ▪ What interventions are most effective at different levels of obesity severity and at different ages and development stages? ▪ What strategies are most effective for long-term maintenance?

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
				▪ Effect on absolute BMI -3.04 (95% CI: -3.14 to -2.94) kg/m^2 (Z= 61.57, p <0.00001) 12 months ▪ -0.14 on BMI-SDS (95% CI: -0.18. to -0.10, Z=7.11, p <0.00001) ▪ -3.27 kg/m^2 on absolute BMI (95% CI: -3.38 to -3.17, Z= 60.10, p <0.00001) **Drug- only over 12 years** Sibutramine ▪ Effect on absolute BMI of Sibutramine over placebo was found of -1.66 kg/m^2 (95% CI: -1.89 to -1.43, Z=14.23, p <0.00001) Orlistat ▪ Effect over placebo on absolute BMI at 6-months follow-up, when given in combination with a lifestyle intervention (-0.76 kg/m^2, 95% CI: -1.07 to -0.44, Z= 4.70, p <0.00001) Metformin ▪ Couldn't pool b/c did not report as intention to treat **Additional Observations:** ▪ The importance of a combined dietary, ▪ physical activity and behavioural component has been highlighted by several studies included in this review ▪ Importance of parental involvement ▪ No effect on linear height growth	
LIFESTYLE					
Nguyen B, Kornman KP, Baur LA. A review of electronic interventions for prevention and treatment of overweight and obesity in young people. Obes Rev 2011 [cited 2013 Jun 26];12(5):e298-314. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2010.00830.x/pdf (2) **Type:** Systematic review	**Population:** Children ▪ Age: 6-12 years ▪ Caucasian ▪ No information on SES ▪ US ▪ More females ▪ BMI ≥ 75th percentile for age and sex Youth**:** ▪ Age: 11-18 years	To provide an evaluation of **interactive electronic media** interventions for the treatment of obesity and/or obesity-related behaviours in children and youth.	**Number and Type:** ▪ 7 studies (specifically on treatment) in 9 articles Children: ▪ RCT Youth: ▪ 6 studies; 4 RCTs, 1 quasi-experimental, 1 longitudinal **Duration:** Children: ▪ 6 weeks Youth: ▪ 12 weeks to 2 years	Results not pooled to due to heterogeneity of studies **BMI** Children: ▪ Stabile BMI and BMI z-scores from baseline to post-treatment ▪ No clear treatment effect Youth: ▪ Significant positive outcomes for BMI and/or BMI z-score ▪ Evidence of maintained BMI up to 4 months follow-up, but not significantly different from control group ▪ Evidence of weight gain	**Limitations** ▪ Children study was underpowered, of poor quality and had a short duration ▪ Heterogeneity of interventions ▪ Lack of isolation of the effects of interactive electronic components ▪ Study looked separately at prevention and

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
	▪ Various ethnic backgrounds ▪ No information on SES ▪ US, Taiwan, Germany ▪ More females ▪ Obese and overweight **Sample Size:** Children: ▪ N=65 Youth: ▪ N=37-140		**Intervention:** Children: ▪ Internet behavioural program vs. control website + parental involvement Youth: ▪ All studies had Internet intervention (1 with telemedicine support) 4 studies with parental involvement (printed material, telephone support, Internet or counselling) **Internet programs:** ▪ Sometimes used incentives ▪ Cognitive behavioural program ▪ Weight loss e-learning ▪ Teaching ▪ Counselling ▪ Nutrition education **Control groups:** ▪ Not used in all studies ▪ Wide variation in control condition, but often non-interactive website or education **Setting(s):** Children: Home-based Youth: Home-based, Hospital + Home-based, School **Quality of included studies:** Quality design score ranged from 13-88% none met all requirements	**Body Fat** Youth: Significant positive outcomes for body fat reduction **Summary:** ▪ "These results should be viewed with caution because of the overall poor quality of the studies. Studies were mostly conducted in the U.S., largely in minority populations, and the direct transferability of interventions to other populations is unclear. Further high-quality research is needed in this area to accurately inform the evidence base." **Additional Observations:** Parental satisfaction with family or life were strong mediators of youth weight loss	treatment, but some prevention studies seem to at times include overweight and/or obese populations, and these are missing from treatment synthesis ▪ Attrition: Children: 58%; Youth: 3%-30% **Future Research** ▪ Better design ▪ More rigorous reporting of methods ▪ Larger studies with longer duration ▪ Isolation of electronic effect
Sargent GM, Pilotto LS, Baur LA. Components of primary care interventions to treat childhood overweight and obesity: a systematic review of effect. Obes Rev 2011 [cited 2013 Jun 26];12(5):e219-35. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2010.00777.x/pdf (3)	**Population:** ▪ Age: 3-11 years ▪ US, Australia, Finland, Italy, Israel ▪ Overweight/ obese + some with normal weight or normal weight at risk b/c of obese parents ▪ About equal M and F but one study with only F	To identify interventions that treated childhood overweight or obesity in a **primary care setting.**	**Number and Type:** ▪ 22 articles in 17 studies ▪ 10 RCTs ▪ 7 non-random trials **Duration:** ▪ 3-12 months, with number of contacts ranging from 1-114 **Intervention:** ▪ Great variation in intervention treatment ▪ Motivation or support ▪ Counselling or education ▪ Provision of written resources ▪ Physical activity sessions ▪ Physical activity + dietary prescription	**Anthropometric** (17 studies) ▪ 8/17 reported significant decreases in anthropometric measures ($p < 0.05$) ▪ Significant anthropometric outcomes reported only in interventions with 5 or move contacts over the intervention period (rate of contact may influence outcomes) **Additional Observations:** ▪ There is a role for medical professional in delivery + assessment and referral ▪ Effective interventions involved counselling or education ▪ No evidence that duration is related to outcomes	**Limitations** ▪ Low methodological rigour ▪ Relied on self-report ▪ Possible selection bias ▪ Variation of evaluation measures ▪ Small sample sizes ▪ Lack of follow-up ▪ Lack of effective control group **Future Research** ▪ Larger studies

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
Type: Systematic Review	**Sample size**: ▪ N= 18-819 ▪ Median 111		▪ NOTE: some involved personnel training before intervention **Setting(s):** Primary care **Quality of included studies:** Scored between 2/10-9/10, few were of high quality		▪ assessing the detailed components of interventions ▪ Longer follow-up
An,J.Y., Hayman,L.L., Park,Y.S., Dusaj,T.K., Ayres,C.G. Web-based weight management programs for children and youth: A systematic review of randomized controlled trial studies. ANS Adv Nurs Sci. 2009:32(3);222-240. (4) **Type:** Systematic review	**Population:** ▪ Age: 8-18 ▪ Some studies included on African-American children ▪ No mention of SES or ethnicity ▪ Some studies looked only at females ▪ United States **Sample Size:** ▪ N=35-2991	To provide evidence regarding the effectiveness of **web-based weight management programs** for children and teens who are overweight and obese.	**Number and Type:** ▪ 8 RCTs **Duration:** 2 weeks-2 years **Intervention:** ▪ Studies included one or more of the following: ▪ Educational component via Internet targeting diet, physical activity, body image and psychosocial ▪ Camp-based or face-to-face sessions ▪ CBT ▪ Parental involvement **Setting(s):** Home, Camp **Quality of included studies:** NR	No pooled analysis due to heterogeneity of interventions and outcomes **Weight Change** (BMI, fat mass) ▪ 5/7 studies reported significant weight decreases ▪ 1 of the 8 studies did not measure weight change **Summary:** ▪ Results suggest the potential for web-based theoretically derived and guided behavioural weight management interventions in overweight and obese children and youth ▪ Web-based weight management programs should incorporate a combination of key factors such as appropriate dietary intake, increased physical activity, behavioural change and family/ parental involvement **Additional Observations** ▪ Parental involvement important	**Limitations** ▪ Small sample size ▪ Significant BMI differences between groups at baseline ▪ Adherence influenced by lottery incentive ▪ Rates of attrition ranged from 4.9% to 30% **Future Research** ▪ Effectiveness of long-term weight loss maintenance is needed ▪ Need to increase methodological rigor ▪ Replicate studies in varying populations
Ayliffe B, Glanville NT. Achieving healthy body weight in teenagers: evidence-based practice guidelines for community nutrition interventions. Can J Diet Pract Res 2010;71(4):e78-86. (5) **Type:** Systematic review	**Population:** ▪ Age: under 18 ▪ 50% of the interventions were offered to specific youth populations (e.g. SES, ethnicity) ▪ Overweight **Sample Size:** ▪ N= NR	To examine which elements of **community interventions** have been successful in treating child and youth obesity.	**Number and Type:** ▪ 22 studies (all study designs except for systematic reviews included in search inclusion criteria) **Duration:** ▪ NR, but most interventions were intensive with weekly sessions for at least the first three months **Intervention:** ▪ All were multidisciplinary: ▪ Education component targeting diet and physical activity ▪ Involvement of registered dietitians or other trained health professionals ▪ Parental/family involvement ▪ Behavioural counselling	No pooled analysis due to heterogeneity of interventions and outcomes **Summary:** ▪ "Intensive treatment interventions, ranging from weekly to monthly, proved to be the most effective in achieving weight loss goals" **Additional Observations:** ▪ Diet seemed to be an important part of treatment interventions, and adherence is improved with behavioural strategies and family involvement **Summary:** ▪ "Obesity treatment was most effective when it was delivered in community settings and had a focus on intensive, multidisciplinary programs,	**Limitations** ▪ One appraiser conducted the evidence evaluation ▪ Little information about the included studies (outcomes and interventions) **Future Research** ▪ Assess barriers that may hinder progress in obese youth such as disordered eating, victimization, personal barriers and food cost

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
			▪ Food environment and policy change ▪ Peer modelling ▪ Technology-based strategies ▪ Behavioural modifications **Setting(s):**Community, School **Quality of included studies:** Limited high- quality studies (ADA score)	which included diet plans and behaviour modification strategies and involved family members" **Additional Observations:** ▪ Programs should consider cultural, social and economic factors	▪ Assess weight loss maintenance
Ickes,M.J., Sharma,M. A review of childhood obesity prevention interventions targeting African-American children. Vulnerable Child Youth Stud. 2011.6(2):103-123. (6) **Type:** Systematic review	**Population:** ▪ Age:7-17 ▪ 40-100% African-American ▪ Some studies in low-income populations ▪ Overweight or Obese ▪ Some studies 100% F ▪ U.S. **Sample Size:** ▪ N=12-261	To review existing childhood **obesity treatment interventions** targeting African-American children.	**Number and Type:** ▪ 8 studies ▪ 2 RCT ▪ 1 stratified randomization, 2 experimental design ▪ 3 unknown **Duration:** 12 weeks - 2 years **Intervention:** ▪ Problem-solving/goal attainment ▪ Interactive behaviour therapy + Internet-based program focus on diet and physical activity ▪ After-school program (nutrition education, physical activity etc.) ▪ After-school dance program + Family-based program to reduce screen time ▪ Education on nutrition + physical activity **Setting(s):** School, After-school/Community, Home-based **Quality of included studies:** NR	No pooled analysis due to heterogeneity of interventions and outcomes **Weight Change (BMI, fat mass etc.)** ▪ 6/8 studies assess obesity-related factors ▪ 6/6 found reductions in one or more of the following: BMI, weight, body fat, BMI percentile, % overweight ▪ 3/6 reported significant findings **Additional Observations** ▪ Parental involvement included in 3 studies.	**Limitations** ▪ This article did not separate prevention and treatment interventions, so discussion dealt with a mix of preventative and treatment programs ▪ Unclear if authors were comparing pre/post or control condition ▪ Did not report how size of BMI or weight reduction ▪ Heterogeneity of interventions **Future Research** ▪ Larger studies ▪ Isolation of effective components
Kelly KP, Kirschenbaum DS. Immersion treatment of childhood and adolescent obesity: the first review of a promising intervention. Obes Rev 2011 [cited 2013 Jun 26];12(1):37-49. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2009.00710.x/pdf (7)	**Population:** ▪ Age: 8-18 years ▪ No information on ethnicity or SES ▪ Overweight/ obese (1 study had some non-overweight participants) ▪ Some studies have higher proportion of females	To review the effect of **immersion treatment** on childhood and youth obesity.	**Number and Type:** ▪ 22 studies ▪ 1 randomized ▪ 5 quasi-experimental ▪ 16 prospective follow-up **Duration:** ▪ Treatment: 10 days - 10 months ▪ Follow-up: 4 to 3.6 years **Intervention:** Immersion environment ▪ Dietary component ▪ Physical exercise/activity requirements	**Average reduction in % overweight across studies:** ▪ 23.9% from pre- to-post-immersion ▪ 20.6% pre-immersion to follow-up **Mean BMI change across studies:** ▪ - 4.5 kg/m² pre- to-post immersion **Additional Observations:** ▪ Longer stays seemed to be associated with better outcomes ▪ Programs that included CBT and follow-up outperformed non-CBT follow-up (also these programs were often longer)	**Limitations** ▪ Variability in outcome measures ▪ Lack of standardized protocol ▪ Low statistical power ▪ Absence of intention-to-treat analyses ▪ Variation in study follow-up length ▪ Authors work at immersion centre

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
Type: Systematic Review	**Sample Size:** ▪ N=15-372		▪ Education in nutrition and cooking ▪ Regular therapy and/or psycho-education toward behaviour change. ▪ Sometimes interventions involved families ▪ NOTE: wide variety of approaches used. ▪ Only 6 studies included a comparison/control group **Setting(s):**Residential, In-patient, Camp **Quality of included studies:** NR		▪ Average attrition 6.8%, ranged from 0-42% **Future Research** ▪ Direct comparisons of outpatient treatment ▪ Cost-effectiveness ▪ RCT ▪ Include CBT ▪ Include better dietary approach (look at healthy food/portion control vs. restriction diets used in current studies)
Kitzmann KM, Dalton WT,3rd, Stanley CM, Beech BM, Reeves TP, Buscemi J, et al. Lifestyle interventions for youth who are overweight: a meta-analytic review. Health Psychol. 2010;29(1):91-101. (8) **Type:** Meta-analysis	**Population:** ▪ Age:6-19 ▪ 6-12 years: about 1/2 the studies, ≤5 years: 0 studies, 13+ years: 1 study, Rest of studies focused on various age groups. ▪ No information on ethnicity or SES. ▪ Overweight **Sample Size:** ▪ N=8-280	To review the efficacy of **lifestyle interventions** on childhood overweight and obesity.	**Number and Type:** ▪ 40 between-group, treatment compared to a control ▪ 36 alternate treatment involved parents ▪ Randomized and non-randomized **Duration:** ▪ 1-104 weeks, with number of sessions ranging from 1-144 **Intervention:** <u>Focus on change in obesity-related behaviours, such as:</u> ▪ Physical activity ▪ Multi-component ▪ Diet or nutrition education ▪ Parent training ▪ Response-cost (+/- reinforcement) ▪ Peer facilitation ▪ Therapy (behaviour, family, reality) ▪ Parent own weight loss ▪ Problem-solving **Setting(s):** Community, School, Medical, Physical training, Research centre, Camp **Quality of included studies:** NR	Pooled average effect size in treatment-control comparisons **Anthropometric Outcomes** ▪ Significant average effect size was d=0.41 (SE=0.07, 95% CI: 0.26 to 0.55) CAUTION: statistics pool effect on a variety of outcomes usually weight, BMI or % overweight **Summary:** ▪ Lifestyle interventions can be effective under a wide range of conditions **Additional Observations:** ▪ Significant effect in even brief interventions (as seen in last treatment measurement and after follow-up) ▪ No significant difference in magnitude of effect size between randomized and non-randomized, although effect slightly higher in randomized ▪ No relationship between treatment effect size and year of publication; however, stricter definition of obesity, so this is based on different populations. ▪ Similar results found across treatment settings	**Limitations** ▪ No summary table of individual study findings ▪ High degree of heterogeneity ▪ Less than 2/3 of studies provided information about severity of overweight at baseline ▪ Publication bias **Future Research** ▪ Compare treatment types and outcome types ▪ Larger studies

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
Kitzman-Ulrich H, Wilson DK, St. George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding adolescent obesity, physical activity, and dietary programs. Clin. Child Fam Psychol Rev. 2010;13(3):231-253. (9) **Type:** Systematic review	**Population:** ▪ Age: 6-16 years ▪ Predominately Caucasian samples ▪ No information on SES ▪ Overweight **Sample Size:** ▪ N=31-190	This review evaluates weight loss, physical activity and dietary interventions in overweight or obese youth with emphasis on **family involvement**.	**Number and Type:** ▪ 21 studies ▪ 18 RCTs ▪ 1 stratified random assignment ▪ 1 controlled clinical study ▪ 1 non-random treatment/control **Duration:** ▪ Not clearly reported ▪ 4 weeks to 10 months (however for some studies only the number of sessions was reported e.g., 3) **Intervention:** ▪ Program components to improve positive parenting styles such as authoritative parenting and child management strategies ▪ Providing appropriate structure and boundaries in the home environment ▪ Providing positive reinforcement for child health behaviours, parent–child communication ▪ Parenting skills ▪ Child management skills ▪ Parental problem-solving techniques ▪ Improve authoritative parenting styles **Co-interventions:** ▪ Diet ▪ Physical activity ▪ Behavioural skills ▪ Therapy **Setting(s):** Clinical, University Setting, Community **Quality of included studies:** NR	**Weight Change** ▪ Effect sizes were calculated for 12 studies with sufficient information ▪ Cohen's d ranged from .05 to .84. ▪ Some programs showed significantly higher weight reductions in the treatment group ▪ Some studies showed reductions in weight loss or BMI z-score but found the scores were not significantly different between treatment and control **Summary:** ▪ "Overall, the review of these studies indicates that including positive parenting styles (authoritative parenting), training in parenting skills and child management strategies, family functioning variables, targeting parental behavioural change and utilizing parents as conduits for family-level change has promise" ▪ Not clear which components are more beneficial or how beneficial they are without concurrent lifestyle interventions	**Limitations** ▪ Small sample sizes ▪ Heterogeneity of interventions ▪ Family-structure interventions implemented with other co-interventions **Future Research** ▪ Studies outside clinical or university setting ▪ Larger studies Studies in more diverse populations
Lambiase M. Treating pediatric overweight through reductions in sedentary behaviour: a review of the literature. J Pediatr Health Care. 2009;23(1):29-36. (10) **Type:** Systematic review	**Population:** ▪ School- age (8-12 years) ▪ No information on SES. ▪ Ethnicity: not well reported on (one study majority white) ▪ Obese, but one study not restricted to obese	To review the evidence on targeting **reductions in sedentary behaviour** to treat pediatric overweight.	**Number and Type:** ▪ 6 RCTs **Duration:** ▪ 3-24 months **Intervention:** <u>Focus on reducing sedentary behaviours, such as:</u> ▪ Reinforcing decreased sedentary behaviour ▪ Reinforcing increased physical activity ▪ Educational programs, TV turn-off, TV weekly limit ▪ Open-loop contingency (accumulated points with pedometer to watch TV)	No pooled analysis due to heterogeneity of interventions and outcomes **Summary:** ▪ "Reductions in sedentary behaviour may be as effective as or even more effective than targeting physical activity directly in decreasing per cent body fat, BMI and per cent overweight" **Additional Observations** ▪ Manipulation of home environment may be just as effective reinforcing reductions in sedentary behaviour	**Limitations** ▪ Small sample sizes ▪ Relied on self-report ▪ Little ethnic diversity ▪ Parent's reinforcement techniques not clear ▪ Heterogeneity of interventions and outcomes

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
	▪ Higher proportion of females in most studies **Sample Size:** ▪ N=10-192		▪ Closed-loop contingency (pedal stationary bike to power TV) ▪ Changes to home environment ▪ Weekly/monthly meetings or education components Control groups: ▪ No intervention or comparison **Setting(s):** Home-/family-based **Quality of included studies:** NR		**Future Research** ▪ Larger studies ▪ Longer follow-up to see if changes are sustained
PHARMACEUTICAL					
Viner RM, Hsia Y, Tomsic T, Wong IC. Efficacy and safety of anti-obesity drugs in children and youth: systematic review and meta-analysis. Obes Rev. 2010;11(8):593-602. (11) **Type:** Systematic review and Meta-analysis	**Population:** ▪ Age: 12-18 years ▪ No information on SES ▪ Predominantly white, black or Hispanic ▪ BMI usually 30-40kg/ m^2 (excluded secondary obesity or diabetes) ▪ US, Brazil, Mexico, Turkey, Canada **Sample Size:** ▪ Sibutramine: N=686 ▪ Orlistat: N=573	To complete a meta-analysis of randomized controlled trials to summarize the efficacy of **anti-obesity drugs** in reducing BMI in obese children and youth.	**Number and Type:** Sibutramine: ▪ 5 double-blind RCT, 2 open-label trial Orlistat; ▪ 2 double-blind RCT, 3 open-label trial, 1 non-blinded trial Only double-blind RCTs with 6-month duration were combined in **meta-analysis** **Duration:** Sibutramine: ▪ 6-12 month Orlistat: ▪ 5-15 month **Intervention:** Sibutramine: ▪ 5-10mg/day vs. placebo Increase up to 15mg/day Orlistat; ▪ 120mg 3x/day vs. placebo and multi-vitamin in both arms Co-interventions: ▪ Both trial arms included a standardized low-fat low-energy diet and encouragement to exercise, with a variable element of behavioural modification in some trials **Setting(s):**Medical **Quality of included studies:** Relatively high quality (QUOROM score)	Meta-analysis of mean difference between drug and placebo **BMI** Sibutramine: ▪ Reduction of 2.20 kg m-2 (95% CI: 1.57 to 2.83) Orlistat: ▪ Reduction of 0.83 kg m-2 (95% CI: 0.47 to 1.19) **Summary:** ▪ "Sibutramine together with behavioural support in obese youth produces a clinically meaningful reduction in BMI of 0.6–0.8 SD and is well tolerated. In contrast, Orlistat together with behavioural support has limited utility as a weight reduction treatment in youth, producing a small effect (0.24–0.3 SD) with frequent gastrointestinal side effects."	**Limitations** ▪ Limited report of randomization, blinding, allocation concealment ▪ Trials in secondary care setting, limit generalizability ▪ Possible publication bias ▪ Short follow-up ▪ High attrition (average 19% Orlistat and 25% Sibutramine) **Future Research** ▪ Longer-term studies ▪ Studies in a range of clinical populations ▪ Observation of weight maintenance after medication stopped ▪ Compare drug to diet and exercise groups only ▪ Assess long-term health risks of the drugs

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
Czernichow S, Lee CM, Barzi F, Greenfield JR, Baur LA, Chalmers J, et al. Efficacy of weight loss drugs on obesity and cardiovascular risk factors in obese youth: a meta-analysis of randomized controlled trials. Obes Rev. 2010;11(2):150-158. 12) **Type:** Meta-analysis	**Population:** ▪ Age: 10 -18 years ▪ No information on SES or ethnicity ▪ US, Brazil, Mexico, Turkey, Canada ▪ Overweight/ obese: BMI ≥ 30 kg/m² ▪ Higher proportion female **Sample Size:** ▪ N=24-539	To conducted a meta-analysis of the efficacy of **Orlistat and Sibutramine** on weight in overweight youth.	**Number and Type:** ▪ 8 RCTs ▪ 5 Sibutramine ▪ 3 Orlistat ▪ 0 rimonabant **Duration:** Sibutramine: ▪ 6-12 months Orlistat: ▪ 5-15 months **Intervention:** Sibutramine: ▪ 5-10mg/day vs. placebo (diet or lifestyle or behaviour intervention in each arm), increase up to 15mg/day ▪ 1 large multi-centre (n=498) ▪ 4 studies= smaller (n<90) Orlistat: ▪ 120mg 3x/day vs. placebo (diet or lifestyle intervention in each arm) ▪ 1 study= large multi-centre (n=539) ▪ 2 studies= smaller (n<50) **Setting(s):** Medical **Quality of included studies:** Indicating good level of quality with 5/8 meeting all criteria	Meta-analysis of mean difference between drug and placebo **Body weight:** ▪ Approximately 5kg weight loss (5.25 kg (95% CI: 3.03 to 7.48) **BMI:** ▪ Approximately 2 kg/m² BMI reduction (1.89 kg m-2 (95% CI: 1.06 to 2.73; I^2 = 82%) **Waist Circumference:** ▪ Approximately 5cm reduction (4.74 cm (95% CI: 2.97 to 6.52; I^2 = 71%) **Summary:** ▪ "Suggests that [drug] therapy in conjunction with behavioural modification may have a role in assisting overweight youth to lose weight"	**Limitations** ▪ Small sample size ▪ Publication bias ▪ Possible selection bias ▪ High attrition (16-34%) **Future Research** ▪ Larger, longer studies needed across different populations to assess weight maintenance ▪ As drug and placebo arms had co-interventions, trials are needed to tease out the effects
Park MH, Kinra S, Ward KJ, White B, Viner RM. Metformin for obesity in children and youth: a systematic review. Diabetes Care. 2009;32(9):1743-1745. (13) **Type:** Meta-analysis	**Population:** ▪ Age ≤ 19 years (6-19) ▪ Ethnicity: US/ AUST: high prevalence of African-American, Hispanic and Asian ▪ SES: unknown ▪ US, Australia, Turkey ▪ Obese ▪ Without diabetes, but all participants were	To summarize the efficacy of **metformin** in reducing BMI in obese children and youth without diabetes.	**Number and Type:** ▪ 5 double-blind RCTs (One crossover-trial) **Duration:** ▪ 6 months **Intervention:** Metformin: ▪ Doses from 1,000-2,000 mg/day ▪ 3 studies included lifestyle co-interventions in both trial arms **Setting(s):**Medical **Quality of included studies:** NR	Meta-analysis of mean difference between drug and placebo **BMI** Metformin: ▪ Reduction of 1.42kg/m² (95% CI: 0.83 to 2.02, I^2: 56.2%) ▪ Without outlier (no discussion why Turkish study had more efficacious results): metformin reduced BMI by 1.15 kg/m² (95% CI: 0.73 to 1.57, I^2: I 0%). **Body Fat** Metformin: ▪ Insufficient data to comment ▪ Sensitivity analysis: no difference by age, dose or baseline BMI	**Limitations** ▪ Short-term follow-up ▪ Small samples ▪ Population heavily biased with ethnicities known to be at increased risk of metabolic disorders ▪ Unadjusted measure without intention-to-treat analysis **Future Research** ▪ Larger, longer studies across different population

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
	hyperinsulinemia or insulin-resistant **Sample size:** ▪ N= 365 participants (320 completers)				
Garcia Diaz E, Martin Folgueras T. Systematic review of the clinical efficacy of Sibutramine and Orlistat in weight loss, quality of life and its adverse effects in obese youth. Nutr Hosp. 2011;26(3):451-457. (14) **Type:** Systematic Review	**Population:** ▪ Age: 12-18 years ▪ No information on SES or ethnicity ▪ US, Brazil, Mexico, Turkey, Canada ▪ Diagnosed obesity: BMI at least 2 units above the 95th percentile for age and sex OR BMI between 30-44 ▪ Mostly did not have concomitant comorbidities **Sample Size:** ▪ N=24-539	To review the evidence about the effect of **Sibutramine and Orlistat** in weight loss and its adverse effects in youth who are obese.	**Number and Type:** ▪ 9 RCTs ▪ 6 Sibutramine ▪ 3 Orlistat **Duration:** Sibutramine: ▪ 3, 6 or 12 month Orlistat: ▪ 6-12 months **Intervention:** Sibutramine: ▪ Usually 10mg/day vs. placebo (diet intervention in each arm 4 studies) ▪ 2 studies= large multi-centre (n=498) (same population, but diff measures reported) ▪ 4 studies= smaller (n<90) Orlistat: ▪ 120mg 3x/day vs. placebo (diet intervention in each arm 1 study) ▪ 1 study= large multi-centre (n=539) ▪ 2 studies= smaller (n<50) **Setting(s):** Medical **Quality of included studies:** Majority reached moderate to high quality (Jadad score)	**BMI** Sibutramine ▪ 3/4 studies: significantly higher reduction in BMI in treatment group vs. placebo (absolute change in initial BMI: -2.9 to -3.6 BMI (kg/m²)) ▪ 1/3- no diff, but follow-up only 3 months Orlistat ▪ 2/3 studies: significantly higher reduction in BMI in treatment group vs. placebo (absolute change in initial BMI: -0.55 to-4.09 BMI (kg/m²)) ▪ 1/3 study: significant higher reduction in BMI in treatment group pre- vs. post- treatment **Weight** Sibutramine ▪ 3/5 studies: significantly greater reduction in treatment group vs. placebo (absolute change in initial weight (kg) -6.5 to -10.3) Orlistat ▪ 1 study: significantly less weight gain in treatment group (+0.53 kg) ▪ 1 study= significantly greater reduction in treatment (6.27 kg) ▪ Note: Results not combined due to high heterogeneity and used ITT results **Summary:** ▪ "The results of this review show that Sibutramine or Orlistat, when combined with a hypocaloric diet, exercise and changes in lifestyle, achieve in obese youth a significantly higher decrease in BMI than when using only diet, exercise and changes in lifestyle."	**Limitations** ▪ Contamination of results given forced association of drug and diet/exercise ▪ Unclear if facilitates sustained weight loss ▪ Did not request additional data from authors ▪ Heterogeneous protocols ▪ High attrition **Future Research** ▪ Assess long-term safety of Orlistat ▪ Limited assessment of quality of life ▪ Longer follow-up to see if sustained weight loss occurs and long-term health consequences ▪ Determine what is optimal duration of treatment (trials 6 and 12 months ▪ Examine efficacy and safety in populations with diabetes, hypertension and smokers

Reference and review type	Population (age, SES, ethnicity, etc.)	Study objectives	Treatment approach	Primary outcome (weight/BMI)	Study limitations and future research
PHARMACEUTICAL					
Padwal R, Klarenbach S, Wiebe N, Hazel M, Birch D, Karmali S, et al. Bariatric surgery: A systematic review of the clinical and economic evidence. Journal of General Internal Medicine. 2011;26(10):1183-1194. (15) **Type:** Systematic review	**Population:** ▪ Ages: 14-18 ▪ No mention of SES or ethnicity ▪ Australia ▪ Mean BMI: 41 kg/m² (Class III obesity or medically complicated Class II obesity) ▪ 68% female **Sample Size:** ▪ N=50	To systematically review the clinical efficacy of **bariatric surgery** in obese youth.	**Number and Type:** ▪ 1 RCT **Duration:** ▪ 2- year follow-up **Intervention:** ▪ Surgery: Adjustable Gastric Banding vs. standard care **Setting(s):**Medical **Quality of included studies:** 3/5 (Jadad score)	**Weight** ▪ 35 kg (28%) reduction after gastric banding compared to a 3 kg (3%) reduction with lifestyle modification ($p < 0.001$) **Waist Circumference** ▪ Improvements in waist circumference ($p < 0.05$)	**Limitations** ▪ Only one small study found reporting on a single surgical procedure **Future Research** ▪ Larger studies ▪ Conduct a systematic review that goes beyond inclusion of RCTs (prospective studies published on this topic weren't included) ▪ Long-term health-outcome of surgery and weight loss maintenance ▪ Nutrient deficiencies and growth in youth who have undergone surgery

References

(1) Oude Luttikhuis H, Baur L, Jansen H, Shrewsbury VA, O'Malley C, Stolk RP, et al. Interventions for treating obesity in children. Cochrane Database Syst Rev. 2009;(1):CD001872.

(2) Nguyen B, Kornman KP, Baur LA. A review of electronic interventions for prevention and treatment of overweight and obesity in young people. Obes Rev. 2011;12(5):e298-314.

(3) Sargent GM, Pilotto LS, Baur LA. Components of primary care interventions to treat childhood overweight and obesity: a systematic review of effect. Obes Rev 2011 [cited 2013 Jun 26];12(5):e219-35. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2010.00777.x/pdf

(4) An JY, Hayman LL, Park YS, Dusaj TK, Ayres CG. Web-based weight management programs for children and adolescents: a systematic review of randomized controlled trial studies. ANS Adv Nurs Sci. 2009;32(3):222-240.

(5) Ayliffe B, Glanville NT. Achieving healthy body weight in teenagers: evidence-based practice guidelines for community nutrition interventions. Can J Diet Pract Res. 2010;71(4):e78-86.

(6) Ickes MJ, Sharma M. A review of childhood obesity prevention interventions targeting African American children. Vulnerable Child Youth Stud. 2011;6(1):103-123.

(7) Kelly KP, Kirschenbaum DS. Immersion treatment of childhood and adolescent obesity: the first review of a promising intervention. Obes Rev 2011 [cited 2013 Jun 26];12(1):37-49. Available from: http://onlinelibrary.wiley.com/doi/10.1111/j.1467-789X.2009.00710.x/pdf

(8) Kitzmann KM, Dalton WT,3rd, Stanley CM, Beech BM, Reeves TP, Buscemi J, et al. Lifestyle interventions for youth who are overweight: a meta-analytic review. Health Psychol. 2010;29(1):91-101.

(9) Kitzman-Ulrich H, Wilson DK, St George SM, Lawman H, Segal M, Fairchild A. The integration of a family systems approach for understanding youth obesity, physical activity, and dietary programs. Clin Child Fam Psychol Rev. 2010;13(3):231-253.

(10) Lambiase M. Treating pediatric overweight through reductions in sedentary behavior: a review of the literature. J Pediatr Health Care. 2009;23(1):29-36.

(11) Viner RM, Hsia Y, Tomsic T, Wong IC. Efficacy and safety of anti-obesity drugs in children and adolescents: systematic review and meta-analysis. Obes Rev. 2010;11(8):593-602.

(12) Czernichow S, Lee CM, Barzi F, Greenfield JR, Baur LA, Chalmers J, Woodward M, et al. Efficacy of weight loss drugs on obesity and cardiovascular risk factors in obese adolescents: a meta-analysis of randomized controlled trials. Obes Rev. 2010;11(2):150-158.

(13) Park MH, Kinra S, Ward KJ, White B, Viner RM. Metformin for obesity in children and adolescents: a systematic review. Diabetes Care. 2009;32(9):1743-1745.

(14) Garcia Diaz E, Martin Folgueras T. Systematic review of the clinical efficacy of Sibutramine and Orlistat in weight loss, quality of life and its adverse effects in obese adolescents. Nutr Hosp. 2011;26(3):451-457.

(15) Padwal R, Klarenbach S, Wiebe N, Hazel M, Birch D, Karmali S, et al. Bariatric surgery: a systematic review of the clinical and economic evidence. J Gen Intern Med. 2011;26(10):1183-1194.

Chapter 6: Cost-Effectiveness Data Extraction Table

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
MESSAGE ENVIRONMENT								
Ban on TV advertising (1) Quality score: 8	**Country:** ▪ Australia **Population:** ▪ All children (not selected by weight) ▪ Ages 5-14 ▪ No information SES/ ethnicity ▪ N=2.4 million in 2001	**Intervention:** ▪ Removal of food advertising during peak child viewing times (morning and afternoon/ evening) **Alternative intervention:** Current practice ▪ Limit amount of ads during children's time slots (5 min/30 min for 5 hour/week) and no ads for 2.5hr/week for preschool children's time slots ▪ Limits on content accuracy, cultural sensitivity, safety etc. **Duration:** ▪ NR	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention:** Total program costs: ▪ $130,000 ($120,000, $140,000) ▪ Assume this is the cost/year of program **Baseline:** ▪ $0 (no previous program) **Total cost off-sets:** ▪ $300M ($130M, $480M) **Incremental costs:** ▪ Net savings (approx): $299.87M	**Included:** ▪ 2 extra staff at the Australian Communications and Media Authority (regulatory framework already exists) ▪ Future health care costs from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Change in other food costs to families ▪ Impact on advertising revenue or sales ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving health	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** For all children 5-14: ▪ 400,000 BMI units saved (170,000, 700 000) ▪ Total DALYs saved: 37,000 (16,000, 59,000)	▪ Dominant (achieves health gain while saving money) ▪ All ICERs were less than $10/ DALY	**Sensitivity analysis:** Intervention still remained dominant if: ▪ 30 staff monitoring compliance ▪ Same method used to calculate both BMI changes for food and drinks ▪ Even if BMI benefit almost completely eroded over time, intervention would remain dominant (b/c of very low modelled cost) ▪ If lost ad revenue/ lost sales reached $2 billion, the gross ICER would still be $50,000/ DALY **Limitations:** ▪ Australian context ▪ Assume BMI reduction is maintained ▪ Likely effective, but limited evidence that can be used for this analysis ▪ Modelled estimated energy change based on results of RCT from Quebec (adjusted downwards to compensate for

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
								increased advertising in other forms) **Comments:** ▪ Used energy change to model effect on BMI and then conversion to DALYs ▪ One method to convert intake to BMI for foods and another for sugar-sweetened drinks ▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs
SCHOOL								
Education to reduce TV viewing (2-4) Quality score: NA	**Country:** ▪ Australia **Population:** ▪ Children in primary school grades 3 & 4 (age 8-10 years) ▪ Number ≈ 268,600	**Intervention:** ▪ 18 hours over 6 months delivered by classroom teachers ▪ 18 classes, 30-50 min early in academic year ▪ TV turnoff challenge ▪ 7 hour/week TV budget ▪ Lessons on intelligent TV viewing	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention :** **Total cost:** ▪ $27.7M (95% UI: $12.7M to $43.3M) ▪ Total cost/ child: $103 **Baseline:** ▪ $0 (no previous program) ▪ Total cost off-sets: NR	**Included:** ▪ Not completely reported in text ▪ All costs to public and private health sectors ▪ All costs to other sectors ▪ Project officers ▪ Full training costs for teachers ▪ Future health care costs from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Teacher time in classroom	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ BMI reduction/ child: 0.45 (0.17, 0.73) ▪ Total DALYs saved: 8600 (4,500, 12,400)	▪ Dominant (e.g. median cost saving of $44M) ▪ Range: large chance of being dominant (98.9%)	**Sensitivity analysis:** ▪ NR **Limitations:** ▪ Assume BMI reduction is maintained ▪ Inconclusive evidence of effectiveness ▪ Australian context **Comments:** ▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
		▪ Newsletters to parents with strategies **Baseline intervention:** ▪ Current practice/no intervention **Duration:** ▪ 6 months		**Incremental costs:** ▪ Net savings (includes offsets): ($43.8M) (95% UI: net saving of $81.8M to net saving of $6.6M)	(as integrated into curriculum) ▪ Parental involvement encouraged, but not included ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving health			losses saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs ▪ Implemented in only grade 3 ▪ School type would not affect uptake (50%)
Education to reduce consumption of fizzy drinks (2-4) Quality score: NA	**Country:** ▪ Australia **Population:** ▪ Children in primary school grades 2 to 6 (age 7-11 years) ▪ Number ≈ 595,000 imple-mented over 5 years (119,000 each year)	**Intervention:** ▪ 4 x 1 hour educational session/ year by study investigator ▪ Achievement of good health ▪ Promotion of drinking water ▪ Fruit tasting ▪ Tooth decay in fizzy drinks ▪ Song and music competition ▪ Art presentations ▪ Classroom quiz game **Alternative/ baseline intervention:** ▪ Current practice/no intervention **Duration:** ▪ 1 year	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention :** ▪ Total cost: $16.6M (95% UI: $7.6M to $32.2M) ▪ Total cost/ child: $28 **Baseline:** ▪ $0 (no previous program) ▪ Total cost off-sets: NR **Incremental costs:** ▪ Net savings (includes offsets): ($26.7M) (95% UI: net saving of $112.7M to net cost of $32.0M)	**Included:** ▪ Not completely reported in text ▪ All costs to public and private health sectors ▪ All costs to other sectors ▪ No additional school staff costs as external field presenters deliver sessions ▪ Program fully coordinated and funded by government ▪ Future health care costs from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving health	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ BMI reduction/ child saved: 0.13 (0.08, 0.34) ▪ Total DALYs saved: 5,300 (1,300, 17,000)	▪ Dominant (e.g. median cost saving $26M + health gain of 5,000 DALYs prevented) ▪ Range: large chance of being dominant (81%) through to small chance of being dominated (7.6%)	**Sensitivity analysis:** ▪ NR **Limitations:** ▪ Assume BMI reduction is maintained ▪ Australian context ▪ Limited evidence of effectiveness ▪ 1 RCT showed decrease in prevalence of overweight/obesity, but not BMI (used to model) ▪ 2 prospective cohort studies show association of BMI and fizzy drink consumption **Comments:** ▪ Assume child receives intervention only once ▪ 1/5 of schools need to be visited each year ▪ Assume uptake does not vary by school type ▪ Modelled on an RCT in UK

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
								▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs
Targeted multi-faceted school-based program (2-4) Quality score: NA	**Country:** ▪ Australia **Population:** ▪ Overweight or obese children ▪ Age: 7-10 years (grades 2-5) ▪ Number ≈ 17,000 over 4 years (4,200 each year)	**Intervention:** ▪ Peer-led program with counselling and social support ▪ Peers are 8th graders ▪ Trained to weigh children, check lunches and recommend changes in eating/exercise habits ▪ Meet 3x weekly to check foods and weigh ▪ Give sticker rewards ▪ 15min/ week with psychologists ▪ 15min/week exercise class ▪ 2x lessons for parents by psychologists	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention :** ▪ Total cost: $2.2M (95% UI: $1.2M to $4.1M) Total cost/ child: $129 **Baseline:** ▪ $0 (no previous program) **Total cost offsets:** ▪ NR **Incremental costs:** ▪ Net savings (includes offsets): ($1.2M) (95% UI: net saving of $5.7M to net cost of $0.38M)	**Included:** ▪ Not completely reported in text ▪ Counsellors, as publicly funded psychologists employed on a part-time basis ▪ All costs to public and private health sectors ▪ All costs to other sectors ▪ Future health care costs from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving health	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ BMI reduction/ child saved: 0.52 (0.10, 0.94) ▪ Total DALYs saved: 360 (90, 1100)	▪ Dominant (e.g., overall cost saving of $1.3M + health gain of 360 DALYs prevented) ▪ 91% chance of being dominant	**Sensitivity analysis:** ▪ NR **Limitations:** ▪ Assume BMI reduction maintained ▪ Australian context ▪ Limited evidence of effectiveness **Comments:** ▪ Modelled as implemented over 4 years rather than implementing it to everyone eligible every 4 years ▪ Modelled based on trial conducted in 1985 (one small randomized trial in US) ▪ Assume uptake of school by type would not differ (50% uptake) ▪ Assume children only need once in their lifetime, so one quarter of schools would need to be visited each year

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
		Baseline intervention: ▪ Current practice/no intervention **Duration:** ▪ 12 weeks						▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs
Multi-faceted school-based intervention with active physical education (2-4) Quality score: NA	**Country:** ▪ Australia **Population:** ▪ Children in primary school grades 1, 2 & 3 (commencing grade 1, age 6 years) ▪ Number ≈ 114,630	**Intervention:** ▪ Based on "Know Your Body" ▪ Manios is a modification of this program, which incorporates an active physical exercise component ▪ 13-17 hours/ academic year of nutrition/ health teaching ▪ 4-6 hours/ academic year of physical activity education ▪ Parental involvement with annual school meetings + information booklets ▪ 2 x 45 min practical	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention :** ▪ Total cost/ year: $54.2M (95% UI: $26.9M to 87.5M) ▪ Total cost/ child: $473 **Baseline:** ▪ $0 (no previous program) **Total cost offsets:** ▪ NR **Incremental costs:** ▪ Net saving (includes offsets): ($14.0M) (95% UI: net saving of $41.9M to net cost of $1.3M)	**Included:** ▪ Not completely reported in text ▪ Costs over 3 years, take as representative annual costs b/c concomitant cohorts ▪ Central and school coordination costs ▪ All costs to public and private health sectors ▪ All costs to other sectors ▪ Future health care costs from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Teacher time (part of curriculum already) ▪ Parental involvement encouraged, but not included ▪ Children's time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ BMI reduction/ child saved: 1.1 (0.82, 1.38) ▪ Total DALYs saved: 8000 (3500, 13500)	▪ Dominant (e.g., median cost saving of 14M) ▪ Range: large chance of being dominant (95.6%)	**Sensitivity analysis:** ▪ NR **Limitations:** ▪ Assume BMI reduction is maintained ▪ Australian context ▪ Effectiveness is not established ▪ One non-RCT studies showed significant BMI benefit for girls only, variations have shown mixed results **Comments:** ▪ Assume uptake does not vary by school type (50% uptake) ▪ Modelled on controlled, non-randomized trial in Greece ▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
		physical exercise classes/week for academic year **Baseline intervention:** ▪ Current practice/no intervention **Duration:** ▪ 3 years			maintaining or improving health			was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs
CATCH (5) Quality score: 7.5	**Country:** ▪ US **Population:** ▪ Ages: 8-11 ▪ Majority Hispanic low-income school (62) ▪ N Intervention: 423 ▪ N Control: 473	**Intervention:** ▪ Classroom curriculum at each grade level ▪ Physical education program ▪ Modifications to school food service ▪ Family/home-based programs **Baseline intervention:** ▪ Current practice/ no intervention ▪ Usual curricula and physical education classes **Duration:** ▪ 3 years	**Perspective:** ▪ Societal **Time horizon:** ▪ 25 years (40-65 years) **Year of costing:** ▪ 2004 **Currency:** ▪ USD **Discount:** ▪ 3%	**Intervention:** ▪ Total Intervention costs for 3 years: US$44,039 **Baseline:** ▪ $0 **Total cost off-sets:** ▪ Medical costs averted: US$36,348 **For Net-Benefit Analysis:** ▪ Costs of lost labour productivity averted: US$75,816	**Included:** ▪ Training ▪ Teachers and physical education teacher, counsellor, food specialist ▪ Promotional costs ▪ Averted future health costs (ages 40-64) ▪ Labour productivity costs (net benefits analysis only) (ages 40-64) **Excluded:** ▪ Materials (subsidized by NGOs) ▪ No health costs measured outside 40-64 years	**Outcome:** Prevalence of overweight (≥85th percentile) **Intervention:** ▪ Boys: 1% increase ▪ Girls: 2% increase **Baseline:** ▪ Boys: 9% increase ▪ Girls: 13% increase **Incremental:** ▪ Cases of overweight averted: 14.93 ▪ QALYs saved: 8.55	**ICER:** ▪ US$900/QALY saved Using Hispanic parameters: US$903/QALY saved **Net Benefit:** ▪ US$68,125 using Hispanic parameters: US$43,239	**Sensitivity analysis:** ▪ Robust to changes in estimates ▪ Sensitive to discount rate **Limitations:** ▪ No accounting for costs between the ages of 20-40 ▪ Did not include all costs of the program **Comments:** ▪ Use CATCH results (obesity status at age 11) to estimate cases averted in 25-29 year olds and then use this to estimate cases averted in 40-64 year olds ▪ ICER based on estimates of health costs for both male and females

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
				Incremental costs: ▪ Total intervention-medical costs averted: US$7,691				
Planet Health (6) Quality score: 8	**Country:** ▪ US **Population:** ▪ Middle school in Boston ▪ Grades 6 and 7 ▪ N= 310 girls and 331 boys completed the trial	**Intervention:** ▪ School-based program with interdisciplinary curriculum ▪ Materials in major subject areas and physical education ▪ Decrease TV and consumption of high-fat foods ▪ Increase physical activity and healthy eating **Baseline intervention:** ▪ Current practice/no intervention ▪ Usual curricula and physical education classes **Duration:** ▪ 2 years	**Perspective:** ▪ Societal **Time horizon:** ▪ 25 years (40-65 years) **Year of costing:** ▪ 1996 **Currency:** ▪ USD **Discount:** ▪ 3%	**Intervention:** Per trial: ▪ Total costs for 2-year program: $33,677 ▪ Total cost/ student for 2-year program: $14 **Baseline:** ▪ $0 **Total cost off-sets:** ▪ Medical costs averted: $15,887 ▪ Costs of lost productivity averted: $25,104 **Incremental costs:** ▪ Total costs for 2 year program-future medical costs averted: $17,790	**Included:** ▪ Intervention costs (training and materials, no extra costs for teachers b/c part of normal school day) ▪ Monetary incentives ▪ Medical costs associated with adult obesity (ages 40-64) ▪ Productivity losses associated with adult obesity (ages 40-64) **Excluded:** ▪ No health or productivity costs measured outside 40-64 years	**Outcome:** ▪ Prevalence of obese students **Intervention:** ▪ Decreased by 3.3% **Baseline:** ▪ Increased by 2.2% **Incremental:** ▪ Prevented 1.9% of female students from becoming overweight adults ▪ 4.13 QALYs saved	**ICER:** ▪ $4,305/QALY saved **Net Benefit:** ▪ $7,313	**Sensitivity analysis:** ▪ Findings were generally robust (cost-effective and cost-saving in all scenarios) ▪ Sensitive to discount rate and teacher's stipend amount ▪ Mean from 10,000 simulation trials with variation of 10 parameters: $4,397 (95% CI: 1,612 to 9,010) **Limitations:** ▪ RCT didn't find significant reduction of obesity in boys, but used effectiveness found among girls as the total effectiveness ▪ Intervention costs were estimated for all participants (n=1,203), but effectiveness was estimated based on 310 participants (females only) ▪ Possible bias due to removal of those lost to follow-up ▪ Number of cases of adult overweight was estimated in a two-stage process (not directly measured)

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
								▪ Assume weight reduction was maintained because no data available ▪ Obesity definitions have changed and are not exactly the same as those used to predict adult obesity **Comments:** ▪ More research is needed on the relationship between overweight in children and obesity in adults, QALYs of overweight in adults and non-overweight adults
Multi-faceted school-based intervention without active physical education (2-4) Quality score: NA	**Country:** ▪ Australia **Population:** ▪ Children in primary school grades 1 and 2 (commencing in grade 1, age 6 years) ▪ Number ≈ 114,630	**Intervention:** ▪ Tamir intervention-based on Know Your Body ▪ Teachers deliver intervention ▪ 15-20 hours of teaching on health, nutrition and physical activity per academic year for 2 years ▪ No additional physical activity **Alternative/ baseline intervention:** ▪ Current practice/no intervention	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention:** ▪ Total cost/ year: $24.3M (UI: $12.6M to $39.2M) ▪ Total cost/ child: $211 **Baseline:** ▪ $0 (no previous program) **Total cost off-sets:** ▪ NR **Incremental costs:** ▪ Net cost (includes offsets):	**Included:** ▪ Not completely reported in text ▪ Costs over 2 years, take as representative annual costs b/c concomitant cohorts ▪ Central and school coordination costs ▪ All costs to public and private health sectors ▪ All costs to other sectors ▪ Future health care cost from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Teacher time (program integrated into curriculum) ▪ Parental involvement encouraged but not included ▪ Children's intervention time costs	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ BMI reduction per child: <u>Boys:</u> ▪ 0.14 (0.20, 0.48) <u>Girls:</u> ▪ 0.31 (0.0004, 0.62) **Total DALYs saved:** <u>Boys:</u> ▪ 500 (600, 2100)	**All children:** ▪ $6,000 per DALY prevented ▪ Range: 14.7% chance of being dominant to a 5.3% chance of being dominated **Girls:** ▪ $13,000/DALY prevented **Boys:** ▪ $40,000/DALY prevented	**Sensitivity analysis:** ▪ NR **Limitations:** ▪ Assume BMI reduction is maintained ▪ Not clear if this was modelled on a previous study or on a new study ▪ Australian context ▪ Effectiveness was not established ▪ One non-RCT studies showed significant BMI benefits for girls only, variations have shown mixed results **Comments:** ▪ Assume uptake does not vary by school type (50% uptake)

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
		▪ Duration: 2 years		▪ $9.0M (95% UI: net saving of $9.1M to net cost of $31.7M)	▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving health	Girls: ▪ 1000 (200, 2800)		▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs
TravelSMART Schools Curriculum (7) Quality score: 8.5	**Country:** ▪ Australia **Population:** ▪ Ages: 10-11 years ▪ No information SES/ ethnicity ▪ Not selected by weight N=267,700 children for curriculum components (up to 956,206 students (5-11 years) in whole-of-school approach)	**Intervention:** ▪ Curriculum-based program ▪ Classroom activities (20 hours over 4 weeks) ▪ Whole-of-school events ▪ Primarily classroom-based ▪ Promotes active transport to school **Baseline intervention:** ▪ Current practice/no intervention **Duration:** Modelled for 1 year	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing**: ▪ 2001 **Currency:** ▪ AUD **Discount:** 3%	**Intervention :** ▪ Total program costs: $13.3M ($6.9M, $22.8M) (Assume this is the cost/year of program) **Baseline:** ▪ $0 (no previous program) **Total cost off-sets:** ▪ $750,000 (-$300,000, $1.9M) **Incremental costs:** Net cost: $12.55M	**Included:** ▪ All costs to participants and families ▪ Costs to all other sectors involved ▪ Recruitment ▪ Training lessons ▪ Promotion ▪ Coordination ▪ Support ▪ Evaluation ▪ Activities ▪ Future health care cost from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Set-up and research and development prior to recruitment phase ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ 890 BMI units saved (–500, 2,900) Total DALYs saved: 95 (–40, 230)	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ 890 BMI units saved (–500, 2,900) Total DALYs saved: 95 (–40, 230)	**Sensitivity analysis:** ▪ Becomes more cost-effective as a larger per cent of total costs are attributed to non-obesity objectives (becomes cost-effective at 55%) ▪ Non-obesity objectives included reduced traffic congestion, accidents and pollution around schools ▪ Exclusion of teacher travel cost reimbursement had negligible impact on ICER ▪ Uncertainty around ICER (uncertainty of costs for coordinator's position, number of school, outcome) ▪ 6.6% change intervention would be cost-effective (Less than $50,000/DALY) ▪ 7.8% chance that intervention would be dominated

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
					maintaining or improving health			**Limitations:** ▪ Limited evidence of effectiveness (based on 1 small pilot study) ▪ Low survey response rate ▪ Only measured change in per cent of students in active transport ▪ Program has since changed ▪ Assume BMI reduction is maintained ▪ Australian context ▪ Primary purpose of program was not obesity prevention **Comments:** ▪ Assumed no effect of active transport on other energy expenditure ▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs
Walking School Bus (8) Quality score: 9	**Country:** ▪ Australia **Population:** ▪ Primary	**Intervention:** ▪ Walk to school by set route through neigh-bourhoods with adult volunteers	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years	**Intervention :** ▪ Total costs/ year (gross): $22.8M (95% UI: $16.6M to 30.9M)	**Included:** ▪ All costs to participants and families ▪ Costs to all other sectors involved ▪ Central coordination ▪ Recruitment of	**Intervention:** ▪ NR **Baseline:** ▪ NR	▪ $0.76M per DALY prevented ($0.23M, $3.32M)	**Sensitivity analysis:** Intervention became cost-effective when there was: ▪ Attribution of a portion of costs to non-obesity-related objectives

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
	school-children ▪ Ages: 5-7 ▪ No information SES/ ethnicity ▪ Not selected for by weight ▪ N=7,840	**Baseline intervention:** ▪ Current practice/no intervention **Duration:** ▪ 1 year	**Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	▪ Total costs per child for one day a week/year: $2,900 **Baseline:** ▪ $0 (no previous program) ▪ Total cost off-sets: $0.24M ($0.05M, $0.86M) **Incremental costs:** ▪ Net cost/ year: $22.56M	governments and schools ▪ Local officer time ▪ Volunteer time ▪ Future health care costs from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Set-up and research and development prior to recruitment phase ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving health	**Incremental:** ▪ 270 BMI units saved (40, 1,300) ▪ Reduction of 0.03 (95% UI: 0.01 to 0.11) BMI units per child ▪ Total DALYs saved: 30 (7, 104)		(e.g., reducing traffic congestion) ▪ Annuitisation of fixed costs ▪ Improved capacity utilization and cost-cutting measures (only under very optimistic scenario) ▪ Increase proportion of children new to active transport (under optimistic scenario) **Limitations:** ▪ Program wasn't intended to be an obesity prevention program (meant to increase number of children walking to school) ▪ Modelled CE on low uptake of program ▪ Assumed BMI reduction was maintained ▪ Australian context ▪ Limited evidence of effectiveness **Comments**: ▪ Used metabolic equivalents to convert to BMI change, then to DALYs ▪ Assumed no change in physical activity at other times or energy intake levels ▪ Under current modelling assumptions, this program is not effective or cost-effective

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
								▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from to BMI to DALYs
APPLE (A Pilot Program for Lifestyle and Exercise) (9) Quality score: 7	**Country:** ▪ New Zealand **Population:** ▪ Primary school age ▪ Ages: 5-12 ▪ Predominately white ▪ Not selected by weight (most were normal weight) ▪ Schools in small communities ▪ N=279	**Intervention:** ▪ Target changes in schools and wider community environment ▪ Provision of activity coordinators and nutrition education ▪ Increase physical activity in school (during class, recess and lunch) and after school ▪ Cooled water filter and free fruit (for 6 months) in schools ▪ Community nutrition resources **Baseline intervention:** ▪ Current ▪ **Duration:** 2 years	**Perspective:** ▪ Societal **Time horizon:** ▪ 0 years **Year of costing:** ▪ 2006 **Currency:** ▪ NZD **Discount:** ▪ 5%	**Intervention:** ▪ Total cost for 2-year intervention: NZ$357,490 ▪ Cost/child for 2-year intervention: NZ$1,281 **Baseline:** ▪ $0 **Total cost off-sets:** ▪ NA **Incremental costs:** ▪ Total cost for 2 -year intervention: NZ$357,490 ▪ Cost/child for 2 year intervention: NZ$1,281 ▪ After discounting: NZ$332,952	**Included:** ▪ Estimated with conservative approach ▪ Coordinators ▪ Admin costs ▪ Training ▪ Monitoring equipment ▪ Overhead cost ▪ Program implementation costs **Excluded**: ▪ One-off costs such as research costs and development cost ▪ Time costs of children/ parents- unclear how to measure ▪ Future health care costs averted	**Intervention:** ▪ BMI z-score mean (SD) pre: 0.61 (0.82), post: 0.45 (1.00) **Baseline:** ▪ BMI z-score mean (SD) pre: 0.80 (0.87) post: 0.90 (0.82) **Incremental:** ▪ BMI z-score significantly lower in intervention group (−0.26, 95% CI: −0.32 to −0.21) (mean difference adjusted for baseline value, other variables)	**7 year olds:** ▪ $1,708/kg of weight gain prevented (average weight gain prevented of 0.75 kg) **13 year olds:** ▪ $664/kg of weight gain prevented (average weight gain prevented 1.93 kg) ▪ (Did not report incremental cost/decrease in BMI z-score)	**Sensitivity analysis:** ▪ Only looked at sensitivity for effectiveness, not cost-effectiveness **Limitations:** ▪ Discounted only the difference in intervention costs between years ▪ Did not measure future health care cost savings ▪ On average intervention group had a slightly lower BMI at baseline ▪ Small sample size and short follow-up ▪ Measured health-related quality of life (HRQoL) with the Health Utilities Index (HUI), but unable to calculate QALYs ▪ Unknown public health significance of incremental cost per kg of weight gain **Comments:** ▪ Prevalence of

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				(or NZ$1,193 per child for 2 years).				overweight did not differ at end of intervention (Taylor, 2007) ▪ HUI questions were non-specific to childhood obesity, and most children were normal weight at start of intervention ▪ Mean HUI values did not differ between intervention and control participants
AFTER SCHOOL								
Active After-school Communities (AASC) program (10) Quality score: 8.5	**Country:** ▪ Australia **Population:** ▪ Ages: 5-11 ▪ Target: inactive children ▪ Not selected by weight ▪ N= 82,500 (assume 57,757 (70%) receive benefit from attendance)	**Intervention:** ▪ Physical activity program during 3-5 pm time slot ▪ In primary schools and out-of-school hours care locations ▪ 2-3 sessions per week for 8 weeks for each of the 4 school terms per year ▪ Small grants to participating schools and organizations to deliver programs **Baseline intervention:** ▪ Current practice/no intervention	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention:** ▪ Total cost for program/ year: $40.3M ($28.6M, $56.2M) **Baseline:** ▪ $0 (no previous program) **Total cost off-sets:** ▪ $3.7M ($2M, $6.3M) **Incremental costs:** ▪ Net cost: $36.6M	**Included:** ▪ All costs to health sector, participants, families and other sectors are included ▪ Central coordination and recruitment of sites ▪ Program delivery planning ▪ Routine operation ▪ Routine support, monitoring, and evaluation ▪ Future health care costs from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Set-up and research and development phase ▪ External evaluation and program maintenance ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ Total DALYs saved: 450 (2,450, 770)	▪ $82,000 per DALY prevented ($40,000, $165,000)	**Sensitivity analysis:** ▪ Not found to be cost-effective with potential cost-cutting measures (increase sites/coordinator, reduce number of coordinators, same wages for all coordinators) ▪ Sources of uncertainty around ICER were number of children enrolled per school and grant funding per school ▪ Would approach cost-effectiveness if 100% of participants received full benefit (were previously inactive) ▪ Only 8.9% chance ICER would be cost-effective **Limitations:** ▪ No evidence of effectiveness at

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
		Duration: ▪ 1 Year			▪ Expenditure related to personal activities for maintaining or improving health			this stage ▪ Assume BMI reduction is maintained ▪ Assume program did not lead to changes in energy intake/ expenditure at other times, and 50% of participants were not previously active ▪ Australian context **Comments:** ▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs ▪ No extra cost for families, but some were already paying a fee to attend out-of-school hours care and would have to continue to do so ▪ Most costs fell on government (regional co-ordinators) ▪ Potential side effects (labelled "fat" because of participation) and long-term funding issues

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
Medical College of Georgia FitKid Project (11) Quality score: 6	**Country:** ▪ US **Population:** ▪ Ages: Third graders ▪ N=601 (Only 182 attended at least 40%, and only these were included in cost-effectiveness analysis)	**Intervention:** ▪ After-school program ▪ Environment that encourages moderate to vigorous physical activity ▪ Discourages sedentary behaviour ▪ 2-hour sessions 5x week ▪ 40 min academic enrichment and healthy snack ▪ 80 min physical activity **Baseline intervention:** ▪ No Intervention: usual after-school care parental or non-parental **Duration:** ▪ Analysis of 1st-year results (will be 3 years in total)	**Perspective:** ▪ Societal **Time horizon:** ▪ 0 years **Year of costing:** ▪ 2003 **Currency:** ▪ USD **Discount:** ▪ NA	**Intervention:** ▪ Total cost for 1 school year (182 kids): $174,070 ▪ Cost/child for the year: $956 **Baseline:** ▪ Total estimated cost/ child/year: $639 (average attendance as intervention (67.1%)) **Total cost off-sets:** ▪ NA **Incremental costs:** ▪ $317/child/ year	**Included:** *Intervention:* ▪ Personnel ▪ Training ▪ Transportation ▪ Materials *Baseline:* ▪ Cost of usual after-school care: parental or non-parental **Excluded:** ▪ Future health costs ▪ Other potential benefits	**Intervention:** ▪ Reduced per cent body fat: 0.7% **Baseline:** ▪ Reduced per cent body fat by: 0.1% **Incremental:** ▪ Reduced per cent body fat by 0.76% (95% CI: 1.42 to 0.09)	▪ $417 per 1% body fat reduction	**Sensitivity analysis:** ▪ Uncertainty around actual per capita cost of usual after-school care ▪ When cost of usual after-school care varied from $5-$10, ICER changed from $98 to $52/0.76% body fat reduction ▪ Could be more cost-effective if attendance was higher **Limitations:** ▪ Difficult to interpret ICER and hard to compare to other published studies (public health significance of 1% reduction in body fat is not known) ▪ Only first year of a 3-year intervention ▪ Estimates on costs for after-school care for control group ▪ No uncertainty intervals around ICER **Comments:** ▪ RCT used to evaluate effectiveness and intention-to-treat (ITT) analysis, there was no significant difference between groups ▪ No attendance requirements ▪ Higher costs if programs are run

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
								outside schools because cost of space rentals ▪ Personnel accounted for the majority of costs
HEALTH CARE								
Laparoscopic adjustable gastric banding (LAGB) Surgery (12) Quality score: 8.5	**Country:** ▪ Australia **Population:** ▪ Ages: 15-19 years ▪ Severely obese population (BMI≥35 kg/ m²) ▪ Private health insurance holders (LAGB is covered by Medicare but currently largely accessible only in private hospitals, so affordable only to those with private insurance) ▪ N=4120	**Intervention:** LAGB plus standard care ▪ Laparoscopic placement of an adjustable silicone band around the upper part of the stomach to produce a small stomach pouch with the patient under general anesthesia, with the port secured to the abdominal wall (less efficient, but has fewer complications than other types of bariatric surgery) **Baseline intervention:** ▪ Current practice/ no intervention **Duration:** ▪ Immediate, followed for BMI change for 3 years	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention :** ▪ Total interven-tion cost: $130M (95% UI: 52M to 265M) ▪ Total cost/ youth: $31,0000 **Baseline:** ▪ NR- difficult to define the resource use and benefits of this group **Total cost off-sets:** ▪ $75M (95% UI: 30.5M to 150M) **Incremental costs:** ▪ Net cost: $55 M	**Included:** ▪ All costs to participants and families (not on health sector b/c done in private hospitals) ▪ Replacement prosthesis and future follow-up ▪ Future health care costs from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Costs of private health insurance ▪ Costs of co-morbidities ▪ Informal care ▪ Medication costs: not available and considered to be minor ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving health	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ 55,400 BMI units saved (95% U: 12,600 to 140,000) ▪ Total DALYs saved: 12,300 DALYs (95% UI: 5000 to 24,670)	▪ $4,400 per DALY prevented (95% UI: 2,900 to 6,120)	**Sensitivity analysis:** ▪ Small variation in patient's resource use ▪ Uncertainty from cost of LAP-BAND system ▪ Patients would have to regain about 80% of weight before it is cost-ineffective **Limitations:** ▪ High out-of-pocket expenses for patients/ families ▪ Only based on data of 28 youths at one centre ▪ Assume BMI reduction at 3 years is maintained ▪ Sample might not have been large enough to detect low-probability events ▪ Australian context ▪ Experience surgical team, lack of adverse effects and success not necessarily possible to replicate elsewhere **Comments:** ▪ Possible unacceptability to stakeholders ▪ Equity issues (rural/ remote and low SES) ▪ Society perspective,

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								but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs ▪ To make more widely available, capacity should be created in public hospital system (large initial capital, training expenses and learning curve for surgeons)
Orlistat therapy (2-4) Quality score: NA	**Country:** ▪ Australia **Population:** ▪ Obese youth Ages: 12–16 years ▪ N=3256	**Intervention:** ▪ 120 mg of Orlistat, given 3x daily orally ▪ Dietary, exercise and behaviour modifications ▪ In existing health care setting ▪ 17 consultations with GP ▪ 4 consultations with dietician **Baseline intervention:** ▪ Current practice/no intervention	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention :** ▪ Total cost: $6.3M (95% UI: $1.4M to $20.0M) ▪ Total cost/ child: $1,935 **Baseline:** ▪ $0 (no previous program) **Total cost off-sets:** ▪ NR **Incremental costs:** ▪ Net cost (includes offsets):	**Included:** ▪ Not completely reported in text ▪ All costs to public and private health sectors and other sectors ▪ Costs to parents ▪ Future health care cost from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ Mean BMI reduction/ child: 0.86 (95% CI: 0.37 to 1.34) ▪ Total DALYs saved: 450 (95% UI: 67 to 1800)	▪ $8,000 per DALY prevented ($3,000; $30,000)	**Sensitivity analysis:** ▪ NR **Limitations:** ▪ Modelled effectiveness based on 1 small RCT ▪ Australian context ▪ Assume BMI reduction is maintained ▪ No definitive long-term risk-benefit profile in adolescents ▪ GI side effects ▪ Orlistat not covered by Medicare and costs impact access **Comments:** ▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
		Duration: ▪ 12 months		$4.9M (95% UI: $1.1 M to $15.9M)	health ▪ Health costs associated with side effects			saved ▪ Assume intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs ▪ Non-adherers contribute costs, but not BMI loss (ITT approach) ▪ Only patients who were responsive to Orlistat assumed to continue past 2-week run-in period
Modelled on LEAP (live, eat and play (13) Quality score: 8.5	**Country:** ▪ Australia **Population:** ▪ Overweight or moderately obese (excludes BMI z-score ≥ 3.0) ▪ Ages: 5-9 ▪ No information SES/ ethnicity ▪ N=9685	**Intervention:** ▪ Family-based management program ▪ Focuses on lifestyle, diet and exercise ▪ Brief solution-focused techniques to modify behavioural determinants of physical activity and nutrition **Alternative/ baseline intervention:** ▪ Current practice/no intervention **Duration:** ▪ 12 weeks (4 consultations)	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention:** ▪ Total costs for 12 week program (gross): $6.3M (95% UI: $5.3M to 7.4M) **Baseline:** ▪ $0 (no previous program) **Total cost offsets:** ▪ $3.3M ($0.6M, $7.5M) **Incremental costs:** ▪ Net cost: $3.0M	**Included:** ▪ GP recruitment and training costs ▪ Costs based on delivery of intervention by GPs to patients ▪ Equipment ▪ Recruitment of children ▪ Consultations ▪ Resources material for families ▪ Time and travel costs for families ▪ Future health care cost from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Costs associated with changing behaviours (gym fees, time/travel costs of parents/ children associated with increasing physical activity or improved dietary habits,	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ 2300 BMI units saved (1100; 6000) ▪ Totally DALYs saved: 511 (90; 1156)	▪ $4670 per DALY prevented (dominated; $0.1M)+	**Sensitivity analysis:** ▪ Variability in the intervention costs related to number of GPs and of patients recruited ▪ Lower recruitment rates did not significantly impact cost-effectiveness ▪ When outlier was removed reduced net ICER ($3,000/DALY saved) ▪ Incentives to GPs reduced net ICER ($2,900/DALY saved) ▪ Based on uncertainty analysis: – 80% chance it is cost-effective by ACE-obesity standards – 9.5% of iterations were dominated (health loss with

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
		BMI assessed at 9 months			▪ time costs involved in changing dietary habits of child) ▪ Set-up and research and development phase ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving health ▪ Benefits to parents/family			higher costs) – 8.4% were dominant (health gain and cost savings) **Limitations:** ▪ Assume BMI reduction is maintained, recent evidence suggests this may not be true ▪ Australian context ▪ Lack of data of intervention's effectiveness ▪ Did not find significant effect in original trial, which could relate to small sample size or Hawthorne effect ▪ Possible stigmatization of bullying and potential to exacerbate eating disorders **Comments:** ▪ Larger RCT under way ▪ Scaled up/extrapolated to national level and assumptions for real-life setting- based on small LEAP trail of 34 doctors 73 children in the intervention and 80 in the control ▪ Trial had one large outlier ▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assume intervention

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
								was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs
LEAP (Live, Eat and Play) (14) Quality score: 6	**Country:** ▪ Australia **Population:** ▪ Ages: 5-9 ▪ Overweight and obese children (excludes very obese children with BMI z-score ≥3.0) ▪ N=82 intervention and 81 control ▪ At 15 months follow-up: 64 intervention and 70 control	**Intervention:** ▪ 4 consultations with GP over 12-week period (with or without their child present) ▪ Brief secondary prevention intervention delivered by GPs to reduced weight gain by targeting physical activity and dietary habits **Baseline intervention:** ▪ Current practice/no organized program **Duration:** ▪ 12 weeks, 9- and 15-month follow-up	**Perspective:** ▪ NR **Time horizon:** ▪ 0 years **Year of costing:** ▪ 2003 **Currency:** ▪ AUD **Discount:** ▪ NA	**Intervention:** ▪ Mean total cost/child: $48,047 ▪ Mean total health care costs: $873 ▪ Total costs of just LEAP program delivery/ child: $705 **Baseline:** ▪ Mean total cost/child: $43,953 ▪ Mean total health care costs:$64 **Total cost off-sets:** ▪ NA **Incremental costs:** Cost/child for intervention and up to 15 months later: $4,094 ($864 to $7324)	**Included:** ▪ Resources required to repeat the intervention ▪ Health care resources (GP visit) ▪ Family resources (time and money for dietary changes) including shopping, preparing meals, etc. ▪ Staff time and materials used to train GPs ▪ Equipment ▪ Travel costs **Excluded:** ▪ Development ▪ Staff time for training ▪ Research costs ▪ Future health cost savings ▪ Children's time	**Intervention:** ▪ BMI at 15 months: 21.7 (3.1) **Baseline:** ▪ BMI at 15 months: 21.2 (2.4) **Incremental:** ▪ Mean BMI difference between groups at 15 months: -0.0 (-0.5 to 0.5) ▪ No significant difference in BMI z-score at 15 months ▪ Significant BMI difference between groups at 9 months, but not sustained at 15 months	▪ Dominated (no effect and intervention is more costly)	**Sensitivity analysis:** ▪ Reduction in cost (by half) when parent's time is valued less because few parents reported they would otherwise be working ▪ Improvements with economics of scale-more cases/GP ▪ Small improvements if unit cost of GP visit is lowered, but most costs come from outside health sector **Limitations:** ▪ Small trial ▪ Short intervention ▪ Few children per GP **Comments:** ▪ RCT design ▪ Majority of costs come from parents ▪ Secondary outcomes: – Significant difference in daily dietary habits at 15 months of follow-up – No difference in physical activity measures ▪ Authors didn't feel the evidence on long-term sequelae of childhood obesity was strong

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
								enough to support modelling of future health cost savings
LEAP 2 (15) Quality score: 5	**Country:** ▪ Australia **Population:** ▪ Ages: 5-10 ▪ Overweight and obese children (excludes very obese children with BMI z-score ≥3.0) ▪ N=258 (139 in intervention)	**Intervention:** ▪ GPs use brief, solution-focused approach ▪ Make and record healthy lifestyle goals ▪ 4 consultations over 12 weeks **Baseline intervention:** ▪ Current practice/no organized program **Duration:** ▪ 12 weeks	**Perspective:** ▪ Health sector **Time horizon:** ▪ 0 years **Year of costing:** ▪ 2007 **Currency:** ▪ AUD **Discount:** ▪ NA	**Intervention:** ▪ Total cost/ intervention child: $1,317 **Baseline:** ▪ Total cost/ control child: $81 **Total cost off-sets:** ▪ NA **Incremental costs:** ▪ Difference/ child: $1,236 (95% CI $1,205 to $1,267)	**Included:** ▪ BMI surveillance ▪ GP recruitment and training ▪ GP consultations **Excluded:** ▪ Future health care savings	**Intervention:** ▪ Mean (SD) BMI at 12 month: 20.8 (2.8) **Baseline:** ▪ Mean (SD) BMI at 12 month: 21.0 (2.4) **Incremental:** ▪ Mean BMI difference (95% CI) at 12 months : −0.11 (−0.45 to 0.22)	▪ Dominated (no effect and intervention is more costly)	**Sensitivity analysis:** ▪ GPs have an artificially small number of children (2.1 per GP in this trial), but if GPs had 30 children costs would be much lower, but would still not be cost-effective ▪ No evidence that attending more consultations improved BMI at 6 or 12 months **Limitations:** ▪ Study was underpowered ▪ Very short RCT (may need longer duration to be effective) **Comments:** ▪ Pooled results with LEAP1 and still did not find significant difference ▪ Prevalence of overweight/ obesity was also not significantly different ▪ No physical or psychosocial harm ▪ No evidence of contamination ▪ High retention rate ▪ No marked improvement on physical activity, nutrition, parental weight

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
Targeted family-based program (2-4) Quality score: NA	**Country:** ▪ Australia **Population:** ▪ Obese children aged 10-11 years ▪ Number ≈ 5 800	**Intervention:** ▪ Opportunistic recruitment by GPs ▪ Medical examination/ dietary counselling ▪ 6 family therapy sessions (pediatrician and psychologist) ▪ 3 medical checks through therapy program ▪ Hospital setting, but could be offered elsewhere **Alternative/ baseline intervention:** ▪ Current practice/no intervention **Duration:** ▪ 14-18 months	**Perspective:** ▪ Societal **Time horizon:** ▪ Rest of life or 100 years **Year of costing:** ▪ 2001 **Currency:** ▪ AUD **Discount:** ▪ 3%	**Intervention :** ▪ Total cost $11.0M (95% UI: $6.8M to $18.3M) ▪ Total cost/ child: $1,896 **Baseline:** ▪ $0 (no previous program) **Total cost offsets:** ▪ NR **Incremental costs:** ▪ Net savings (includes offsets): $4.0M (95% UI: net saving of $19.0M to net cost of $2.4M)	**Included:** ▪ Not completely reported in text ▪ All costs to public and private health sectors ▪ All costs to other sectors ▪ Future health care cost from obesity-related diseases averted ▪ Adult time costs **Excluded:** ▪ Children's intervention time costs ▪ Future productivity loss savings ▪ Health costs-unrelated to obesity due to additional life years ▪ Expenditure related to personal activities for maintaining or improving health ▪ Benefits to parents or wider family	**Intervention:** ▪ NR **Baseline:** ▪ NR **Incremental:** ▪ BMI reduction/ child saved: 1.70 (0.68, 0.72) ▪ Total DALYs saved: 2700 (1000, 6300)	▪ Dominant (e.g., overall cost saving of $4.1M + health gain of 2,700 DALYs prevented) ▪ Range: narrow with a very high chance of being dominant (83%)	**Sensitivity analysis:** ▪ NR **Limitations:** ▪ High out-of-pocket costs to families, but not discussed what these are ▪ Australian context ▪ Assume BMI reduction is maintained ▪ Limited evidence of effectiveness **Comments:** ▪ Modelled based on a study done in Sweden in 1993 ▪ ITT approach, non-completers contributed to costs but not benefits ▪ Society perspective, but offsets only capture health care costs and do not capture time and productivity losses saved ▪ Assumes intervention was in a steady state ▪ Markov modelling ▪ Variety of assumptions needed to translate from behaviour change to BMI to DALYs ▪ Sufficient evidence of effectiveness ▪ 1 small RCT with statistically significant results ▪ Supporting evidence from 2 other RCTs

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
Group versus mixed family-based therapy (16) Quality score: 4	**Country:** ▪ US **Population:** ▪ Ages: 8-12 years ▪ Overweight/ obese children ▪ Caucasian ▪ N= 24 families	**Intervention:** *Group treatment* ▪ 60 min group therapy ▪ Parent therapy sessions ▪ Child therapy sessions – Teach families to change habits – Traffic Light Diet – Physical activity – Goal setting – Self-monitoring – Stimulus control – Reinforce-ment **Alternative intervention:** *Mixed treatment* ▪ Same program as group treatment, but: – 40 min group therapy – 15-20 min individual therapy **Duration:** ▪ 5 months, follow-up at 6 and 12 months	**Perspective:** ▪ NR **Time horizon:** ▪ 0 years **Year of costing:** ▪ NR **Currency:** ▪ USD **Discount:** ▪ NA	**Intervention :** ▪ US $491.51 **Baseline:** ▪ US $1390.70 **Total cost off-sets:** ▪ NA **Incremental costs:** ▪ NR	**Included:** ▪ Costs for both completers and non-completers ▪ Orientation ▪ Screening ▪ Staffing costs ▪ Materials ▪ Travel expenses **Excluded:** ▪ Costs related to data collection ▪ Costs to families ▪ Future health care costs savings	**Intervention*:** ▪ Decrease in prevalence of overweight after 12 months 6.88% ▪ Decrease in Z-BMI units after 12 months: 0.49 **Baseline*:** ▪ Decrease in prevalence of overweight: after 12 months 6.95% ▪ Decrease in Z-BMI units after 12 months 0.55	▪ Dominant (both treatments produce similar results, but group therapy is much less expensive)	**Sensitivity analysis:** ▪ NR **Limitations:** ▪ Individual therapy was very short, and it is questionable what kind of effective relationship would be made during this time ▪ Possible selection bias ▪ Power may be too low ▪ No sensitivity analysis **Comments:** ▪ Also measured parental outcomes ▪ Unclear if these weight changes are included in the outcomes reported under the heading effects ▪ Group-based treatment is more cost-effective than group and individual therapy together

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
Group versus routine individual therapy (17) Quality score: 6.5	**Country:** ▪ Finland **Population:** ▪ Ages: 7-9 years ▪ Obese children (weight for height 120 to 200%) ▪ N=70	**Intervention:** ▪ Group ▪ 14 sessions (parents and children in separate sessions) ▪ 1 joint session on making healthy snacks ▪ Conducted by dietitian and nutrition students ▪ Written materials **Alternative intervention:** ▪ Routine program ▪ 2 individual sessions for children by school nurses **Duration:** ▪ 6 months, 6-month follow-up	**Perspective:** ▪ Service provider **Time horizon:** ▪ 0 years **Year of costing:** ▪ 2004 **Currency:** ▪ EUR **Discount:** ▪ NA	**Intervention :** ▪ Total cost/6 months: €11, 432 ▪ Total cost/ child: €327 **Baseline:** ▪ Total cost/6 months: €2,150 ▪ Total cost/ child: €61 **Total cost off-sets:** ▪ NA **Incremental costs:** ▪ NR	**Included:** ▪ Labour ▪ Materials ▪ Recruitment **Excluded:** ▪ Costs from research component ▪ Costs to participating families ▪ Future health costs	**Intervention:** ▪ Mean change in weight for height (%): -3.4 (95% CI: -6.0 to -0.7) ▪ Mean change in BMI-SDS: -0.2 (95% CI: -0.3 to -0.1) **Baseline:** ▪ Mean change in weight for height (%): 1.8 (95% CI: -0.9 to 4.5) ▪ Mean change in BMI-SDS: -0.1 (95% CI: -0.2 to 0.0) **Incremental:** ▪ Difference in mean change in weight for height (%): 5.2, p=0.008 ▪ Difference in mean change in BMI-SDS: 0.1, p=0.081	**After 6-month follow-up:** ▪ €53 per 1% decrease in weight for height ▪ €2750 per 1 point decrease in BMI-SDS	**Sensitivity analysis:** <u>Best-case scenario:</u> ▪ €26 per 1% decrease in weight for height ▪ €92 per 0.1 decrease in BMI-SDS <u>Worst-case scenario:</u> ▪ Equally effective for 1% decrease in weight for height ▪ Equally effective for 0.1 decrease in BMI-SDS (group would not be beneficial at any investment) <u>Assume two group leaders instead of one:</u> ▪ €75 per 1% decrease in weight for height ▪ €391 per 0.1 decrease in BMI-SDS **Limitations:** ▪ Assume linearity between costs and weight for height decreases, but not previously assessed ▪ Only from service provider perspective (no family/individual costs and no future health savings incorporated) ▪ Did not include measures of uncertainty for estimates **Comments:** ▪ Group therapy was more costly and more effective and was

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
								found to be more cost-efficient ▪ Evidence for effectiveness based on a RCT ▪ Higher recruitment costs in routine program ▪ Higher treatment costs in group program ▪ Comparable ICER at end of intervention as with 6-month follow-up
Parent-only versus family-based group interventions (18) Quality score: 4.5	**Country:** ▪ US **Population:** ▪ Ages: 8-14 ▪ Mostly Caucasian low and high SES families ▪ BMI > 85th percentile ▪ N=93 children and their parents	**Intervention:** ▪ Family-based Intervention (N=33) ▪ Focus on monitoring diet and physical activity ▪ Nutrition education and pedometer-based step program ▪ Goal setting **Alternative intervention:** ▪ Parent-based intervention (N=34) ▪ Focus on monitoring diet and physical activity ▪ Nutrition education ▪ Goal setting ▪ Behaviour management strategies	**Perspective:** ▪ NR **Time horizon:** ▪ 0 years **Year of costing:** ▪ NR (between 2005-2007) **Currency:** ▪ USD **Discount:** ▪ NA	**Intervention :** ▪ Total: $20,928 ▪ Cost/child: $872 **Baseline:** ▪ Total: $13,546 ▪ Cost/child: $521 **Total cost off-sets:** ▪ NA **Incremental costs:** ▪ NR	**Included:** ▪ Training ▪ Weekly supervision ▪ Group leaders, material, incentives, food ▪ Travel expenses **Excluded**: ▪ Costs to participants ▪ Costs of determining eligibility (physician appointments) ▪ Research costs ▪ Future health costs	**Intervention:** ▪ Average decrease in BMI z-score: 0.115 **Baseline:** ▪ Average decrease in BMI z-score: 0.090 **Incremental:** ▪ NR	▪ NR	**Sensitivity analysis:** ▪ NR **Limitations:** ▪ Did not include potential long-term cost savings in analysis (e.g., reductions in medical costs due to improved health) ▪ No incremental assessment or sensitivity analyses **Comments:** ▪ Among control group: average increase in BMI z-score 0.022 ▪ Parent-only was more expensive but had a larger effect (public health significance of the effect unclear)

Program name/ reference/ quality checklist score‡	Country/ population	Intervention/ alternative/ duration	Perspective/ time horizon/ year of costing/ currency/ discount rate	Costs	Types of costs included	Effects	Incremental cost-effectiveness ratio (ICER)	Sensitivity analysis/ limitations/ comments
		Duration: ▪ 4-month intervention, 6-month follow-up						

Notes:

‡ Quality score: Each of the 10 questions in the checklist were scored as follows, for a maximum score of 10: 0 if requirements were not met, 0.5 if they were partially met, and 1 if requirements were met. It should be noted that this number only shows how many checklist items were completed and is not a validated quality score, as one point in the score my represent a major or a minor methodological issue.

* Calculated from total cost x change/dollar

⁺ Reporting of uncertainty interval in Moodie et al. 2008 (13) and Moodie et al. 2011 (9) does not match the estimates in the cost-effectiveness plane diagram, which shows the net cost per DALY saved. This indicates there may be an error in reporting of these uncertainty intervals, and these were therefore only reported in this table (not the text).

NA: Not applicable, NR: Not reported; DALY: Disability-adjusted life-year; QALY: Quality-adjusted life-year

References

(1) Magnus A, Haby MM, Carter R, Swinburn B. The cost-effectiveness of removing television advertising of high-fat and/or high-sugar food and beverages to Australian children. Int J Obes (Lond). 2009;33(10):1094-1102.

(2) Carter R, Moodie M, Markwick A, Magnus A, Vos T, Swinburn B, et al. Assessing cost-effectiveness in obesity (ACE-obesity): an overview of the ACE approach, economic methods and cost results. BMC Public Health. 2009;9:419.

(3) Haby MM, Vos T, Carter R, Moodie M, Markwick A, Magnus A, et al. A new approach to assessing the health benefit from obesity interventions in children and adolescents: the assessing cost-effectiveness in obesity project. Int J Obes (Lond). 2006;30(10):1463-1475.

(4) Victorian Government Department of Human Services. ACE-obesity assessing cost-effectiveness of obesity interventions in children and adolescents: summary of results. Melbourne, Australia: State of Victoria; 2006 [cited 2013 Jun 26]. Available from: http://docs.health.vic.gov.au/docs/doc/0AE260B1268E0450CA257B2C000F9178/$FILE/ace_obesity.pdf

(5) Brown HS,3rd, Perez A, Li YP, Hoelscher DM, Kelder SH, Rivera R. The cost-effectiveness of a school-based overweight program. Int J Behav Nutr Phys Act. 2007;4:47.

(6) Wang LY, Yang Q, Lowry R, Wechsler H. Economic analysis of a school-based obesity prevention program. Obes Res. 2003;11(11):1313-1324.

(7) Moodie M, (7) Haby MM, Swinburn B, Carter R. Assessing cost-effectiveness in obesity: active transport program for primary school children--TravelSMART Schools Curriculum program. J Phys Act Health. 2011;8(4):503-515.

(8) Moodie M, Haby M, Galvin L, Swinburn B, Carter R. Cost-effectiveness of active transport for primary school children - Walking School Bus program. Int J Behav Nutr Phys Act. 2009;6:63.

(9) McAuley KA, Taylor RW, Farmer VL, Hansen P, Williams SM, Booker CS, et al. Economic evaluation of a community-based obesity prevention program in children: the APPLE project. Obesity (Silver Spring). 2010;18(1):131-136.

(10) Moodie ML, Carter RC, Swinburn BA, Haby MM. The cost-effectiveness of Australia's Active After-School Communities program. Obesity (Silver Spring). 2010;18(8):1585-1592.

(11) Wang LY, Gutin B, Barbeau P, Moore JB, Hanes J,Jr, Johnson MH, et al. Cost-effectiveness of a school-based obesity prevention program. J Sch Health. 2008;78(12):619-624.

(12) Ananthapavan J, Moodie M, Haby M, Carter R. Assessing cost-effectiveness in obesity: laparoscopic adjustable gastric banding for severely obese adolescents. Surg Obes Relat Dis. 2010;6(4):377-385.

(13) Moodie M, Haby M, Wake M, Gold L, Carter R. Cost-effectiveness of a family-based GP-mediated intervention targeting overweight and moderately obese children. Econ Hum Biol. 2008;6(3):363-376.

(14) Wake M, Gold L, McCallum Z, Gerner B, Waters E. Economic evaluation of a primary care trial to reduce weight gain in overweight/obese children: the LEAP trial. Ambul Pediatr. 2008;8(5):336-341.

(15) Wake M, Baur LA, Gerner B, Gibbons K, Gold L, Gunn J, et al. Outcomes and costs of primary care surveillance and intervention for overweight or obese children: the LEAP 2 randomised controlled trial. BMJ. 2009;339:b3308.

(16) Goldfield GS, Epstein LH, Kilanowski CK, Paluch RA, Kogut-Bossler B. Cost-effectiveness of group and mixed family-based treatment for childhood obesity. Int J Obes Relat Metab Disord. 2001;25(12):1843-1849.

(17) Kalavainen M, Karjalainen S, Martikainen J, Korppi M, Linnosmaa I, Nuutinen O. Cost-effectiveness of routine and group programs for treatment of obese children. Pediatr Int. 2009;51(5):606-611.

(18) Janicke DM, Sallinen BJ, Perri MG, Lutes LD, Silverstein JH, Brumback B. Comparison of program costs for parent-only and family-based interventions for pediatric obesity in medically underserved rural settings. J Rural Health. 2009;25(3):326-330.

Appendix 6: Inventory of Current Provincial, Federal and Multi-Level Government Initiatives

Summary of Ontario Government Initiatives that Affect Childhood Obesity

Ministry	Healthy eating initiatives	Physical activity	Built environment
Ministry of Agriculture, Food and Rural Affairs	▪ Pick Ontario Freshness Strategy ▪ Foodland Ontario Program ▪ Food for Health Research Theme ▪ Ontario Market Investment Fund ▪ Ontario Collaborative Group on Healthy Eating and Physical Activity (OCGHEPA) ▪ Health Check Restaurant Program ▪ Broader Public Sector Investment Fund: Promoting Ontario Food ▪ Royal Agricultural Winter Fair – Journey To Your Good Health ▪ Canadian Nutrition Society – Mobilizing the Food-Health Agenda Workshop ▪ Canadian Restaurant and Foodservice Trade Show – Fresh Ideas for Foodservice: Meeting Market Trends Program ▪ Canada's Outdoor Farm Show – Celebrating Healthy Living Expo ▪ Gimme 5 Commodity Cards		
Ministry of Health and Long-Term Care	▪ Healthy Communities Fund (Provincial Grants Stream, Partnership and Resource Streams) ▪ Northern Fruit and Vegetable Program ▪ EatRight Ontario ▪ Child Health Program - breastfeeding support ▪ Urban Aboriginal Healthy Living Program	▪ Pause to Play ▪ Healthy Communities Fund (Provincial Grants Stream, Partnership and Resource Streams)	
Ministry of Education	▪ Ontario Health and Physical Education curricula ▪ Foundations for a Healthy School Framework ▪ Healthy Schools Recognition Program ▪ School Food and Beverage Policy ▪ Healthy Food for Healthy Schools Act, 2008 ▪ Trans Fat Standards Regulation (O. Reg. 200/08)	▪ Daily Physical Activity in Elementary Schools ▪ Ontario Health and Physical Education curricula	
Ministry of Children and Youth Services	▪ Student Nutrition Program - Nutrition Guidelines ▪ Akwe:go and Wasa-Nabin Urban Aboriginal Programs ▪ Healthy Babies Healthy Children, and Aboriginal Healthy Babies Healthy Children ▪ Provincial Youth Justice Services Custody/ Detention Facilities		

Summary of Ontario Government Initiatives that Affect Childhood Obesity – Cont'd

Ministry	Healthy eating initiatives	Physical activity	Built environment
Ministry of Children and Youth Services		▪ Akwe:go Urban Aboriginal Children's Program	
Ministry of Tourism, Culture and Sport		▪ After-School Program ▪ Healthy Communities Fund (Local/Regional Grants) ▪ Community Aboriginal Recreation Activator Program (CARA) ▪ Aboriginal Sport and Wellness Council of Ontario	▪ Ontario Trails Strategy
Ministry of Aboriginal Affairs		▪ Promoting Life-skills in Aboriginal Youth (PLAY)	
Ministry of Finance		▪ Children's Activity Tax Credit	
Ministry of Transportation		▪ Cycling Skills and the Young Cyclist's Guide ▪ Road Safety Education Curriculum Resource for Schools	▪ Bicycle Network Research Project ▪ Transit Supportive Guidelines ▪ Ontario Bikeways Planning and Design Guidelines Update ▪ Cycling Infrastructure Pilot Projects ▪ Capital Cost Eligibility Criteria for Rapid Transit Projects
Ministry of Municipal Affairs and Housing			▪ Provincial Policy Statement ▪ Planning Act (development control tools to implement PPS policies for healthy built environments) ▪ Planning by Design: A Healthy Communities Handbook ▪ Planning InfoSheets for community design, intensification, transit-supportive land use ▪ Development Permit System: A Handbook for Municipal Implementation ▪ Provincial Policy Statement ▪ Planning Act (development control tools to implement PPS policies for healthy built environments) ▪ Planning by Design: A Healthy Communities Handbook ▪ Planning InfoSheets for community design, intensification, transit-supportive land use ▪ Development Permit System: A Handbook for Municipal Implementation ▪ The Building Blocks for Sustainable Planning

Summary of Ontario Government Initiatives that Affect Childhood Obesity – Cont'd

Ministry	Healthy eating initiatives	Physical activity	Built environment
Government of Canada	▪ Nutrition North Canada ▪ Food and Drugs Act - Labelling of food products ▪ Canada's Food Guide ▪ Surveillance of food and nutrient intakes ▪ Sodium and trans fat reduction frameworks ▪ Food safety activities ▪ Eat Well and Be Active Educational Toolkit ▪ Canada's Physical Activity Guides		

Summary of Federal/Provincial/Territorial Government Initiatives that Affect Childhood Obesity

FPT table	Initiative	Factors		
		Healthy eating	Physical activity	Built environment
Public Health Network Healthy Peoples, Healthy Communities Steering Committee (HPC-SC)	Curbing Childhood Obesity Framework for Action (2010)	✓	✓	✓
	Curbing Childhood Obesity: A Federal, Provincial and Territorial Framework for Action to Promote Healthy Weights - Actions Taken and Future Directions (2011)	✓	✓	✓
	National Dialogue on Healthy Weights (March-September, 2011)	✓	✓	✓
	National Summit on Healthy Weights (February, 2012)	✓	✓	✓
	Measurement and Monitoring Task Group	✓	✓	✓
	Options paper to support multi-sectoral planning on healthy eating and physical activity in community design and the built environment	✓	✓	✓
FPT Group on Nutrition (FPTGN)	Healthy Eating Education and Awareness Initiative	✓		
	Food retail availability reports	✓		
	School Food and Beverage criteria	✓		
	Report on 'Integrating Healthy Eating into the After-School Time Period'	✓		
	Feasibility Study of the 'State of Home Economics – Nutrition and Food Skills Education in Canadian Schools'	✓		
FPT Task Group on Disclosure of Nutrition Information in Restaurants and Foodservices	Common approach/national framework for disclosure of nutrition information	✓		
Sport, Physical Activity and Recreation (SPAR)	Multi-Sectoral Framework for Action on the After-School Time Period	✓	✓	✓

Appendix 7:
Ontario Public Health Unit Survey

Healthy Weights / Childhood Obesity Initiative Survey of Ontario Public Health Units

What is your name?

What is your title and program area?

Which public health unit do you represent?

Please provide your email address.

Provide a phone number where we may contact you.

We are going to ask you about your health unit's current involvement in addressing healthy weights and obesity prevention in children 0-19 years. For each initiative your health unit leads or collaborates in, we are going to ask eight questions. After you have answered all eight questions you will have the option of entering additional child and youth health-related healthy weights and obesity prevention initiatives in which your health unit is involved.

Initiative 1

1. **Name or title of initiative**

2. **What role does your health unit play in this initiative? (Select all that apply)**

   ☐ Lead

   ☐ Collaborate, please specify with whom _____

   ☐ Other, please specify... _____

3. **Provide a brief description of the initiative including objectives and key activities. If available please provide a link to further information.**

4. Which of the following best describes the initiative? (Select all that apply)

- ☐ Program / Service
- ☐ Policy / Legislation
- ☐ Health communication, please describe (e.g., fact sheet, campaign, etc.): _____
- ☐ Other, please specify... _____

5. Which of the following areas of action are included in this initiative? (Select all that apply)

- ☐ Work with colleagues in sport, physical activity, recreation and education in particular, as well as other sectors, to promote physical activity for children/youth
- ☐ Work with colleagues in sport, physical activity, recreation and education in particular, as well as other sectors, to promote healthy eating for children/youth
- ☐ Support multi-sectoral planning on physical activity in community design and the built environment
- ☐ Support multi-sectoral planning on healthy eating activity in community design and the built environment
- ☐ Support actions to improve the availability and accessibility of nutritious foods in urban, rural and remote communities, particularly among vulnerable populations
- ☐ Support cross-sectoral collaborative efforts to increase the availability of nutritious foods in places where children live, learn and play
- ☐ Have guidelines for the provision and procurement of food
- ☐ Work with colleagues in the education, sport, physical activity and recreation sectors using a comprehensive health promotion approach to enhance food skills and create supportive environments both at school and in the after-school time period
- ☐ Promote awareness of and access to nutritious foods and beverages to make the healthier choice the easier choice
- ☐ Facilitate broader implementation of existing policies, guidelines and tools to promote healthy eating and to decrease the marketing of foods and beverages high in fat, sugar and/or sodium in various media and in places where children gather
- ☐ Have food and nutrition guidelines in child daycare settings
- ☐ Collaborate with Boards of Education to implement PPM 150
- ☐ Use a screening tool to identify preschoolers at risk for nutritional concerns
- ☐ Plan to become or already have Baby-Friendly Initiative designation
- ☐ Use the new WHO Growth Charts in your programming
- ☐ Have a comprehensive healthy weights program
- ☐ Offer or link to programs and services that promote positive parenting, healthy family dynamics and healthy growth and development
- ☐ Collaborate with community partners in the management and/or medical treatment of childhood obesity
- ☐ Healthy communities initiative
- ☐ Other, please specify.... _____

6. What is the target population of the initiative? (Select all that apply)

- ☐ Preconception
- ☐ Prenatal
- ☐ Infant (0-12 months)
- ☐ Toddler (1-2 years)
- ☐ Preschool children (3-5 years)
- ☐ School-age children (6-12 years)
- ☐ Youth / Teenagers (13-19 years) _____
- ☐ Parents
- ☐ General public
- ☐ Vulnerable population, please specify: _____
- ☐ Other, please specify: _____

7. What is the setting for this initiative? (Select all that apply)

- ☐ Home
- ☐ Daycare _____
- ☐ School
- ☐ Community
- ☐ Workplace
- ☐ Other, please specify: _____

8a. Has this initiative been evaluated?

- ○ Yes
- ○ No

8b. If "yes", do you have a report describing the evaluation results that you can share?

- ○ Yes
- ○ No

8c. If "yes", please provide a link.

Do you have another initiative to enter?

- ○ Yes
- ○ No

Appendix 8: Ontario Public Health Unit Survey Results

Public Health Unit Scan Results

What role does your health unit play in this initiative? (Select all that apply)

	Health unit (n=36)	Initiative (n=433)
Lead	100.0% (36)	66.5% (288)
Collaborate	94.4% (34)	56.6% (245)
Other	25.0% (9)	3.0% (13)

Which of the following best describes the initiative? (Select all that apply)

	Health unit (n=36)	Initiative (n=433)
Program / Service	94.4% (34)	69.7% (302)
Report / Policy / Legislation	83.3% (30)	19.9% (86)
Advocacy	86.1% (31)	31.6% (137)
Health Communication	83.3% (30)	30.3% (131)
Other	58.3% (21)	13.6% (59)

Which of the following areas of action are included in this initiative? (Select all that apply)

	Health unit (n=36)	Initiative (n=433)
Work with colleagues in sport, physical activity, recreation and education in particular, as well as other sectors, to promote physical activity for children/youth	91.7% (33)	37.2% (161)
Work with colleagues in sport, physical activity, recreation and education in particular, as well as other sectors, to promote healthy eating for children/youth	88.9% (32)	36.0% (156)
Support multi-sectoral planning on physical activity in community design and the built environment	72.2% (26)	15.5% (67)
Support multi-sectoral planning on healthy eating/food and nutrition in community design and the built environment	75.0% (27)	15.5% (67)
Promote the availability and accessibility of nutritious foods in places where children live, learn and play	94.4% (34)	42.7% (185)
Promote the availability and accessibility of physical activity opportunities in places where children live, learn and play	91.7% (33)	34.6% (150)
Work with colleagues in the education, sport, physical activity and recreation sectors using a comprehensive health promotion approach to enhance food skills and create supportive environments both at school and in the after-school time period	86.1% (31)	24.5% (106)
Facilitate broader implementation of existing policies, guidelines and tools to promote healthy eating and to decrease the marketing of foods and beverages high in fat, sugar and/or sodium in places where children gather	77.8% (28)	19.6% (85)
Have guidelines for the provision and procurement of food	75.0% (27)	16.6% (72)
Offer or link to programs and services that promote positive parenting, healthy family dynamics and healthy growth and development	80.6% (29)	28.9% (125)

	Health unit (n=36)	Initiative (n=433)
Use 2006 World Health Organization (WHO) Child Growth Standards and 2007 WHO Growth References Charts in programming	38.9% (14)	5.3% (23)
Plan to become or already have Baby-Friendly Initiative designation	75.0% (27)	9.2% (40)
Use a screening tool to identify preschoolers at risk for nutritional concerns	55.6% (20)	6.2% (27)
Have food and nutrition guidelines in child daycare settings	38.9% (14)	5.1% (22)
Collaborate with community partners in the management and/or medical treatment of childhood obesity	33.3% (12)	4.8% (21)
Have a comprehensive healthy weights program	22.2% (8)	4.2% (18)
Healthy communities initiative	41.7% (15)	7.6% (33)
Other	61.1% (22)	11.8% (51)

What is the target population of the initiative? (Select all that apply)

	Health unit (n=36)	Initiative (n=433)
Preconception	58.3% (21)	8.1% (35)
Prenatal	75.0% (27)	16.9% (73)
Infant (0-12 months)	72.2% (26)	19.6% (85)
Toddler (1-2 years)	75.0% (27)	18.9% (82)
Preschool children (3-5 years)	88.9% (32)	28.9% (125)
School-age children (6-12 years)	94.4% (34)	45.3% (196)
Youth / teenagers (13-19 years)	86.1% (31)	36.5% (158)
Parents	88.9% (32)	45.0% (195)
General public	80.6% (29)	27.7% (120)
Vulnerable population	61.1% (22)	17.6% (76)
Other	80.6% (29)	25.4% (110)

What is the setting for this initiative? (Select all that apply)

	Health unit (n=36)	Initiative (n=433)
Home	77.8% (28)	17.8% (77)
Daycare	69.4% (25)	15.2% (66)
School	94.4% (34)	47.1% (204)
Community	91.7% (33)	60.3% (261)
Workplace	58.3% (21)	13.2% (57)
Other	61.1% (22)	12.0% (52)

Has this initiative been evaluated?

	Health unit (n=36)	Initiative (n=433)
Yes	100.0% (36)	34.6% (150)

Appendix 9: Inventory of Ontario Public Health Unit Initiatives

Inventory of Public Health Initiatives

NOTE: The information contained within this table is presented as reported by the public health units. No edits have been made to the content in order to retain the original information provided.

Initiative	Description	Evaluated?
Healthy Schools Elementary/ Secondary School Project	Pilot "Healthy Schools" have been identified by each school board to receive concentrated time and support from a designated public health nurse (PHN) to assist with the implementation of a healthy school approach. Elementary schools that are not part of the pilot continue to receive support through a Liaison PHN. These services include timely and effective consultation, and support and linking with community resources and delivery of services with group presentations & projects.	Yes
Support to Pause to Play	Support of Pause to Play is a tri-county community campaign and tool kit that schools can use and adapt to promote reducing screen use (TV, computers, video games, etc.) and increasing physical activity time. The objectives of the campaign and tool kit include raising parental and student awareness of the impacts of high amounts of screen use in children and youth, reducing the amount of time children and youth are inactive during the after-school and evening hours, and encouraging active play instead of screen use. Key components of the tool kit include a letter and information package sent to each elementary school in Elgin St. Thomas, a log sheet for students to track their progress during the campaign, newsletter inserts, school announcements, fact sheets and other resources.	Yes
3 out of 4 - that's the score	Students in grades 4 and 5 track healthy lunches during March. They receive education about food groups and are encouraged to include three different food groups for the month. This initiative includes a classroom challenge - the class with the highest percentage of 'compliance' over the month is eligible to win a prize (the prize is a class party where students are taught how to make Smoothie parties - they are given recipes, learn how to follow the recipe, measure ingredients, etc.).	No
A Breastfeeding Companion	This program offers one-on-one telephone peer support to mothers who have chosen to breastfeed. This program matches volunteers experienced and trained in breastfeeding with clients who want more support while breastfeeding. Most clients are referred through the HBHC program.	Yes
A Tool for Every Teacher: Resource & Training	The Tool is a Question and Answer resource for teachers that provides them with simple concrete information on what is helpful and what is harmful with regard to teaching, role modelling and responding to issues re: media literacy, healthy eating, physical activity, healthy weights healthy body image/self-esteem and eating disorders. This resource is usually provided with consultation or training.	Yes
ABC - All Babies Count (local Canada Prenatal Nutrition Program)	The objectives of ABC are to provide education, support and links to community services to high-risk pregnant women in the region and to reduce the rate of low birthweights in the region's population. Key activities include food stills and education (re: food and feeding, birth, caring for infants). This initiative also facilitates peer support and provides referrals to community agencies/public health (e.g., Healthy Babies Healthy Children program).	Yes
Access to affordable physical activity opportunities	This initiative provides physical activity opportunities for low-income families at 25% of the cost and enables low-income families to enrol their children in physical activities such as swimming lessons, soccer etc.	No
Access To Affordable Recreation	This initiative provides capacity-building - mobilization and sharing of best practice. It also coordinates and facilitates knowledge exchange and planning opportunities.	No
Access to Healthy Foods	This initiative addresses access to healthy foods through the following activities: analysis of nutritious food basket data, food desert mapping, Good Food Box partnership and Good Food community markets.	No

Initiative	Description	Evaluated?
Access to Recreation	This initiative allows health units to work with community partners to identify and address opportunities to increase access to low-cost and no-cost recreation opportunities. e.g. Join In website, Swim to Survive	No
Active and Safe Routes to Schools	The Active and Safe Routes to Schools Initiatives promotes the use of active and efficient transportation for the daily trip to school, addressing health and safety issues. Some of the many activities and programs in this initiative include: School Travel Planning, International Walk to School Day, Walking/Wheeling Wednesdays; Winter Walk to School Day; iCanwalk to school...can you?; Walking school bus; idle-free zones; and walking clubs	No
Active Community Coalition	This is a community coalition that promotes and supports sports, recreation and leisure activities. The objectives of this coalition are to increase physical activity levels of people of all ages and abilities and to raise awareness and knowledge of the existing sport and recreation opportunities available in the community. Key activities of this initiative include developing and promoting a print guide of all the available sport, recreation and leisure opportunities in the community and maintaining and promoting an interactive website where people can search for activities based on their interest, age and location. Another key component of the program is a community event whereby a select number of local sport and recreation organizations offer their services free for one day for the community to try and be active as a family or on their own.	No
Active Fun Kits	Parent support tool to encourage family-based physical activity	No
Active Living Before, During and After Pregnancy	Part of broader work to encourage/support healthy maternal weight before pregnancy and appropriate weight gain during pregnancy to reduce the risk of childhood obesity.	No
Active Living charter	Create and adopt with the municipalities Active Living charter so that the municipalities have an active role to play in the health benefits of their constituents.	No
Active Tools for Schools	This is a tool kit for the school community that identifies and provides links to resources that promote and support daily physical activity in schools. It utilizes a framework similar to Nutrition Tools for Schools in that it outlines strategies and activities within nine elements needed to build an environment that supports opportunities for students to easily access physical activity opportunities.	No
Active Transportation Master Plan Development	As part of the development of the Active Transportation Master Plan, one health unit is part of the support staff for the regional Active Transportation Advisory Committee.	No
Adventures in Cooking	This program is an after-school cooking program for children aged eight to 12 that was created with the input of several community partners. The materials include a comprehensive, five-lesson Adventures in Cooking Leader's Manual and promotional DVD based on pilot programs held in small Northern Ontario communities. Adventures in Cooking integrates healthy eating, food/kitchen safety and cooking skills using a fun, hands-on approach that encourages kids to take the lead.	Yes
Advocacy and Knowledge Exchange related to the Balanced Approach to Healthy Weights	Objectives of this initiative are to create healthy supportive environments and public policy that support achieving and maintaining a healthy weight. Activities include: (1) Partner with community groups, municipalities and public service venues to align approaches for healthy weights programming, (2) Promote and support policy development through consultations and participation on community groups/coalitions, and (3) Work to guide decision-makers to develop and implement healthy public policies.	No
Advocacy and Knowledge Exchange related to the enhancement of access to recreation and sustainable mobility	The objective of this initiative is to encourage the creation of access policies to create supportive environments for affordable access to recreation and sustainable mobility.	No
Affordable Access to Recreation Workshop	This workshop was held for recreation providers, thus addressing social determinants of health as barriers to physical activity. At this workshop, Parks & Recreation Ontario (PRO) outlined the prevalence of poverty in the region, gave examples of best practices and how communities across Ontario have addressed the issue, showcased local solutions and led dialogue about local issues.	No

Initiative	Description	Evaluated?
After-School Programming Needs Assessment and Stakeholder Consultation	This initiative involved the following activities: ▪ Map the location and type of after-school programming in the area and conduct a needs assessment of after-school program providers in order to determine how best the health unit Physical Activity Team can support after-school programming ▪ Consult with local child care providers to determine what role the health unit can play to assist them in integrating physical activity into their after-school programs	No
Assisting school boards with food service contract negotiations	Assisting local school boards with their food service contract negotiations.	No
Baby's Day Out	A program that encourages parents of infants (zero to one year) to gather with Early Child Development workers and a public health nurse or health unit specialist (dietitian, speech pathologist, etc.) to briefly speak to parents surrounding topics specific to healthy choices and to promote healthy behaviours in families, including healthy eating and physical activity.	Yes
Baby & Me Clinic/ Intake	At Baby & Me clinics and drop-ins to the health unit to see the intake nurse, we perform well-baby checks that involve getting the height and weight of the child, and from there we plot where they are on the WHO growth chart. Nurses involved have been trained on how to use WHO growth charts and explain the child's growth to the parents. Through the clinics and drop-ins, the most common questions are regarding nutrition. This gives nurses the opportunity to promote healthy eating habits according to Canada's Food Guide. Nurses can also make referrals to dietitian services, if needed. Numerous fact sheets are available for the nurses to use to start conversations with parents around healthy eating habits.	No
Baby-Friendly Initiative	The Baby-Friendly™ Initiative is an international initiative established by the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) in 1991 that promotes, protects and supports breastfeeding. BFI is an evidence-based strategy to promote, protect and support the initiation and continuation of breastfeeding through implementation of best practices in health services. BFI is a performance indicator for the Reproductive and Child Health Program in the Public Health Accountability Agreement. Health units provide a variety of programs and services to promote, protect and support breastfeeding. *Key activities*: Meeting the objectives of the BFI integrated 10 steps and being WHO code compliant. *Objective*: Achieve BFI accreditation through the Breastfeeding Committee for Canada. Prenatal class curriculum is designed around BFI with the promotion of breastfeeding, benefits of breastfeeding and exclusive breastfeeding for the first six months of life with the introduction of solids at six months and continued breastfeeding for two years and beyond.	Yes
Babyville	Objectives of this initiative are: (1) to provide an opportunity for parents of infants under one year of age to meet one another and share expertise; (2) to provide parents with the opportunity to learn from one another about the challenges typical of the first year; (3) to increase parents' awareness of skills, knowledge and abilities they already have; and (4) to create a social network that will sustain itself once the group is over.	Yes
Balanced Approach Education and Awareness Initiatives	Objective: ▪ To educate both at the individual (lifestyle-focused) and organizational (policy-focused) level in order to change the societal norm related to weight and shape preoccupation. ▪ Public Education and awareness of the balanced approach philosophy and our approach to healthy weights promotion done through website content, newspaper articles and media interviews, internal health unit newsletters and through the development of resources and fact sheets.	Yes
Be Safe Be Smart When you... Walk, Drive, Bike - Road Safety Communication Campaign	Road Safety Communication campaign targeting elementary schoolchildren, parents and grandparents, post-secondary population. Products include posters and fact sheets, newsletter inserts. Long -Term Goal: ▪ Reduced collisions between cars, bikes and pedestrians in school zones ▪ Reduced injuries and death due to road incidents around school zones Short-Term Goal: ▪ Increased awareness and knowledge about the importance of road safety around elementary school zones, as well as post-secondary institutions. ▪ Increase walking, biking and driving skills among students and parents in elementary schools	No

Initiative	Description	Evaluated?
Be Your Best Self	Be Your Best Self is a communications project to engage youth aged 13 to 24 to take action on health issues. The goals are to develop communication activities that are: ▪ Innovative and engage youth ▪ Ignite ideas to take action on health ▪ Link youth to opportunities to develop skills for college, university and future employment ▪ Connect youth from across the city around health issues that are important to them ▪ Help young people be their best self with the following outcomes: ▪ Youth taking action on their own health, including healthy eating and physical activity ▪ Youth taking action and role modelling healthy behaviours to friends and family ▪ Youth taking action on health issues in their community	Yes
Best Start Hub Programming	To increase understanding among parents of the importance of physical activity (PA) and healthy eating (HE) as it relates to overall health of parents being good role models; respond to requests for PA and HE information; share new PA guidelines with Hubs; healthy eating discussions with Hub and parents, healthy eating skill-building activities (baby food-making, menu planning, etc.).	
Bodywize Challenge	This teaching resource comprises of a series of interactive lesson plans, background information, suggested activities and resources. The topics addressed focus on maintaining a healthy lifestyle and address issues of body image, self-esteem, healthy eating and physical activity. The Challenge invites intermediate teachers to register, teach three or four lessons from the BodyWize Forget the Size kit and receive an in-class presentation from a public health nurse. All classes registered are eligible for a grand prize, which is a skill-based cooking experience.	Yes
Breastfeeding Buddies	A peer-focused support group for breastfeeding moms and moms-to-be. Volunteers are trained to provide one-on-one telephone support to breastfeeding women. Goal is to improve the duration rates of breastfeeding.	No
Breastfeeding Challenge	Raise awareness about breastfeeding as the normal method of feeding; promote breastfeeding in public to help create a supportive community/environment for breastfeeding mothers; provide a supportive environment for breastfeeding mothers at the event and change public perceptions of breastfeeding in public places; breastfeeding mothers sign up for the event; gathering of breastfeeding mothers and their infants/additional children at specific day/time; "Latch on" of breastfeeding babies at the same time; healthy snacks are served and grab-bags provided to mothers (contain info about health unit programming, blanket, other incentive items); media promotions and interviews (radio and newspaper); potential recruitment for volunteer telephone breastfeeding support program	No
Breastfeeding Classes	Lactation consultants teach a breastfeeding prenatal class that is free to all pregnant women and their partners. Goal is to establish breastfeeding and connect to resources postpartum.	No
Breastfeeding Clinics	Postpartum women are contacted at 48 hours and two weeks to collect Breastfeeding Surveillance and to book a BF clinic appointment with a lactation consultant. The goal of this service is to increase the duration of breastfeeding by providing mothers with the support they need in the early weeks of breastfeeding. Our finding of our Infant Feeding Survey 2011 demonstrated the rapid drop-off of breastfeeding rates in the first six to eight weeks postpartum. These clinics were created to in order to give women the support they need to continue to breastfeed.	No
Breastfeeding Connection	New mothers who choose to breastfeed are provided with a trained peer volunteer to support them through their breastfeeding journey.	No
Breastfeeding Project - BFI	To work collaboratively with partners to increase awareness and skills, policy, supportive environments to increase initiation, duration and exclusivity of BF among priority populations. The BFI committee will continue this work toward BFI designation.	No
Breastfeeding support	Activities: operate a phone line for consultation and support of parents with concerns about their children, including providing breastfeeding support. One-to-one breastfeeding consultations are also provided.	No
Built environment work with municipality	All new subdivisions and zoning changes are reviewed by health unit staff for walkability issues. This process allows the health perspective (e.g., sidewalks, connectivity) to be included in reports to council.	No

Initiative	Description	Evaluated?
Built Environment Working Group	An internal working group using the THCU planning steps to ensure a solid base for providing input to municipal planning decisions that impact health (healthy eating, physical activity, air and water quality, injury prevention). Planning that takes into account the impact of the built environment on a healthy community will have a significant impact on childhood obesity.	
Calling New Parents	A weekly drop-in support program for new parents with infants zero to six months, which supports breastfeeding, transitioning to solids, healthy growth and development etc.	No
Can Bike School Cycling Education Program	The CAN-BIKE program is funded through a grant from the Ministry of Health Promotion's Healthy Communities Fund which currently falls under the Ministry of Health and Long-Term Care. The purpose of this program is to offer Can Bike Cycling education to elementary school students	No
Canada Prenatal Nutrition Program (CPNP)	CPNP is a weekly prenatal program that provides group and individual support and education from public health nurses and registered dietitians in collaboration with community partners. The goals of CPNP are to improve the health of mothers and infants; to reduce the incidence of unhealthy birthweights and to promote and support breastfeeding. Activities in CPNP programs vary and include food demonstrations; opportunities to cook with participants; and/or provide healthy snacks and groceries for participants.	Yes
Celebration of Dance	This event promotes dance as physical activity in schools; for use during DPA and for children to increase activity levels. Students and teachers learn a series of dances over a year and then come together in one place to perform them in a high-level event. In total, around 5,000 students participate in this year-long activity.	No
Cardiovascular Disease Prevention Network (school-age children branch)	This network was formed to create information and solutions for schools to promote healthy nutrition via the non-food rewards offered in the classroom and healthy ways to fundraise.	Yes
Cardiovascular Disease Prevention Network (CDPN)	This network has produced a survey, report card, training (teachers, parents, principals) on priority areas regarding nutrition: classroom rewards, catered lunches, fundraising. This network has used PPM 150, School Food and Beverage Policy as a springboard to get these messages out.	Yes
Child Health Survey 2003 & Call to Action	In 2003 the health unit undertook a survey of grade 1 children to determine the percentage of children who were overweight or at risk of overweight and to determine the attitudes and behaviours of the children and their families related to healthy eating and physical activity (via a parent survey). Results from this survey were used in 2005 to develop a Call to Action for school communities, community organizations and businesses, health professionals, parents and workplaces to take a comprehensive approach to supporting physical activity and healthy eating for children and their families to build a lifetime of good health.	No
Child Nutrition Network	This is a longstanding network in our community promoting school nourishment programs in local schools.	No
Childcare Centre Workshops	Since front-line child care centres are uniquely positioned to influence nutrition and activity patterns in young children as well as influence parents through example and knowledge dissemination, this initiative provides training to professional child care providers at least twice a year on a wide range of topics. Some examples include: updates on pediatric nutrition guidelines; the psycho-social aspects of feeding young children; weight sensitivity and the role of the child care provider; ideas for talking to parents about food situations; review of the Day Nurseries Act; recommendations for planning a cycle menu; provision of indoor/outdoor games and activities designed to teach healthy eating and active living to young children.	Yes
Children's Environmental Health Programs	This is a comprehensive program that provides children's environmental health programming across the health unit region, partnering with the Canadian Partnership for Children's Environmental Health on national and provincial projects. Initiatives look at links between "obesogens" as it relates to causes of obesity (e.g., research has identified links to obesity when pregnant women are exposed to hormone disruptors like bisphenol A and phthalates).	Yes

Initiative	Description	Evaluated?
Colour It Up	Colour It Up is an exciting proven provincial program that helps women and their families learn to eat the number of servings of vegetables and fruit recommended by Canada's Food Guide. The program aims to inform, educate and support behaviour change related to women's vegetable and fruit acquisition, preparation, storage and eating. Specifically, Colour It Up focuses on: 1. Increasing self-efficacy (a person's strong belief in her ability to make a change); 2. Reducing barriers to vegetable and fruit consumption through group learning exercises and experience-sharing; and 3. Fostering adequate social support to facilitate these changes in the reality of women's everyday lives.	Yes
Come Cook with Us and Community Kitchens	This initiative is one that involves the implementation of a food skills program with identified priority populations, including parents and caregivers .	Yes
Common Messages for Childhood Healthy Weights	Development of common messages on parenting, healthy eating and physical activity for health care professionals to use when working with families and children and in various settings including media, school etc. Also includes algorithm for Brief Contact intervention on healthy eating, physical activity and physical inactivity, as well as a referral pathway.	No
Communities In Action and Active Transportation	The health unit works with municipalities and members of community in the region to advocate for land-use planning policies that encourage active transportation. The health unit is also involved in promoting " Share the Road" messages for motorists and cyclists and raising awareness about the importance of community design to promote walking, cycling and active transportation.	No
Community Food Advisor Program	The Community Food Advisor program provides, through trained volunteers, reliable information and education that promotes safe and nutritious food selection, preparation and storage practices to consumers. Through this volunteer peer education program, people in communities who have a love of food and some knowledge and skills in food handling, are provided with technical and leadership training. Upon successful completion of their training, the volunteer peer educators become certified as Community Food Advisors and work in their community to improve and promote safe and healthy food selection, preparation and storage practices.	
Community Food Network/ Poverty Reduction	The Community Food Network brings together community partners monthly to ensure that everyone in the community has enough healthy food to eat as part of a long-term food security strategy.	No
Community Food Places Initiative	Support the creation of "community food places," where community members (including families and children) can increase their access to nourishing food through involvement in community food programs that address access and food skills.	No
Community Food Programs	Public health staff work with community partners to initiate, support and promote food programs such as community gardens, community kitchens and the Good Food Box (an inexpensive box of fresh produce). Partners are raising awareness about the importance of buying local food to ensure a local sustainable food system and to support local farmers. Partners are also working with food banks, the Food4All Warehouse in Northumberland and the Food Secure Source Warehouse in the city to increase access to healthy food choices. Additionally, a network of community partners called FoodNet work together to increase healthy food choices for low-income families and individuals. The health unit website has information about where to obtain low cost or free food.	No
Community Food Security Strategy	Initiatives of this strategy include Nutritious Food Basket Survey; Supportive Environment projects (Good Food Box, Community Gardens and Community Kitchens) and a Local Food project.	No
Community Gardens	Supports community members (including families, school communities and neighbourhoods) with the development of community gardens to increase local consumption of fruit and vegetables.	
Community Gardens Advocacy	Create viable, accessible community gardens that include the source of plants and whether they are edible or inedible. This initiative provides an opportunity for cooperation, education and skill-building on many levels	Yes
Community Health Website - Active Living Section	The community health website is an online resource for information regarding various health topics. The active living section links the community to physical activity guidelines, tips to get active, walking programs, health benefits of physical activity, trails, age-specific information, etc.	No

Initiative	Description	Evaluated?
Comprehensive School-Based Healthy Eating Initiatives	Several comprehensive healthy eating campaigns that target a number of key messages. These include: Blast Off With Breakfast, Four For Lunch, Rethink Your Drink, Paint Your Plate as well as Nutrition Tools For Schools - which has 18 action guides based on the essential elements for a healthy school nutrition environment. Key activities cover the four pillars in the foundations for a healthy school - curriculum, social and physical environment and community partnerships - also linking to families and homes.	Yes
Conduct GIS food mapping project.	Conduct GIS mapping for food access and food insecurities. Objective: to complete spatial analysis of access to food retailers.	No
Consultative Approach in Schools	Public health staff work with school staff, teachers and students using a consultative approach to assess, plan, implement and evaluate chronic disease and injury prevention (CDIP)-related initiatives in schools. The main objectives of the consultation process are: 1) To help schools identify CDIP-related needs through an assessment of the school environment. 2) To assess what actions the school is currently undertaking in order to address each need identified. 3) To identify any TPH CDIP programs/services that schools already access. 4) To assess the school's interest and resources available to address CDIP needs and to assist in the development and/or implementation of an action plan. 5) To support schools in evaluating their activities and to assist with future planning.	
Consumer Health Education	Consumer Health Education programs and services includes the following key activities: promoting key messages for nutrition and feeding of young children through resource development; workshops (specifically introducing solids, feeding older babies and toddlers), web, and media. Objective: to increase the knowledge of parents and caregivers of infants and young children related to nutrition and feeding topics.	No
Cooking up some fun	Food skills workshops for school-age children	No
Count Your Steps Pedometer Program	In partnership with participating libraries and municipalities, residents can borrow a pedometer and tracking kit.	No
Creating a Healthy School Nutrition Environment Campaign	Increase awareness and knowledge of the whole school community, of key elements of a healthy school nutrition environment (HSNE) and a whole-school approach to creating a HSNE. Another objective was to increase awareness of Nutrition Tools for Schools for comprehensive HSNE policy.	Yes
Creating Nutrition Standards for Nutrition for Learning Student Nutrition Program	Nutrition for Learning (a not-for-profit student nutrition program) collaborated with the health unit to develop a set of nutrition standards to be used in all Nutrition for Learning programs in the community that is aligned with the MCYS Student Nutrition Program Guidelines, Ministry of Education Food and Beverage Policy Standards and School Board policy standards.	No
Creation of self-assessment tools and menu planning tool for daycare	We are in the process of developing a self-assessment tool and menu planning tool for our daycares so that they are able to offer nutritious foods to the children under their care.	No
Curriculum Support – Trillium Lakelands District School Board	Health promoters support teachers with implementing curriculum by working directly with students on topics of interest to them, such as, body image. Body image is complex and incorporates skill and knowledge development related to psycho-social factors, as well as behaviours related to healthy eating, physical activity, and tobacco and substance misuse.	
Curriculum Support for Teachers	Support teachers with resources to promote physical activity through the curriculum.	No
Daily Physical Activity Support to all elementary schools	Events, in-class demonstrations and workshops are offered to support school boards and schools with mandatory 20 minutes of daily physical activity for students. Our agency shares an employee with the public school board; a teacher and physical activity specialist who is highly trained and regarded.	Yes
Development Application Review	The health department provides comments to development applications, including changes to local official plans, zoning bylaws, secondary plans, subdivision plans and site plans. In coordination with the Regional Planning and Transportation Services, the health department focuses on active transportation.	No

Initiative	Description	Evaluated?
Discover Your Inner Chef Campaign	Discover Your Inner Chef is a campaign targeted to low-income single parents. The campaign focuses on building food-budgeting skills for adults or young adults in the community who need information about eating healthy on a budget. The food budget kit assists residents in developing their food skills in using Canada's Food Guide, menu planning, shopping smart, cooking at home and using leftovers.	Yes
Action Challenge Contest	The Action Challenge is a contest where participants ages five and up track their physical activity for several weeks in a row. The goal is to reach the recommendations from the CSEP Guidelines. Eligible tracking forms are entered into a draw to win prizes supplied by all of the partners. The local media provides in-kind coverage of the contest. Each year different target audiences are defined, and different promotional strategies are used.	No
Early Prenatal Education	Early prenatal classes are offered to expectant mothers and their partners using Best Start modules. This is a four-week series promoting healthy lifestyle choices, including healthy eating and physical activity.	Yes
Eat & Learn - Student Nutrition Program	Eat and Learn offers funding and support to schools that want to have a breakfast, snack or lunch program. Funding comes from various sources. The program works with parents and school staff to get needed funding and helps schools plan their activities.	Yes
Eat Smart	Eat Smart! is an award program that recognizes schools, workplaces and recreation centres that meet exceptional standards in nutrition, safe food handling and a smoke-free environment.	No
Eat Smart Recreation Program	The Eat Smart!® Recreation Centre Program supports healthy environments by qualifying recreation centres on a set of three standards: Nutrition - the facility must offer healthier food choices in the snack bar and vending machines; packaged products are evaluated using the Eat Smart!® Choices Calculator to determine whether or not they meet the Eat Smart!® nutrition criteria; Food Safety - the facility's snack bar must have an excellent track record in food safety based on requirements in the Ontario Food Premises Regulation and at least one employee certified in safe food handling; and 100% smoke-free environment – the facility must be in compliance with the Smoke-Free Ontario Act (2005) and not sell tobacco products or accessories.	Yes
Eat Smart Workplace Program	Eat Smart Workplace Program encourages and awards workplace cafeterias for providing supportive environments by offering healthier food and beverage choices. Workplaces play a role in addressing childhood obesity as parents are gatekeepers of healthy eating information and food, are powerful role models for children with regards to healthy eating behaviours.	No
Active and Safe Routes to School	Tri-county steering committee to promote safe, active transport to and from school and the development, implementation of School Travel Plans	No
Health Local Food Charter	To develop and promote a local food charter. Key activities: awareness-raising (e.g., public launch and social media); – advocacy--sign the petition/challenge (supporting behaviour change)	No
Energize challenge	The challenge was designed for grade 2 students (according to their curriculum requirements). It is a year-long challenge, where each month the students are asked to do activities to increase their level of physical activity and eating better. The uptake was 50% of all of our schools. We are in the process of doing a qualitative evaluation with the teachers.	Yes
Energy Drink Advocacy	'The Ontario Energy Drink Work Group' was formed in the summer of 2011 with the mandate to plan and coordinate advocacy and education related to the formulation, sale and consumption of energy drinks in Ontario. From a healthy weights point of view, the concern is the trend toward large increases in the consumption of sugar-sweetened beverages, including energy drinks, and its potential impact on weight and displacement of healthier beverages. To date, the group has attempted to influence changes to Health Canada's Proposed Approach to Managing Caffeinated Energy Drinks; convince some Ontario fitness facilities (e.g., Good Life and Athletic Club) to discontinue the sale of energy drinks at their clubs; collaborate on education materials on the dangers of energy drinks for parents; and drafted an energy drink alPHa resolution for the 2012 Annual General Meeting (via OSNPPH) that supports the recommendations of the OEDWG, the most pertinent for this survey being that Health Canada and the Province of Ontario prohibit the advertising and sale of energy drinks to children and adolescents.	No
Environmental Assessments Transportation	Since 2011, the health department has provided comments to Environmental Assessment Studies for changes on regional roads (focus on active transportation).	No

Initiative	Description	Evaluated?
Every 10 Minutes Counts	In the planning stage - a cross-generational campaign educating the community at large that Canadian Physical Activity guidelines can be met in daily increments and that daily activity does not all have to be done at one time.	No
External Advocacy and Knowledge Exchange (to achieve community food security)	Objective: a. policy-makers have the information required to enable them to amend current policies or develop new policies that would create community food security b. Increased number of policies that support healthy eating and community food security in public service venues c. Increased capacity of community partners to achieve/contribute toward community foods security and food skills programming. Activities: partner with community groups/municipalities and public service venues to align approaches for community food security, including food skills programming; promote and support policy development through consultations and participation on community groups and coalitions; encourage the creation of a sustainable community food system and the provision of local food security; encourage the creation of supportive environments by guiding decision-makers to develop and implement healthy public policies that support community food security. Activities that create a supportive environment include supporting community gardens; Good Food Box Program; Nutrition Tools for Schools	No
Family Health	Provide support to families with children zero to 19 years of age. Activities include the promotion of physical activity guidelines and how to incorporate into daily lives.	No
Farm to School	Farm to School brings fresh, locally grown produce into elementary schools through existing student nutrition programs.	No
Fat Talk Free Workshop	Invited people who work with youth from the community and schools to attend and learn that focusing on weight and obesity in messaging has been linked to eating disorders, disordered thinking, fat phobia/discrimination and could be leading to obesity issues. Promoted taking the focus off weight and instead instilling positive/healthy approaches to and experiences with food and physical activity.	Yes
Feeding Your Baby	The Health Unit Registered Dietitians provides this two-hour workshop to parents and caregivers on feeding their six- to -12-month-old.	No
Females Using Energy for Life (FUEL)	FUEL is an after-school physical activity program for female youth. It combines fun activities with an opportunity to meet new people and learn more about how to live a healthy lifestyle. The school nurse is available to provide interactive "Girl Talk" sessions on many different topics such as self-esteem/body image, sexual health, dating and relationships, emotional well-being, healthy eating, physical activity This is a great time to talk about things that affect teenage girls in a comfortable and safe environment. The program runs for a select period of time during the school year depending on what the advisory committee decides. Each session is about one hour in length and will feature a fun activity to enjoy.	Yes
Females Using Energy for Life (FUEL)	This is a pilot, in a secondary school, of a girls-only physical activity program. The goal of FUEL is to provide female youth the opportunity to be physically active, at no cost to them, in an inclusive, non-competitive, female-only environment. Weekly after-school sessions are held, giving participants the opportunity to try a variety of activities.	No
Fit for Life and Health Action Teams (HAT)	Both Fit for Life and HAT are Healthy Schools initiatives with the goal of creating a healthy, active school environment. Increasing opportunities for physical activity and healthy eating are two areas that many Fit for Life and HAT schools address. School-based initiatives are based on school-specific needs and can include a wide variety of health promotion strategies. Support is provided to the schools via school board health and physical education departments as well as public health nurses.	Yes
Fitness Gram	This is a physical literacy program. A fact sheet was created for teachers to assist them with implementing the program. Also offered teacher training on sensitivity.	No
Fleming College – Fresh Start	Staff work with college students to develop peer-to-peer lifestyle programs. These include running clubs, smoking cessation supports and learning to cook classes in the residence.	No

Initiative	Description	Evaluated?
Food Access Working Group (FAWG) of the Food Roundtable	With regard to food security, a public health nutritionist (PHNutr) co-chairs the Food Access Working Group (FAWG) of the community's Food Roundtable, which acts as the Food Security Action Group Task Force for Poverty Elimination (GWTFPE). In 2011, this group completed a food access guide for service providers and a collective kitchen manual. The Food Roundtable also received endorsement for their GW Food Charter from City Council. In 2011, the PHNutr collaborated on the Food Bank project to complete four focus groups and 102 surveys to collect information about the needs of food bank users. From this information, 17 food skills sessions were completed. In addition, the PHNutr is engaged in conversations with Headwaters Communities in Action (HCIA), which is exploring opportunities to enhance local, sustainable food systems, food literacy and access to healthy food for all as a community priority.	Yes
Food Action Community Mapping Project	Work with community partners to update map twice annually on locations of local food programs that are available for family members in the community.	No
Food Charters	The health unit continues to work with community partners to develop food charters for the city. A food charter is a document that outlines values and beliefs about the food system in the community to inform and direct local initiatives for food security and the development of a sustainable food system.	No
Food For Kids (FFK)	Provides support to 47 school nutrition programs that provide nourishing snacks, breakfasts and lunch programs. Supports include assistance with funding, nutrition guidance and community partnerships.	No
Food for Learning	Food for Learning is our regional student nutrition program and provides breakfast, snack and occasional lunch programs for over 10,000 children each year. The health unit dietitian is a member of the advisory committee and participates in the annual workshops for school program coordinator, assists with the development of the program's newsletter, assists with some of the on-site visits to school programs to enhance quality assurance and address questions, and provides consultation on nutrition issues.	
Food for Thought	Food For Thought is a cooking program designed for children ages nine to 12 that was developed by the health unit and the Community Development Council. The program manual includes instructions for program leaders, age-appropriate recipes and lesson-plan activities covering healthy eating, food safety and kitchen safety. The program consists of six two-hour sessions and is designed for groups of 12 children and two leaders. Children learn to make a variety of simple, low-cost breakfast, lunch and snack recipes, which they can then make on their own at home. An important part of the Food For Thought program occurs after the recipes are completed, when time is provided for participants to sit down and socialize as they share the meal together. When the meal is finished, the children are also responsible for cleaning up before they leave. The Food For Thought program manual was pilot-tested and manual revisions completed. Participant feedback from the pilot program indicated that 89% of participants tried eating some new foods during the program sessions, and 89% felt confident that they could make most of the recipes again at home. The Food For Thought program manual has been disseminated to various community agencies through a train-the-trainer workshop. Parents attend the final session to enjoy the food prepared by the children.	Yes
Food For Thought - Canadian Prenatal Nutrition Program	The program aim is to reduce risk factors that may affect maternal health during pregnancy and a healthy birth outcome. Three priority areas identified Mental Health Promotion, Injury Prevention and Healthy Weights. The following topics related to Healthy Weights are covered; healthy weight gain, prenatal support or education, breastfeeding, physical activity, obesity prevention, food security assistance, collective food preparation and/or purchasing, nutrition education/healthy eating, eating disorders, mental health and effect on weight.	No
Food For You, Food For Two	This Canada Prenatal Nutrition Program is a free drop-in program offered in underserviced areas in our region. Goal is to assist pregnant women to have the healthiest baby possible. Nutritious recipes are prepared and enjoyed each week, and program includes a public health dietitian, public health nurse and family resource worker. Participants learn about healthy eating during pregnancy and in the postpartum period. A public health nurse teaches participants about breastfeeding, infant growth and development, and physical activity. Groceries are provided.	No
Food Matters Coalition	Food Matters was established in 2009 in recognition of the need to provide a venue where community agencies and individuals can work on issues related to food security. The vision is all people have access to safe, adequate and nutritious food that is obtained in ways that maintain dignity.	No

Initiative	Description	Evaluated?
Food Security Campaign	Nutritious Food Basket survey results are used as an advocacy tool for the issue related to food security and child poverty. Results are shared in two fact sheets (see below) with community partners in a mail-out campaign, and a media campaign highlighting the result takes place annually as well.	No
Food Security Directories	Develop and maintain Food for All directory and website that guides community members (including families, community agencies and schools) to food security programs and options for affordable, nutritious food.	No
Food Security Network	The purpose of the Food Security Network is to work in partnership to develop and promote food security through activities such as awareness-raising, education and advocacy. The network provides a forum for information sharing and collaboration on actions that will contribute to food security and a sustainable local food system. The goals of the network are: - raise awareness about the fact that people are going hungry in the community; identify and use opportunities to educate the community about food security; provide information about and promote programs and services that foster access to safe, affordable, nutritious and personally acceptable food; identify needs for food security programs and look for ways and means to invest in them through community partnerships; identify and advocate for ways and means to improve food security; promote partnerships and programs that support rural-urban food links and the availability of locally grown foods; consider opportunities for collaboration with other organizations to further the goal of food security. The health unit supports the network and in the three years to date has taken on the chair and recording functions. A report on activities of the network to date will be available in the next month or so. There are a number of subcommittees working on different aspects, and the health unit also distributes a monthly e-newsletter.	
Food Skills	Public health food workers provide opportunities for skill development in food preparation and cooking for groups of people such as low-income individuals and families and youth. Some topic areas include reducing sodium, cooking from scratch, cooking on a budget, preparing healthy snacks and cooking with more vegetables and fruit.	Yes
Food Skills in Priority Populations	This initiative aims to improve food choice and food consumption behaviours through food skills training and to enable people to acquire skills they need to access food that is nutritious, safe, culturally and socially acceptable. This is accomplished through partnerships with community health/resource centres, the food bank and schools. Food skills include the skills from five general categories: knowledge about food (nutrition value, label reading, food safety and ingredient substitution; feeding relationships); meal planning; conceptualizing food (creative use of leftovers); mechanical techniques of food preparation; food perceptions (using senses for texture; taste and satiety cues).	No
Food skills needs assessment	We have just completed a needs assessment (literature search, environmental scan and key informant interviews) to identify priority populations in our area and look at possible food skills initiatives. We have also identified possible community members/organizations that would support the planned activities.	
Food Skills Programming	Objectives: a. Increased opportunities for food skills development among priority populations b. Increased awareness and knowledge of healthy eating, Canada's Food Guide and food skills (note: food skills are defined, at an individual and household level, as a complex, interrelated, person-centred set of skills that are necessary to provide and prepare safe, nutritious and culturally acceptable meals for all members of one's household. Food skills include knowledge, planning, mechanical techniques and food perceptions). Activities: Education and awareness health communications available on website, hard copy, TV and radio interviews; lifestyle-focused group workshops offered to community re: food skills prep workshops, grocery store tours; collaboration and training provided to community partners that service children and youth (including low-income/priority populations) and their parents - re: food skills; general healthy eating, food safety.	
4 for Lunch	The goal of 4 for Lunch is to increase the number of students packing four food groups for lunch. The program includes curriculum-matched lessons and a challenge to students and their families to make healthy lunches, which include food from each of the four food groups of Canada's Food Guide, for one week. The challenge is meant to be fun, with a light positive message that includes activities, recipes and incentives.	Yes

Initiative	Description	Evaluated?
Fun, Active, Motivated, Elma (FAME)	FAME is a five-month-long physical activity challenge taking place in one school. The goal is to get all students and staff participating in at least 15 minutes of physical activity outside of school hours. Tracking forms and activity ideas are provided each month. The initiative is planned, implemented and promoted by a committee of grade 7 and 8 students with guidance from a teacher and health unit staff.	No
Giddy Up Let's Grow & Giddy Up Prenatal	Giddy Up Let's Grow is an e-newsletter service for parents or young children. Newsletters written by a parent are sent monthly until age one and then periodically until age six. Topics include healthy eating/weights as well as growth and development. Giddy Up Prenatal (Expectant Parent Booklet) provides expectant parents with information they need to improve pregnancy and birth outcomes. Designed for woman in early to mid-pregnancy. Includes a community resource listing. This resource is distributed in partnership with local prenatal service providers.	No
Girl Talk and Training on Weight Bias - planning stage	Addressing unhealthy eating and physical activity behaviours via mental health /positive self-esteem and body image. Girl Talk is a specific program with public health nurses facilitating small groups regarding healthy eating, physical activity, media awareness to promote positive body image. Training on weight bias helps facilitate "do no harm" when planning and implementing healthy weight/obesity prevention programs.	Yes
Girls and Physical Activity	A physical activity resource checklist has been developed for girls to address the decrease in physical activity reported in the female secondary school-aged population. Suggestions and ideas are based on the four foundations of a healthy school model (in class education, supportive environment, physical environment and community partners). The initiative promotes lifelong skills that offer options outside of the traditional competitive team and individual sport environment while promoting relationship-building and self-esteem. Additionally staff participate as active members of internal and external coalitions, and community committees including consulting with Parks and Recreation and OPHEA. Schools are a large stakeholder, and a framework has been developed again based on the comprehensive school health model pillars to promote ideas and information related to girls and physical activity. Staff support healthy schools committees to initiate, implement and evaluate activities related to this topic as well as encourage co-factoring of other related health topics such as nutrition and injury prevention. Provided consultation and feedback for Catholic and public school board healthy schools and workplace policies. Promotional items are also offered in context with programming to offer acknowledgement of participation and incentives for engagement. Staff answer media requests and author articles for a public health workplace wellness newsletter that reaches parents to complement messages that students receive in schools. Additionally, there is a division-wide project on chronic disease prevention taking place which includes participation from staff working on this project as well as a building healthy communities initiative to which consultation and feedback is provided. Currently staff are looking to phase two of this initiative and exploring a targeted population directed by evidence and social determinants of health which may be newcomer girls accessed through welcome centres.	
Go Girls Mentoring program	Mentoring program designed to encourage physical activity, healthy eating and self-esteem in girls 12 to 14	
Good Food Box	The Good Food Box is a non-profit, volunteer-supported food security program that allows individuals to pre-purchase a monthly, affordable box of fresh fruit and vegetables that is delivered to one of a large network of host sites throughout area neighbourhoods a few weeks later. Our main objective is to enhance community food security and nutrition by providing affordable, quality produce to those whose access to fresh food may be restricted by limited financial resources, transportation, knowledge or mobility. The Cooking with the Good Food Box Program gives vulnerable parents and parents-to-be an opportunity to learn new cooking skills and try new foods from the box.	Yes
Grade 5 free swim passes	All grade 5 students are provided with free swimming passes for the school year 2012-13. Incentives will be given to use the pass, as this is the first year of the program in the community. The goal is to encourage the establishment of healthy behaviours by promoting easy access to a free and fun activity. Families will be encouraged to accompany the students. Girls in this age group tend to decrease their levels of physical activity, so the program will encourage girls to remain physically active.	Yes
Grade 5 Action Pass	The grade 5 action pass gives all grade 5 students in the region free and unlimited access to programs such as public swimming, public skating and drop-in programs. Once obtained the pass can be used at any participating recreation centre.	Yes

Initiative	Description	Evaluated?
Grade 5 and 9 community physical activity pass (free)	Students in grade 5 and 9 are given a photo identification card which entitles them to free access to both urban and rural arenas, pools and the YMCA pool and gymnasiums, which would normally require a gate fee. The cards are good while the students are in their grade 5 and 9 years and extend through the summer until August 31. Each student receives a schedule of all the activities: skate, swim and open gym, and the times available. Phone numbers of the facilities have been included.	Yes
Growth Monitoring	PHNs monitor growth of high-risk infants in HBHC and as needed when clinical assessment indicates	No
Baby-Friendly Initiative	A community action group working together to protect and support breastfeeding through evidence-based programming and use of best practices. By promoting informed decision-making education collaboration, empowerment and public participation the BFI aims to increase breastfeeding rates in the region.	No
Food Council	The goal of the Food Council is to increase awareness of food systems issues and opportunities in the region and communicate with a common voice to promote action.	No
Social Media Strategy for Parents	An online resource via Twitter and WordPress platform that provides latest parenting news, tips, health information including healthy eating and physical activity.	No
Prenatal Nutrition Program	A program designed to meet needs of at-risk pregnant women by providing them with various resources to improve their health and to increase the number of babies born with a healthy birthweight. Mothers stay in the program up to six months postpartum and learn cooking skills, education on healthy eating, parenting etc.	Yes
Harvest Cooking Program	Objectives are to increase vegetable and fruit consumption for low-income families and increase food skills for low-income families. Key activities include: fresh produce distributed free of charge through monthly food depot; sampling and recipes at food depot of monthly produce; community members prepare food samples and enjoy a meal together with their families the day before the monthly food depot at the community health centre.	No
HEAL Strategy (Healthy Eating Active Living)	The HEAL strategy has three main objectives: to decrease consumption of energy-dense nutrient-poor foods and beverages; to increase physical activity through walking and active transportation; and to engage the "whole of community" to change social and physical environments. Using a multi-pronged approach the goal is to provide knowledge and skill-building opportunities to individuals and create environments that support the changes to healthy eating and active living.	No
Health Before Pregnancy Communication Campaign - Baby on the way?	This health communication initiative are strategies used toward program goal – to enable all children to attain and sustain optimal health and developmental potential. Two free packages are distributed – Health Before Pregnancy Makes a Difference and Prenatal Information Package.	Yes
Healthiest Babies Possible Program	The Healthiest Babies Possible program provides one-to-one nutrition counselling and education to pregnant women who are nutritionally at risk for having a low birthweight baby. The program also provides clients with food certificates for purchasing healthy food; TTC tokens for travelling to appointments in community sites; prenatal vitamins for the pregnancy; and referrals to other public health services and community resources. The goal of the program is to contribute to healthy birthweights among nutritionally at-risk pregnant women.	No
Healthy Babies Healthy Children (HBHC) Home Visiting Program	HBHC is a preventative, early-intervention program designed to help children achieve their full potential. Public health nurses and Family Home Visitors work together with families to promote physical, cognitive, communicative and psycho-social development of children. The program identifies high-risk families during prenatal, postpartum and early childhood development through screening and assessment.	Yes
Healthy Babies, Healthy Children Cooking Class	Provide education and skill-building opportunities to increase ability to access nutritious, safe, personally acceptable food. Activities include safe food-handling practices, basic cooking skills and grocery store tour.	Yes

Initiative	Description	Evaluated?
Healthy Bites	Goal of Healthy Bites is to support the creation of an equitable, comprehensive multi-year school nutrition environment awards program in elementary schools. Short-term objectives (one to 12 months): - To increase awareness in a healthy schools approach as it applies to healthy eating within the school setting - To increase commitment in a healthy schools approach as it applies to healthy eating within the school setting Medium-term objective (one to three years): - To increase the number of schools participating in creating a healthy nutrition environment using a comprehensive approach Long-term objectives (three to five years): - To increase the availability of maximally nutritious foods and beverages, and to reduce the availability of minimally nutritious foods and beverages via changing school behaviour in order to support students and staff in making healthier food and beverage choices. - To influence the development and implementation of policy and strategy related to healthy eating and healthy weights that will support access and consistent messaging related to improving healthy school nutrition environments. Key Deliverables - School Nutrition Checklist (assessment tool) - Presentations / workshops offered to school councils, school staff and healthy school team - Facilitate the creation of a Student Nutrition Action Committee and Student Nutrition Action Plan - School recognition award and celebration at year-end - Partnerships with community groups/members Expected outcomes: A comprehensive nutrition strategy that aligns with the foundations for a healthy school and the nine essential elements of a healthy school nutrition environment, strengthening school nutrition policy development. At least 23 elementary schools are expected to participate over a three-year period.	Yes
Healthy Body Image promotion	Health unit partners with the local eating disorder program to prevent childhood obesity and disordered eating though the promotion of positive body image to a variety of audiences. Most initiatives promote medial literacy, development of healthy relationships and positive connection with food and activity as follows: The Dressing Room Project involves a workshop for grade 7 to 8 girls where they learn about how advertising can manipulate them into being dissatisfied with how they look. Dangers of dieting and the importance of regular healthy eating are explored. Girls have an opportunity to create positive message cards to remind them when they look in the mirror that beauty comes in all shape sand sizes. Selected cards created by local students have been made into mirror decals and posted in dressing rooms around the community. Buttons, pens and advertisements have also been produced to promote the campaign. This train-the-trainer model facilitates mental health providers to partner with health unit staff across the district to deliver the Dressing Room Project. Workshops geared to parents/foster parents, coaches, teachers-in-training are provided on request including BodySense to promote positive body image in sport. Currently exploring the possibility of training local BodySense facilitators for our region, through partnerships with sports and mental health organizations.	Yes
Healthy Communities Fund Partnership Street	In 2011/12 the purpose of the program was to: mobilize communities to foster and develop policies that make it easier for Ontarians to be healthy; increase the number of networks, community leaders and decision-makers involved in healthy eating and physical activity policy development; enhance local capacity of networks, community leaders and decision-makers to build healthy public policies; increase the quantity and impact of local and regional policies that effectively support physical activity and healthy eating. The purpose of the Healthy Eating / Physical Activity Policy Mobilization Plan was for partnerships to identify what healthy eating and/or physical activity policy priority/priorities they would be working toward and what actions and activities would be initiated by the partnerships to achieve identified policy outcome(s). The actions and activities that the partnership engaged in should have been to achieve progress toward the selected policy/policies. Policy goal and objectives of the partnership include: increase the number of municipal policies that improve healthy eating (HE) and physical activity (PA) through advocating for and assisting in the development and implementation of: a) local policies that ensure affordable and accessible recreation activities for all, free universal programs for all residents and increased availability of activities across neighbourhoods, and b) municipal/town planning policies that increase access to healthy food and meal preparation skills for priority populations	No
Healthy Communities Guideline Development	In collaboration with Planning Services, the health department provides technical support on nutrition and physical activity factors in the development of the Healthy Communities Guidelines, according to the Regional Official Plan Amendment.	No

Initiative	Description	Evaluated?
Healthy Eating & Active Fun	Healthy Eating & Active Fun For Young Children is a free four-week program geared toward families with children ages zero to six. This program provides parents and grandparents with useful and practical tips, information and hands-on ways of being active and eating well with their children. The program includes information on active play and other activities parents can do with their child at home as well as healthy snack and recipe ideas. Parents will also learn how to read food labels to assist them in making healthy food choices at the grocery store.	Yes
Healthy Eating Active Living (HEAL) Workgroup	This initiative includes: 1. Hop, Skip, Munch! Resource development related to healthy eating and physical for early years educators. 2. Healthy Bodies Happy Kids. Resource development related to healthy eating and physical activity for after-school educators. 3. Education strategy that focuses on enhancing public health professionals' knowledge and skills related to aspects of obesity prevention, such as physical activity, healthy eating and healthy weights.	No
Healthy Eating and Active Living (HEAL) Award program	Financial awards are given annually to schools that meet the HEAL criteria. Healthy active living awards are given out to graduating secondary school students who meet the criteria. Teacher champions are identified in every elementary and secondary school and are a liaison for public health in each school.	No
Healthy Eating and Healthy Physical Activity Priority Group Child and Youth Agenda	The Child and Youth Network began in 2007 with identification of community priorities and building local community initiatives around the priorities. For the past five years the Healthy Eating and Healthy Physical Activity priority has worked through community collaborative projects to plan and implement strategies in the areas of the following: planning and Implementation of community strategies in the areas of: 1) Promotion and building Healthy Eating and Healthy Physical Activity awareness and education; 2) Creating healthy and active neighbourhoods; 3) Changing resident behaviours and habits; 4) Building community connections for population with barriers to physical activity and healthy eating; 5) Building an evidence base in Healthy Eating and Healthy Physical Activity measurement and tracking	No
Healthy Eating Environment Guidelines for Child Care	A set of nutrition guidelines for all licensed child care centres. Objective is to improve the eating environments and healthy food choices within child care centres. Intent is to implement as policy next year.	No
Healthy Eating Environmental Toolkit - Nutrition Guidelines	The tool kit is a nutrition resource for child care centres and early-learning sites. The purpose of the tool kit is to provide child care and early-learning staff with nutritional guidelines to help their decision-making around food choices for the children they work with. It also promotes role-modelling of staff to promote healthy choices.	No
Healthy Eating in Child Daycares	Working with local child care providers around nutrition recommendations as per the Day Nurseries Act with a focus on developing/refining food skills and menu planning in child care centres	No
Healthy Eating in Group Homes	Healthy Eating in Group Homes. Guidelines: Based on the need identified by a local stakeholder to improve the nutrition environment in local group homes, the Youth on Track for Healthy Eating (Pilot Project for Group Homes) was initiated. The goal of this project has been to create healthier nutrition environments in selected pilot group homes via the introduction of Healthy Eating Guidelines. The intent was that these group homes share their successes and become champions of the guidelines for all group homes in our community. Ultimately the expectation is to have these guidelines adopted as "best practices" by these agencies so that a healthy eating environment in these homes becomes the norm. In addition, the project has involved staff from a local college child and youth worker program so they can integrate this critical information into the course work for future child and youth workers. This will assist them in ensuring better preparation to promote good nutritional practices in group home settings. Activities to date include: the development of a Nutrition Environment Guideline Checklist; a launch event to kick off the guidelines and inform respective group home staff about the guidelines; food safety and healthy eating skill-building for staff from the respective group homes as well as students from the child and youth worker program at a local college.	No
Healthy Eating in School	Public health dietitians at the health unit work with community partners to provide services that support school nutrition programs, such as providing healthy snacks and meals, and training for and ensuring compliance with the provincial school food and beverage nutrition policy.	No

Initiative	Description	Evaluated?
Healthy Eating in School	Dietitians work with community partners to provide services that support school nutrition programs, such as providing healthy snacks and meals, and training for and ensuring compliance with the provincial school food and beverage nutrition policy.	Yes
Healthy Eating Makes the Grade	Healthy Eating Makes the Grade (HEMG) is a community partnership that is advocating for healthier nutrition environments in and around schools in order to improve access to healthy foods for students. Parents, students, teachers, school administrators, municipal planners, food producers/vendors, health and social service providers are working together to: promote healthy eating through youth-led groups at several high schools; build support for healthy food zones around schools; raise awareness and support for school gardens through education and policy, and promoting healthy school food environments; make connections to promote healthier cafeteria choices healthier cafeteria choices. This project was made possible through funding by the Heart and Stroke Foundation of Ontario.	Yes
Healthy Eating Playbook for Coaches	This guide provides information on how to help a team/coach make healthier food choices.	No
Healthy Eating Program for Gr 9/10 Family Studies Classes	Web-based learning to tie in with school curriculum. Students learn about the per cent daily value (%DV) of different foods and menu-planning skills based on nutrients, etc. Students are directed to various websites. There is a lesson plan for the teacher and class assignment. Program is currently in the pilot phase.	No
Healthy Eating-Rethink Your Drink	The health unit works toward initiatives that address risk factors for an unhealthy weight. For example, the Healthy Eating component focuses on building skills and knowledge for priority populations, improving access to vegetables and fruit; reducing consumption of sugar-sweetened beverages and supporting workplaces, recreation centres and school with providing healthy foods and beverages. The purpose of the Rethink Your Drink Campaign Advocacy Campaign is to decrease access to, and consumption of, unhealthy beverage choices and to increase awareness about the benefits of healthy drinks and the health risks associated with sugar-sweetened beverages. Recent research has correlated drinking sugar-sweetened beverages with an increased risk of weight gain, cavities, diabetes, high blood pressure and heart disease.	Yes
Healthy Eating Working Group	This working group has meetings with community members who are engaged in food and nutrition issues and initiatives. Purpose is to increase the capacity of community partners to coordinate and develop local healthy eating programs and services; to work with municipalities to support healthy public policy and creation or enhancement of supportive environments. The working group is currently developing a food charter, and plans are under way for three public forums to get input on the food charter.	No
Healthy Eating, Physical Activity, Body Image & Self-Esteem Common Messages Discussion Paper	The purpose of this paper is to assist public health staff to implement the messages of the Vitality Approach. It is hoped that this discussion paper will help staff provide consistent, clear recommendations and information for the public on issues of weight, healthy eating, physical activity, body image and self-esteem. The messages are for the general population and do not necessarily address the circumstances of all individuals.	No
Healthy Food For Healthy Schools Protocol, including PPM 150 Implementation Support	In collaboration with the public school board, the health department supported the creation and implementation of a protocol that identifies the requirements in the Healthy Food for Healthy Schools Act, 2008, and the accompanying Policy Program Memorandum 150, School Food and Beverage Policy (PPM 150).	
Healthy food healthy kids	Trying to provide healthy nutritious idea for snacks or meals in settings other than schools where children live and play. A survey was done to see what was needed for organizations that have children under their care (outside the school setting). From there, a conference was organized, and workshops were offered to show people how to make easy nutritious snacks in less than five minutes.	No

Initiative	Description	Evaluated?
Healthy Living Strategy	The Healthy Living Strategy is an integrated chronic disease prevention planning framework. The goals are to 1) increase physical activity; 2) decrease sedentary behaviour; 3) increase consumption of plant-based foods; 4) decrease consumption of processed foods; and 5) achieve and maintain healthy weights by focusing on the physical activity, sedentary behaviour and healthy eating goals. This initiative is based on the best-practice approach of a comprehensive and integrated chronic disease prevention strategy to build a lifetime of good health versus focusing on a specific risk condition such as weight.	No
Healthy Measures	There are two components to this program: (1) Healthy Measures is an approach that encourages women to take healthier measures or steps to better health without focusing on weight loss. Healthy Measures is based on three key messages: be active, eat well and be yourself. One component of Healthy Measures is a six-week series of classes targeted to women. This series of classes includes a grocery store tour, a new physical activity to try each week and healthy lifestyle topics such as menu planning, healthy dining out, positive body image, flexibility and strength training. The classes are taught by a public health dietitian, public health nurse and fitness instructor. (2) Health unit staff worked with a masters student to do some focus groups and development of messaging on healthy weights for men. An article is soon to be published in Health Psychology (a special issue on men's health) about the outcome of the student's research. Despite targeting men and women, the program aims to impact on developing healthy attitudes in adults to healthy eating and physical activity and weight.	Yes
Healthy School Award	The Healthy School Award is formal recognition for using a comprehensive approach to healthy eating, physical activity and other topics. It assists with building capacity in schools to create environments supportive of healthy eating and physical activity utilizing a comprehensive approach.	No
Healthy Schools	Support development of healthy schools and healthy school nutrition environments in Peterborough County and City. The health unit staff work together to support comprehensive school health approach in local schools. Grants awarded in elementary and secondary schools based on school's priority and involvement of youth; many projects focus on nutrition/healthy eating and physical activity. Staff supports school teams in providing information and supporting implementation and evaluation of plan.	Yes
Healthy Schools	Healthy Schools utilizes a best-practice, comprehensive school health framework to address a variety of health topics, including healthy eating and physical activity that are identified through a needs assessment by the school community. Healthy schools committees are formed or joined with an existing school committee with representation from school administrators, teachers, parents and students and in consultation with public health nurses and nutritionists. They develop action plans with a range of activities to address the health topic. Plans are implemented, and the impact is evaluated and celebrated by the school population. We continue to work with school boards who have developed Healthy Schools and Workplaces policies.	Yes
Healthy Schools 2020	A common vision of children and youth being physically active and making healthy food choices every day is what united four public health units and nine school boards. Since the signing of the declaration in 2009, workshops for principals, teachers, parents and other stakeholders in school health have been delivered. Support for PPM 150 was a priority recently, and by using the Nutrition Tools for Schools Program the health unit was able to support schools in taking the policy a step further to include healthy fundraising, healthy classroom rewards and healthy lunch programs and food service contracts. Physical activity remains an integral part of this initiative moving forward even though the majority of the work over the past couple of years has focused primarily on creating healthy school nutrition environments.	Yes
Healthy Schools Pilot	The health unit is working with two elementary schools in the district school board to pilot the Healthy Schools approach. The Healthy Schools approach is a comprehensive approach covering the four components of a healthy school as outlined in the Ministry of Education's Foundations for a Healthy School Framework (High-Quality Instruction and Programs, A Healthy Physical Environment, A Supportive Social Environment & Community Partnerships). The Healthy Places team is supporting the process, which involves gaining commitment from the school community, forming a Healthy School committee, identifying strengths and needs, developing and implementing a tailored action plan and evaluating the process and outcomes. During the next school year, the team plans to support additional schools and further promote the Healthy Schools approach throughout our school boards.	

Initiative	Description	Evaluated?
Healthy Secondary School Nutrition Program	Objectives: To help create a healthy, nutritious environment in secondary schools by assessing the Nine Essential Elements to a Healthy School Nutrition Environment (HSNE). Key Activities: work with school groups to (1) help form a committee devoted to addressing nutrition in the school, (2) identify areas of nutrition concern, (3) develop a plan of action and implement (4) evaluate and celebrate.	No
Healthy Vending Machines	Collaborated with Student Nutrition Program to sponsor the purchase of three healthy vending machines - selling healthy products to three area secondary schools. This initiative was designed to meet the needs of three specific schools that are geographically isolated and do not have cafeterias or access to healthy foods off school property. The vending machines are primarily stocked with dairy products due to data indicating that this population has lower than recommended calcium intake.	No
Healthy Weight Messaging for the zero to six-year- old population	Healthy weights messages are provided in clinic settings and at Healthy Baby Healthy Children family home visits.	No
Healthy Weights Key Messages paper	The Healthy Weights Key Messages paper was written in 2007 to provide a uniform message for all health unit staff to deliver on the topic of healthy weights. It was developed by an interdisciplinary committee and staff training occurred by team. Although the document is five years old it still provides a strong reminder about how powerful words on around a topic so important within our society.	No
Healthy Weights Messages for the Early Years	Prenatal health fair display and the distribution of resources	No
Healthy Weights Staff Education	Three-hour workshop for public health staff promoting a three-pronged integrated approach to healthy weights: being physically active, eating healthy and positive mental health and well-being. Workshop goal: to enable public health staff to communicate positive and consistent healthy weights messages.	Yes
Healthy Weights Task Force and Strategy	The interdisciplinary task force began in 2006 and helps to develop and coordinate the healthy weights initiatives that support the healthy weights strategy across programs and target audiences. Based on the balanced approach to promoting healthy weights, strategy targets schools, work sites, families and municipalities to build capacity, community awareness, partnerships and develops policies to promote healthy eating, active living and feeling good about yourself where we live, learn and play.	Yes
Healthy Weights Web Page	Information to support individuals to maintain and achieve a healthy weight is provided.	No
Healthy Weights: Takes Action	Healthy Weights: Takes Action is a multi-year project. Years one and two identified community priorities and aligned partner and health unit programming. Main role for health unit at this time is coordination and knowledge translation.	No
Healthy, Happy Kids Project	The Healthy, Happy Kids campaign involves a comprehensive booklet, information cards and a monthly e-bulletin, all promoting a balanced approach to achieving a healthy lifestyle. It is designed for parents with children aged four to 12 and offers tips on how they can help their children be well-nourished, more active and feel good about themselves. Each month, the e-bulletin encourages nearly 600 parents across the district to make small, positive, lasting changes that could impact child and family health. Low-cost events and programs are also highlighted so families can take advantage of activities such as free-skates, swims or community gardens close to home. Key messages around reducing sedentary behaviour, screen time and increasing incidental movement and unstructured play are incorporated throughout the project, such as “Pause to Play” (screen-time message) and Big Boreal Adventure (play outside message). Effort is made to promote cross-program topics such as children’s environmental health, oral health, food safety, sun safety, injury prevention, Triple P and flu clinics. The e-bulletin began in 2009 in response to parents’ requests for ongoing practical ideas and support. Signing up for the e-bulletin is promoted through school and community events, advertisements and print materials that are available for distribution across the district.	Yes
High School Vending Machine initiative	Three vending machines stocked with healthy choices (as per new School Food & Beverage Policy) were purchased and provided to local secondary schools. Machines stocking dairy products were purchased as data indicates that the secondary student population does not consume adequate calcium.	No

Initiative	Description	Evaluated?
Hub Trail Initiative	Support advocating and planning on increasing physical activity in community design and the built environment. The objectives are to increase physical activity in the community; to support active transportation in municipal official plans; to promote the use of the Hub Trail to residents and as a tourism attraction. Construction of a 23-km trail have been completed; therefore key activities at this point include to complete signage along the trail, promote use of trail, to evaluate the use of the trail, to secure further funding to extend trail development in other parts of the community.	Yes
Healthy School Initiative	This initiative addresses the link between the health of students and their learning success. The program recognizes the importance of a learning environment that reinforces positive health messages and contributes to the physical, mental, emotional, social and spiritual health of students, staff and families. This initiative is aligned with the Ministry of Education's Foundations for a Healthy School Framework. Examples of key activities: establishing a healthy school committee with students, teachers and community members; working with the committee to engage in a healthy schools planning process (create a vision, develop and implement a plan, evaluate and celebrate); developing leadership skills in students to engage them throughout the process; working with partners to share healthy school messages within the community.	Yes
In Motion	In motion is a community-based strategy to encourage residents to be more physically active for health benefits. Activities have included: two surveys on adult physical activity levels; school and workplace workshops; participation in community events; social marketing; school physical activity and screen-time challenges; and development of resources. In recent years, grade 5 students in four municipalities received a pass allowing them free admission to public skating and swimming in the municipality in which their school is located. Some municipalities also offered activities such as golf, hip-hop dance and martial arts at a reduced cost with the pass. The purpose of the program is to increase physical activity and sport participation among grade 5 youth by removing the barrier of cost and increasing accessibility to recreational facilities.	No
Ignite! (Physical Activity Network)	Ignite! is a network of partners interested in physical activity promotion. Has been in place for several years. Health unit staff support the network and provide an e-newsletter which gives updates on topics of interest, new research, upcoming events, etc. The group used a Healthy Communities grant some years back to purchase a "Physical Activity Cruiser." the "IPAC," which members can borrow to support the running of physically active games at various community events (a trailer with several pieces of equipment suitable for an outdoor event with a large number of people). They also put on some workshops of interest to local recreation providers, coaches, school health and phys ed personnel, etc. (e.g., bringing in a presenter on fundamental movements). Some of the partners have had Healthy Communities grants, and the health unit supports those activities on request and when possible. Partners work together on planning and implementing a training day for the recreation partners' summer staff, which includes information and ideas on healthy eating and physical activity for children.	
Eat Smart Recreation Centre Program	Promote the Eat Smart Recreation Centre Program. Objectives: increase access to healthy food choices in local recreation centres.	No
Implementation of NutriSTEP screening tool in the community and Family Health Teams	The NutriSTEP screening tool is a validated tool that screens children three to five for risk of overweight/obesity. We are working with community partners to implement the tool with parents, and next will be working with family health teams to incorporate into their practice. Goal: Identify nutrition-related problems during the early years to provide opportunities to enhance parents' abilities to support healthy growth and development Objectives: to identify potential nutritional problems early in children's lives; provide parent referral to community resources; monitor community child nutrition problems. Activities: 1. Implement NutriSTEP in the following settings: Healthy Babies, Healthy Children program; primary care (family health teams); school boards; Better Beginnings program 2. Provide staff training to all relevant community stakeholders 3. Next Steps: to work with family health teams to incorporate into their practice.	No
In motion certified! program	This initiative offers the in motion certified! program: a physical activity/healthy eating recognition program for child care centres and elementary schools. Each participating school/ child care centre provides programs/teaching/activities in order to reach eight levels of success. In 2011, 24 elementary schools and eight child care centres were involved in the program.	Yes

Initiative	Description	Evaluated?
Increased access and availability to healthy foods and physical activities	The health unit, recreation programs and YMCA collaborated to initiate free swim/skate passes for all grades 4/5 students. This program provides unlimited access to facilities across the municipality. Provide support to the student nutrition program to offer healthy foods for breakfast and/or snack for school-aged children. Support community partners through land use, funding dollars, program promotion to implement initiatives for community gardens, fruit and vegetable voucher program, cooking clubs throughout the municipality. We are embarking on a new initiative to support our school boards with promoting physical activity in the before- and after-school program.	Yes
Increasing Physical Activity and Reducing Sedentary Behaviour in Childcare Settings: Creating Supportive Environments	After conducting a survey with licensed child care providers regarding physical activity and sedentary behaviours, we have applied for funding through the Heart and Stroke Foundation to create a network with the EDs of the child care centres focusing on the development of policies and improved practices related to physical activity and sedentary behaviour. Goal: The overall goal of this project is to enhance supportive environments that promote increased physical activity and reduced sedentary behaviour among children in the early years (zero to five years old) who attend licensed child care centres in the region. Objectives: a) Influence physical activity and sedentary behaviour policy development and revision among local child care centres; b) Enable partners to become advocates for promotion of physical activity and reduction of sedentary behaviour in the early years; c) Enable partners to work toward development of guidelines to support child care centres in promoting physical activity and reducing sedentary behaviour; d) Increase awareness among Ministry of Child and Youth Services representatives of the importance of physical activity and the reduction of sedentary behaviour in the early years. Activities: 1. Invite community stakeholders to form a partnership to advocate for supportive environments for physical activity in the early years; 2. Conduct environmental scan of best-practice guidelines for physical activity in daycare setting in other jurisdictions; 3. Develop draft documents for partnership including, for example, terms of reference, purpose of partnership, potential direction and activities, meeting agendas. Circulate to members to obtain input and advice (this will be continued in first partnership meeting); 4. Hold approximately four bi-monthly meetings with partnership members (exact dates to be confirmed); 5. Evaluate the partnership.	No
Infant Feeding Class	Activities: Deliver an Infant Feeding Curriculum in a class format to parents of infants zero to 12 months. Objectives: 1. To provide parents with the knowledge to exclusively breastfeed until six months of age; 2. To provide parents with the knowledge to appropriately and safely introduce complimentary solid foods at six months of age; 3. To provide parents with the knowledge to progress through the stages of introduction between six and 12 months; 4. To encourage parents to follow their infants' cues and respond to their needs; 5. To encourage parents to establish a healthy lifestyle with their infant that includes healthy eating and physical activity.	No
Physical Activity Directory	The Physical Activity Directory is a listing of local physical activity opportunities. The directory contains information, by area, about facilities and programs available to adults, youth and children. It is available online and in health unit and municipal offices and promoted through the media as a source of information.	

Initiative	Description	Evaluated?
Healthy Active School Communities	The Healthy Active School Communities (HASC) initiative is a comprehensive school health program that the health unit has supported, in collaboration with school boards and other local partners, for almost 10 years. The model has recently been revised to enhance the quality and effectiveness of the program and to increase sustainability. The new model, introduced to schools in September, 2011, incorporates significant new school health research, as well as addresses local feedback from participating schools. There are now two ways for schools to take part in HASC, based on their stage of readiness: HASC or HASC too! All elementary schools are encouraged to participate. Schools that choose to participate in HASC are encouraged to follow a process that supports quality curriculum instruction, a healthy physical environment, a supportive social environment and community partnerships. These schools are supported by health unit staff with regular communications, professional development opportunities and information about curriculum resources and supports. Schools that are ready to make a more in-depth commitment to the comprehensive approach to school health apply to the HASC too! program. Schools committed at this level receive all general supports provided to HASC schools plus in-depth support from a public health nurse or dietitian assigned specifically to work with the school. The health professional will assist the school's action team in collaborative planning, engaging students and parents, developing community partnerships and providing expertise and guidance in health promotion. Education opportunities for parents, training and development of HASC student leaders, and employee wellness are also part of the program. Part of the current approach involves working more closely with the school boards to enhance support foe comprehensive school health at the board level. We presented a "business case" and have been working with senior administration to encourage schools to participate fully.	Yes
Partnership for Healthy Kids	We are a site for the Ophea Partnership for Healthy Kids and are working with Ophea and other provincial partners to support and enhance our HASC (comprehensive school health) initiative.	
Key messages dissemination "Healthy Bodies: Eat Well, Be Active, and Feel Good About Yourself - Using Common Messaging to Support Health"	A document was adapted from a couple of other health units who had done a similar initiative. Intended for the use of health professionals, educators and others interested in working to promote healthier lifestyles within our community, the key messages are meant to assist professionals in providing consistent, evidence-based messages and recommendations for the public on issues of weight, healthy eating, physical activity, body image and self-esteem. The messages are for the general population and do not necessarily address the needs of all individuals. The three main themes of the document are: Eat Well, Be Active and Feel Good About Yourself. Today's emphasis on obesity often leads to a focus on weight. While excess weight is a risk factor for some chronic diseases, it's important to remember that weight is only one indicator of health. Other factors such as genetics, age, activity levels and eating habits affect health as well. In fact, people who are overweight can improve their health status and reduce their risk of chronic disease by engaging in healthier behaviours, independent of weight loss. Therefore, to help children and adults achieve better health, it is our goal to encourage people of all shapes and sizes to focus on healthy lifestyle behaviours instead of focusing on weight. We have been disseminating the key messages document and providing consultation.	
General information and resources	We have a Healthy Life Line which is promoted to the community for questions from the public on healthy eating, physical activity and healthy weight. We provide resources for the public and specific audiences (e.g., disseminating the new CSEP physical activity and sedentary behaviour guidelines for young children to schools, daycares, physicians, media, etc.; maintain information on the website; provide displays and educational materials for schools, workplaces and the community.	
Physical Activity leaders in Schools (PALS)	PALS stands for Physical Activity Leaders in Schools. It is a program that provides training to intermediate students so that they can help lead physical activities in their school. The goal is to increase the number of opportunities available at the school to be active. Having older students lead younger students in physical activities is a win-win idea! Older students are great role models for younger students. Seeing the intermediates being active and having fun can have a big impact on the younger students. Health unit staff adapted the program, produced training materials and implement the training and follow-up support.	
Internal Health Weights Strategy	Cross-team (internal) committee that meets quarterly to share information, resources, supports and to develop an internal strategy around healthy weights and healthy weights messaging. Has proposed organization-wide policies and procedures and education. Would like to follow-up with external training and support for community partners.	No

Initiative	Description	Evaluated?
Internal knowledge exchange and professional development	Objectives: a. Increased integration of mental health promotion into all healthy weights programming. b. Decreased weight bias (in the general population and in health care providers). c. Increased knowledge and confidence of community partners to deliver effective healthy weights programming. Increased number of opportunities for the general public and priority populations to participate in self-esteem/body image programming. d. Increased positive talk and role modelling among adult influencers. Activities: a. Act as both principle investigators (Foundational Standards Specialist) and knowledge users (public health nutritionist) on research project investigating process of increasing knowledge of weight/ obesity and the integration of mental health promotion into obesity prevention/healthy weights promotion and chronic disease prevention. Health unit is a site for interventions. Development of an internal Balanced Approach Community of Practice - staff from across the health unit will meet regularly to discuss, share and plan comprehensive healthy weights programming. Provincial working group has now formed into national working group exploring effective and appropriate community healthy weights promotions.	Yes
Introducing Solid Foods Workshop	This class focuses on introducing solid foods to babies and answers common questions parents have about baby's first foods. Parents also learn how to make baby food and are given the opportunity to taste both store-bought and home-made foods. Goal and Objectives; To inform parents of the correct age and order of introduction of solids for their baby. By the end of the workshop parents will know when to start solid foods and order of introduction of solid foods, have increased skill in making home-made baby food, and know the benefits and drawbacks of using home-made and commercial baby foods.	No
Joinin	In collaboration with community partners, the health unit participates in the program Helping Everyone Access Recreation Together (H.E.A.R.T). The aim of this project is to ensure that everyone in Northumberland has equal opportunity to participate in recreational activities. Upcoming activities and information about available subsidies and an online sports equipment swap is available at www.joininnorthumberland.ca. A tool kit is also available that provides practical suggestions and ideas to organizations about how to remove financial barriers so that all families can participate in physical activity. Public health staff have worked on a similar project with community partners.	No
Kids In Motion	This initiative is a pedometer lending program for schools. The objectives are to increase physical activity of children and youth in a school setting and to encourage walking by using a pedometer and tracking steps walked. Individual schools borrow the pedometer kits (pedometers, log books) for a specified time and run it with in the school setting.	No
KidSport	KidSport chapters were established several years ago in a few of our communities in response to the need identified by sport and recreation leaders and social service providers. KidSport chapters provide financial assistance and equipment to children and youth who meet the eligibility criteria and who might not otherwise be able to participate in organized sports. Objective: reduce financial barriers for local children and youth to participate in sport.	No
KidSport Timiskaming	To provide grants for registration and equipment for organized sport for those four to 18 who meet LICO requirements. Provide opportunity to purchase low-cost equipment through equipment swaps. Raise awareness. As capacity allows, provide opportunity for youth to try various sports at no cost.	No

Initiative	Description	Evaluated?
Coalition for Active Transportation	Coalition for Active Transportation is a partnership of community agencies and community representatives working to make our city a place where active transportation is safe, secure, convenient, efficient and attractive. Mandate: 1. To promote The Active Living Charter of the City.; 2. To collaborate with organizations, groups and individuals who promote Active Transportation as part of an active lifestyle with the aim to enhance safety and increase the number and quality of Active Transportation opportunities; 3. To work with the city to identify paths and sidewalks that will connect neighbourhoods and destinations; 4. To advocate for standardized provincial legislation to increase pedestrian safety through pedestrian crossings; 5. To identify gaps in the Step Safe process and work with stakeholders and the city to develop clear lines of communication and expectations, to enhance sidewalk safety and accessibility; 6. To support bicycle safety education for cyclists, awareness education for drivers and encouragement to both to "share the road"; 7. To develop an annual action plan to identify activities and tasks, and seek out individuals and groups committed to each task. (This will include communications considerations for each activity.) Projects will be addressed by working groups and at general meetings; 8. To update the community summarizing progress to date on our website and in an annual report; 9. To provide residents with both educational opportunities and opportunities to contribute ideas about Active Transportation--for example through speaker series, workshops and our website; 10.To conduct a survey of adults in the city to obtain baseline information on mode, frequency, time and purpose of active travel in different seasons, and to identify barriers to Active Transportation and opportunities to enhance it; 11. To conduct the same survey in the same seasons in three to five years to assess changes and to determine strategies to further enhance Active Transportation; 12. To have regard for "universal design" accessible to all.	No
Lake to Lake Cycling and Walking Trail	This project is being led by a regional infrastructure planning group. They will be collaborating with local municipalities and local conservation areas to develop a walking and cycling route. Active Healthy Communities sits on the advisory committee for this project.	No
Let's Get Cooking	A food skills literacy program aimed at training volunteers who will teach children and adolescents food skills in a comprehensive setting.	No
Live Outside the Box	Creates a level of awareness and self-assessment about physical and sedentary habits. Aims to limit the amount of sedentary activity, e.g., time spent in front of a TV or computer, and replace it with physical activity.	
Local Community Food Centre	The Local Community Food Centre will be "A Place for Food." Opening in fall, 2012, the centre will have: community gardens and a greenhouse to give people the chance to get their hands dirty growing their own food; a community kitchen for sharing and developing cooking skills and for cooking healthy drop-in meals to share with folks in need in our dining area; and a food distribution centre, where large-scale donations and purchases of healthy (and as much as possible local!) food from agriculture, retailers and processors will be distributed back out to local food banks, community meal providers, student nutrition programs and other not-for-profit food initiatives.	No
In motion	Social Marketing and Education: - campaigns to promote physical activity and healthy eating - creation and dissemination of resources - partnerships with other community projects.	No
Mix it Up - Moving, Mixing and Munching Together	Mix it Up! is a free two-hour workshop for parents and their children. Those participating will: ▪Learn fun new games that get kids moving ▪ Make healthy, tasty snacks together ▪ Enjoy eating your tasty new creations at the "dinner table" ▪ All while learning skills you'll be able to use at home.	Yes
More to Me…Than What You See	A health promotion program for grades 4, 5 and 6 to help girls develop healthy body image and self-esteem.	Yes
Mother and Young Child Clinics (Prenatal Postnatal Nurse Practitioner	Nurse Practitioner Clinical Services are offered at five drop-in community outreach sites to improve the reproductive, maternal and child health outcomes in the Baptist communities in the area. This integrated service delivery model is connected with a variety of early identifications and family support services offered by local service providers.	No
Mothercare	Mothercare is the Canadian Prenatal Nutrition Program.	Yes
Motiv8	Motiv8 is an initiative designed to help individuals, families and organizations address healthy lifestyle behaviours through specific strategies to improve awareness, enhance motivation, build skills and provide opportunities that promote and support physical activity and healthy eating in a variety of settings.	No

Initiative	Description	Evaluated?
Motiv8 Workplace Series	This five-week series is designed to encourage and empower employees to make healthy lifestyle choices. It is delivered by a team of health professionals, including a public health nurse, a public health dietitian and a public health physical activity specialist. Sessions will include food demonstrations and flexibility and strengthening exercises designed to build skills and break down barriers to healthy eating and active living.	Yes
Move Yourself to Better Health Campaign	This physical activity campaign is focused on getting residents to be more active. The objectives of the campaign include raising awareness of the health benefits of being active, helping people to see how easy it is and overcoming barriers. The campaign has evolved since 2010 to include messages targeted to a variety of audiences in a variety of settings across the community.	No
Moving and Grooving with Energy (GAME)	Getting physically active with your children by participating in a fun program that gets you Grooving and Moving. Age-appropriate physical activities, songs and nutrition tips are shared with parents and children. Participants should wear comfortable clothing.	No
Multiple school-based initiatives	4 FOR LUNCH: Grades K-8; A healthy eating challenge that encourages students and their parents to pack lunches containing foods from all four food groups. Includes display, take-home brochures, tracking sheets and curriculum lessons, and Parfait Party for grade 4 classes. BATTLE OF THE BEVERAGES: Grades K-8; An interactive display that teaches students to make healthy drink choices by showing the amount of sugar in today's most popular beverages. Includes display, props and student pamphlets. ENERGY DRINK CAMPAIGN: Grades 7-8; An interactive awareness activity that teaches students the risks associated with consuming energy drinks. Includes display, pamphlets, posters, activities and teacher's guide. HEALTHY LUNCHES TO GO! Parents; A nutrition workshop facilitated by public health professionals for busy parents who are challenged to send healthy, safe, kid-friendly lunches to school. NUTRI-THON: Grades 1-3; A nutrition workshop led by grade 6-8 peer leaders who teach curriculum matched nutrition information through a variety of fun and interactive games and activities. COOKING TOGETHER: Grades 3-8 and Parents; A hands-on, after-school cooking workshop where parents and their children cook a meal together and learn valuable kitchen skills. PHYSICAL LITERACY: K–grade 2 and parents; An interactive peer- or health unit-led workshop where participants will learn about the concept of physical literacy and how learning physical movement skills early in life can lead to overall healthy development (physical and emotional health). The parents/ teachers will receive education on the various stages of motor development, tips on how to enhance a child's skill level and overall physical literacy. HEALTHY HEARTS: Grades K-8 and parents; A fun, interactive workshop that includes both physical activity and nutrition information, It encourages not only students, but parents and caregivers to participate in a variety of fun challenges. Participants will gain knowledge on the importance of keeping our hearts healthy and how the lifestyle choices we make can help keep us safe. NUTRITION TOOLS FOR SCHOOLS: A comprehensive tool kit that leads you through a step-by-step process for forming a nutrition committee and creating a healthy school nutrition environment in your school. ACTIVE AND SAFE ROUTES TO SCHOOL: Grades K – 8 students and parents; A range of cool initiatives to help parents and kids find alternative ways to get to school safely, while saving the environment and fitting physical activity into their day. ACTIVE PLAYGROUNDS: Grades K-8; Variety of resources to get kids active on the playground including: Playground Stencils Kit – to create a variety of permanent indoor/ outdoor game outlines (hopscotch and four square games); "Outdoors: The Ultimate Playground" kit . Health promoting school nurse will facilitate the training of a team of teachers/peer leaders using ideas from the resources – emphasizing participation and fun. HEALTHY SCHOOLS CLUB: A whole-school club, including teachers, principal, students, parents, and facilitated by the Healthy Schools public health nurse. Using a comprehensive school health approach, Healthy Schools Club brings members from the school community together to focus on creating healthier lifestyles and environments for living, learning and working!	Yes
Municipal Child Care Policy Initiative	This initiative will provide guidelines for the inclusion of health foods served, procured and offered to children in the municipal child care setting. This will also include guidelines for snacks provided, the amount of time children are given to eat and others.	No
Municipal HE Recreational Policy	To support healthy eating in recreational centres.	No
Municipal Policy Scan	The goal of the policy review was to create a snapshot of reported municipal policy activity in the Healthy Communities Fund Partnership priority topic areas: healthy eating and access to nutritious food; access to recreation and physical activity including active transportation and the built environment; access to tobacco-free environments; the prevention of alcohol and substance misuse; injury prevention; and policies to promote mental health.	No

Initiative	Description	Evaluated?
Newsletters	We create and distribute newsletters to schools, workplaces and recreation facilities throughout the region. The topics covered include risk factors for chronic disease as well as other health topics. Physical activity and healthy eating are covered in each issue.	Yes
Nobody's Perfect Parenting Program	A parenting program that addresses misconceptions about healthy eating and physical activity. The program lays the foundation for healthy eating and normalizes eating patterns through stages of growth and development. It integrates play as a key aspect of healthy growth and development.	
Northern Fruit and Vegetable Pilot Program	Delivery of a fruit or vegetable twice a week to elementary schoolchildren in the health unit area. Education support provided. Objective is to increase variety of fruit and vegetable acceptance and consumption.	Yes
Northern Ontario Fruit and Vegetable Program	Two to three servings of vegetable and fruits are served to elementary students from January to June. An educational component, using Paint Your Plate! Create a Masterpiece, is also included for teachers and schools to promote the benefits of consuming vegetables and fruit to students and their families.	Yes
NutriSTEP (Nutrition Screening Tool for Every Preschooler) screening	NutriSTEP is a nutrition risk screening questionnaire in which parents answer questions to assess the eating habits of toddlers and preschoolers (age three to five) and identify nutrition problems. A second version of NutriSTEP for toddlers (aged 18 to 36 months) will soon be available. Objective: to development, validate, implement and evaluate NutriSTEP screening tools. Key Activities: promote and distribute the screening tools to families; provide phone counselling service for parents; provide training to professionals involved with NutriSTEP; participate as collaborator in research study funded by the CIHR to develop and validate a NutriSTEP questionnaire and nutrition education fact sheet for toddlers; provide support for research study funded by CIHR to develop and evaluate an electronic version of the NutriSTEP questionnaires (e-NutriSTEP); advocate for province-wide support for NutriSTEP; sit on NutriSTEP Provincial Advisory Committee.	Yes
NutriSTEP: Healthy Weights Program for Toddlers and Preschoolers	Objectives: a. Increased knowledge, confidence and capacity of health unit staff, of the four constructs of NutriSTEP and their corresponding recommendations, by December, 2012.; b. Increased number of preschoolers and toddlers screened for nutritional risk, by December, 2013; c. Increased opportunities to access programming and support to healthy lifestyle programming and/or information for parents of toddlers and preschoolers, by December, 2012.; d. Increased awareness and knowledge of parents of toddlers and preschoolers of healthy child lifestyle behaviours and their role as adult influencers, by December, 2013.; e. Increased knowledge and capacity of community partners, to address healthy child lifestyle issues, by December, 2013. f. Increased partnership and collaboration of community partners to support community implementation of the NutriSTEP program, by December, 2013. g. Decreased number of preschoolers and toddlers at nutritional risk, by December, 2015. Activities: small group workshops for (high-risk) parents/caregivers of toddlers and preschoolers, on the topics of healthy eating, physical activity and positive self-esteem/ body image. These workshops link with the NutriSTEP screening tool which HU staff will implement. As needed (and only for orphan patients screened as high risk) provide tailored information re: healthy eating, physical activity and positive self-esteem/body image. Future work includes linking with community partners to coordinate and develop/align healthy weights programming (which includes healthy eating, physical activity and positive self-esteem/body image) in the health unit catchment area.	No
Nutrition Education/ Training for Adult Influencers in Best Start Hubs and Daycare Centres	To increase nutrition skills among Hub and daycare providers so that they may role-model healthy eating behaviours; delivery of healthy eating workshop to Hub workers; working with Hubs and daycare to plan future sessions.	No
Nutrition Screening Tool for Every Preschooler (NutriSTEP®)	Nutrition Screening Tool for Every Preschooler (http://www.nutristep.ca/) is a valid and reliable nutrition risk screening questionnaire that is planned for a fall, 2012, launch through the ESTPH Healthy Babies, Healthy Children program. For the moderate-risk/high-risk scores, classes directed to caregivers addressing risk factors are being considered by the health unit (details to be confirmed).	Yes
Nutrition Spy Mission	To engage elementary students in supporting healthy eating using a Nutrition Spy Mission program involving grade 8 students. Activities include development of the kit, promotion, distribution. Will attempt to evaluate with the teachers who took this on at the end of this school year.	No

Initiative	Description	Evaluated?
Nutrition Tools for Schools	Nutrition Tools for Schools is a tool kit for public health to use with schools to promote and support the creation of a healthy school nutrition environment. It uses a comprehensive approach by looking at sending consistent messages about healthy eating in the classroom, in the home, as well as the social and physical school environment.	Yes
Nutritious Food Basket Costing	All health units do annual food costing, according to the Nutritious Food Basket Protocol, 2008, which consistently shows that families living on a low income or in poverty cannot afford to eat a healthy diet. Providing this information to community partners, politicians, etc., and doing advocacy based on the reporting of these costs in relation to the costs of housing and other basic expenses has the goal of influencing policy decisions and the adequacy of income required to support a healthy diet. Having a sufficient income is a prerequisite to purchasing healthy food and therefore impacts considerably on childhood obesity. We have sometimes used the information to host a community forum to raise awareness of the difficulty of living a healthy life on a low income. We have a Meal or No Meal kit which our partners can borrow providing an activity where people participate in a spending exercise to make choices on how to spend a month's income in various scenarios. This was used at a community forum where the results of the NFB were also presented.	No
Official Plans, City Transportation Plan	Work with city planners to ensure that city plans incorporate built environment structures that promote safe and active transportation.	No
On Track Screening Clinics	Screening clinics for preschoolers. Screening on development, nutrition, health (NP exam) and oral health.	No
Ongoing nutrition support to school and childcare centres through consultations by public health (PH) nutritionists	Our health unit provides ongoing nutrition support to school and child care centres through consultations by public health (PH) nutritionists. Between January, 2011, and November, 2011, a PH nutritionist consulted 183 times with school staff, parents and others on PPM 150. In addition, a PH nutritionist assists child care centre supervisors and cooks to plan healthy menus that meet the requirements of the Day Nurseries Act. In 2011, 35 menus were assessed for child care centres based on nutrition guidelines that are above and beyond the nutrition standards under the Day Nurseries Act. A presentation on menu planning was conducted at the annual Cooks' Conference where 50 participating child care cooks received a Menu Planning Tool that would assist them in developing healthy menus for children.	No
Ontario Student Nutrition Program (OSNP)	Our health unit strongly supports the Ministry of Child and Youth Services' Ontario Student Nutrition Program in schools (http://www.osnp.ca). We chair the Community Nutrition Partnership that oversees the program and allocate a public health dietitian, a school team public health nurse and a public health inspector to the program to ensure safe food handling and the accurate implementation of the set nutrition standards at program sites. We are involved in two to three education sessions to volunteers of the program each year and participate in related campaigns (e.g., The Great Big Crunch).	No
OPHA Food Security Work Group	This public health work group advocates for policies and programs at the provincial and federal level that increase access to nutritious, safe and culturally and personally acceptable foods.	No
Outdoor Recreation and Natural Environments Committee	Work with others in the community to promote physical activity and outdoor recreation opportunities.	No
Health Unit Baby-Friendly Initiative (BFI)	Purpose - to protect, promote and support breastfeeding as the cultural norm –and to attain BFI designation for Health Unit by 2014. Objective - to implement activities to meet the Breastfeeding Committee for Canada's integrated 10 Step Practice Outcome indicators.	No
Pedometer lending program for community, schools and workplaces	Community health offers a classroom/workplace set of 40 pedometers on loan to schools and workplace for walking program/initiatives. Individual pedometers are also available on loan via the libraries located across the county.	No
Peer Nutrition Program	The Peer Nutrition Program is a free nutrition education program for parents and caregivers of children six months to six years of age. The program is led by trained community nutrition educators and is supported by registered dietitians. The program is culturally adapted to diverse populations and offered in many languages. Services: educations sessions, counselling with a dietitian, community gardens, support sites.	Yes

Initiative	Description	Evaluated?
Peers Running Organized Play Stations (PROPS)	PROPS is a program that encourages children to use their time productively in the school yard by helping them learn new and traditional games.	No
Gleaning Program	This program organizes trips to local farms to glean free fruit and vegetables, which increases community members' access to fruit and vegetables and physical activity.	No
Physical activity and walkability promotion / school travel planning	This program involves activities and advocacy initiatives to create infrastructure, policies and social climate to enable elementary children to walk or bike to school. Infrastructure objectives include school site-specific infrastructure changes or revisions, city-wide Active Transportation Plan for on-street bike lanes, advocacy for sidewalks around schools. Policy objectives include incorporation of policies into the 2012 City Official Plan revision, e.g.,, complete streets policy; and advocacy to school boards to adopt policies that support system-wide change around school travel planning. Awareness and education objectives include implementation of Active and Safe Routes to School events and programming. Skill development objectives target safe cycling skills.	Yes
Physical Activity Family Toolkit	The physical activity family tool kit includes the information families need to be able to build activity into everyday life. Included in the kit are fact sheets, tips and age-appropriate resources for children, youth and adults to assist them with planning and tracking their activity.	Yes
Physical Activity School Handbook	The handbook guides the school community through the process of creating a healthy active school environment that encourages young people to embrace physical activity. The handbook is based on the comprehensive school health model and incorporates the components of the foundations for a healthy school document issued by the Ministry of Education.	No
Physical Literacy Development for Children 0-6	The program promotes the development of physical literacy skills for children zero to six by educating daycare providers, teachers, parents and caregivers about how to incorporate fitness into the lives of young children, the importance of learning basic skills such as throwing, kicking and catching, and the benefits of physical literacy for lifelong activity.	No
Pilot test of Nutristep screening tool	In 2012 a public health unit will initiate a nutrition screening tool called NutriSTEP (Nutrition Screening Tool for Every Preschooler). This tool assists parents and practitioners identify children who may have eating problems and nutritional risks. Research shows that NutriSTEP not only screens for nutrition risk but also serves to increase nutrition awareness and knowledge among parents and caregivers. NutriSTEP will be launched as a pilot project in Dufferin in collaboration with child care centres and also made available to all WDG parents through KIDS LINE.	No
Planning Nutritious Menus	A public health dietitian teaches daycare menu planners about the Day Nurseries Act, CFG and steps in planning a menu, including the Motiv8 messages-- choose water and enjoy more vegetables and fruit. A community food advisor presents food safety skills and does a food demonstration of a few meal and snack ideas. Goals/objectives: to equip daycare menu planners with the knowledge and tools to plan menus that meets the Day Nurseries Act and CFG. By the end of the workshop, daycare menu planners will: know how to plan nutritious menus according to the DNA taste test, three new child-friendly recipes, know food safety recommendations and practice their menu planning skills with other participants through a menu planning exercise.	No
PLAY Program	The PLAY program is a train-the-trainer initiative that engages school staff and students in physical activity opportunities. PLAY leaders are identified and trained to provide students with opportunities to be moderately or vigorously active in games that they choose and enjoy. This initiative encourages physical activity, increases inclusiveness and decreases social isolation on the school playground over recess	Yes
Playground Activity Leaders in Schools (PALS)	PALS is a playground leadership program for schools. It encourages all children to participate in activities during recess breaks. Objectives ▪Increase physical activity ▪Decrease conflict and reduce the incidence of playground bullying ▪Provide a leadership opportunity for students ▪School staff supervise the program ▪Senior students act as playground activity leaders for younger students during recess breaks ▪Public health staff provide training for the students to implement the program and provides ongoing support	Yes

Initiative	Description	Evaluated?
Playground Stencil Program	One way to increase children's physical activity levels is to provide a variety of opportunities for physical activity in convenient locations. The Playground Stencil Program creates opportunities for physical activity by providing painted active asphalt games for students and children. Objectives: increase opportunities for physical activity among school-aged children; increase opportunities for unstructured play	No
Policy and/or Guidelines for Healthy Eating Choices at Parks and Recreation Centres	Advocating for healthy food choices at municipal parks and recreation facilities within the region. Key objectives are to increase the accessibility of healthy foods at parks and recreation facilities; increase the choices of healthy food; develop policies and/or guidelines that will be included in the parks and recreation master plan. Activities include: contacting key stakeholders involved in decision-making at the municipal level, providing information on Healthy Communities Survey that includes information supporting need for healthy food choices, adapting Eat Smart! Recreation Centre Toolkit, promotion of program.	No
Positive Parenting	Healthy weight messages are integrated into positive parenting sessions and material. Nutrition and physical activity are core messages in prenatal classes, prenatal health fairs, healthy babies/healthy children consultations, well-baby clinics, website material and written parenting material.	No
Prenatal Education (Classes)	To increase understanding among parents-to-be of the importance of PA and nutrition as it relates to overall health of parents being good role models. Provide parents-to-be with physical activity and healthy eating information; tips to being physically active while pregnant (with health care provider approval); how to remain physically active after the baby arrives; appropriate foods to eating during late stages of pregnancy, early postnatal nutritional needs of infants and mothers.	–
Prenatal Health Fair	Two fairs are hosted each year – one in the north of the region and the other more central. Short-term outcomes include: increase awareness of the importance of taking folic acid, physical activity, healthy eating, avoiding alcohol/substance use, prenatal parenting supports, signs of preterm labour and benefits of breastfeeding. Education sessions provided have included topics such as breastfeeding and making your own baby food.	Yes
Prenatal Pedometer Program	Pregnant women and their partners are provided with pedometers for four weeks to encourage physical activity. Healthy weights in mothers are linked to healthy weights in children. Parents who engage in physical activity have children who are more likely to be physically active.	Yes
Prenatal Programming includes the following: Smile (Supporting infant and mother learning experience, TEAM (teen education and mothering program) and the online prenatal module	The health department is the lead for SMILE prenatal classes and the Online Prenatal Classes. TEAM is a collaborative program which provides opportunity for teen mothers to complete their secondary school diplomas. All programs cover topics such as healthy eating, physical activity and the benefits of breastfeeding.	Yes
Preschool Checkpoints	Promote NutriSTEP and nutritional screening of toddlers and children at Preschool Checkpoints. Objectives: to identify and refer children at nutritional risk.	Yes
Professional Capacity Building	In collaboration with various professional groups and committees, provide nutrition consultation and supports: - Healthy Beginnings - Nobody's Perfect - weekly parenting program - Come Grow with Us -health information manual and newsletter for child care providers - Canada Prenatal Nutrition Program (CPNP) - Community Action Program for Children (CAPC) - Child and Family Collaborative - Early Identification Network - Reproductive Health Network - OPHA - Reproductive Health Group	Yes
Program Activity Leaders in Schools	We promote the program to schools, provide training resources (booklets) and kits of equipment and offer assistance with training peer leaders to enable them to lead physical activities in the playground during recess and lunch	Yes

Initiative	Description	Evaluated?
Programs and services that support healthy choices by making change/enhancing their environment (physical, social and culture).	Health units collaborate with school boards with implementation of the PPM 150 Nutrition and Food Beverage Standards by reviewing all food products that can be purchased in elementary schools. We are working with recreational centres to offer more healthy food choices. The health unit provides workshops for daycares (including home daycares), which is an opportunity for providers to reflect on the menu provided and to assess if it meets the recommendations based on the Canada's Food Guide. We also provide food skill opportunity to prepare and taste-test new recipes. The health unit has developed a corporate food and beverage policy that provides supportive environments for healthy eating. The policy supports healthy eating at meetings and functions and programs.	Yes
Promote 'Eat Well Be Active' resources for Health Canada	Resources are offered to schools and community groups. The program and resources are also promoted on our community health website.	No
Promote Healthy Schools Recognition Program	Work in partnership with our comprehensive school health team and local school boards to recognize physical activity and/or nutrition programs in schools. Recognize the program via media releases, letters of commendation from MOH. Community. Share resources and support school family health events.	No
Promote healthy urban design/active transportation plans	Community health collaborates with community partners to advocate for a supportive built environment and complete streets that support active transportation. This year we are facilitating a Building a Bike-Friendly Lambton project, which includes: -Hosting a bike summit with Share the Road Cycling Coalition -Celebrating June as bike month, in partnership with local regional trails, the Safe Roads Committee and our municipalities. -Public education and awareness about bike safety, injury prevention, active transportation -Creating a strategy for a renewed master transportation plan in our municipality	No
Promote Physical Activity and Sedentary Behaviour Guidelines	Canadian physical activity and sedentary behaviour guidelines are shared with public at community events, distributed at presentations with community partners (e.g., early-years centres, after-school programs, workplaces, family health teams, schools, etc.). The guidelines are also highlighted in media releases for the residents.	No
Promote the Garden Fresh Box Program	Promote the Garden Fresh Box Program, a food-buying program for fresh fruit and vegetables. Objectives: increase access to healthy food choices.	No
Promoting physical activity at school	Provide support for the DPA mandate - information on the health benefits of regular physical activity; lending library of kits that teachers can use; workshops for teachers and provide ideas for activities and sometimes able to provide simple equipment; offer challenges; promote the kits and resources available; work with partners such as Ophea; promote walking clubs at school as well as walk-to-school initiatives (including promoting provincial initiatives).	–
Promotion of healthy eating in childcare centres	A public health nutritionist provides support to licensed regional child care centres in promoting healthy eating. The nutritionist conducts train-the-trainer sessions once per year with child care staff at the region's child care forum on various topics related to healthy eating. As well, healthy eating is promoted in region's day nursery manual.	Yes
Promotion of Provincial Campaigns - Pause to Play, iwalk, I can walk to school can you, Spring into Spring	Public health supports and enhances a number of provincial campaigns to promote and support children and families to be physically active. Links to promotional materials are promoted through newsletter, on websites, at healthy school committees and healthy school student clubs. Public health nurses encourage schools to participate by providing links to campaign materials and activity suggestions on Healthy Schools actions plans.	Yes
Provide input into local planning documents	The health department is consulted and asked to provide comments into local planning documents such as the Regional Official Plan, the Bicycle Master Plan, the area municipalities' local municipal plans. The information provided to the planning department clarifies how the built environment affects the risk factors for chronic disease and how the built environment could be enhanced to support people to lead healthier lives (e.g. making the community more walkable, ensuring access to healthy foods etc.)	No
Provision of Healthy Weights Resources to Health Care Providers	Twice-a-year resources to support health care provider interactions with patients are promoted through a mail-out to 428 health care providers across the region. Examples of resources include small changes you can start today to maintain and achieve a healthy weight: Healthy Weights posters; walking guide; fruit and vegetable wallet tracker; physical activity wallet tracker; Where's the Salt?; Get Your Fats Straight; The Buzz on Alcohol	No

Initiative	Description	Evaluated?
Public education and awareness related to physical activity	Objective: to increase the public's awareness of the importance of benefits of physical activity and opportunities to do so. Activities: public promotion through website content listing links related to physical activity (physical literacy/active start/PA guidelines, active transportation etc.), leisure-guide ads, radio ads, newspaper articles, promoting local trails, cycling, skate exchanges, free or low-cost opportunities to be active.	No
Rainbow Fun	Rainbow Fun is a training program for child care providers to engage children ages three to six years in activities related to physical activity, healthy eating and self-esteem. The Rainbow Fun program consists of a training session, resource binder and poster as well parent handouts. Training includes physical activity, healthy eating and self-esteem activities that providers can use in their centres. Objectives ▪ To increase the number of child care providers who are aware and knowledgeable of the importance of physical activity, healthy eating and self-esteem to a young child's overall health. ▪ To increase parents' awareness of the importance of physical activity, healthy eating and self-esteem to their child's overall health. ▪ To increase the number of child care providers who use the Rainbow Fun resources at least three times a week.	Yes
Raise a little health	A comprehensive health promotion program with multiple components, including a public health nurse liaison with each school and each school board. Activities include: - teacher newsletter, featuring actionable items (not just information) - parent newsletter, "Raising Health Kids" - consultation service for teachers by phone or email; the goal is assisting teachers to teach health curriculum - a resource loaning library with up-to-date resources for teachers, including a delivery service (partner with school boards) - healthy environment advocacy and partnership with schools, school boards, school councils, teachers and students.	Yes
Raise the Bar Intramural Program – Workshops	Workshops for student leaders are run twice a year by our physical activity specialist. Student leaders are trained to run intramural programs in their schools.	No
Raising the Bar --childcare quality assurance program	A voluntary accreditation process for licensed child care programs to improve the quality of care (quality assurance, best practice, staff professional development). Centres sign on to participate each year. Following a review to ensure they meet the quality standards outlined in Raising the Bar criteria, programs receive a designation of bronze, silver or gold. Objectives: to strongly influence the development of a nutrition policy and procedures that the centres will need to follow as part of the Raising the Bar program. Key activities: as a member of the Raising the Bar leadership committee, provide ongoing support and consultation regarding developing and implementing sound and attainable nutrition policy and procedures for the Raising the Bar program and to the child care centres participating in the program	No
Reduce barriers in access to physical activity, sport and recreation	Community health seeks opportunities to partner with various community organizations to reduce barriers in access to physical activity, including: -partner with after-school programs to promote physical literacy opportunities (partner with sporting organizations to offer skill development workshops) -host community events that make it affordable for residents to try various activities (e.g. Sport Expo, 3 on 3 Street Hockey Challenge, Snowfest Winter Physical Activity demonstrations) -collaborate with local sport and recreation organizations to offer 'in-kind' programs/workshops with community groups	No
Registered Dietitian Support to Healthy Babies Healthy Children (HBHC) Program	Objectives: 1. To provide one-on-one nutrition consultations to parents of children with feeding or nutrition issues; 2. To provide dietitian support to HBHC nurses and family visitors, who in turn support families in identified feeding and nutrition goals.	Yes
Reproductive Health - Prenatal Classes	Prenatal classes: The goals of these classes are to: ▪ provide participants with the information and skills they need to improve pregnancy and birth outcomes; ▪ help participants have a positive birthing experience; and ▪ prepare participants for early parenting.	Yes
Rethink Your Drink - planning stage	To educate about healthy beverage options. cross-generational campaign focusing on sugar, fat content in beverages, as well as caffeine and also energy drinks	No
Review childcare menus for compliance with the Day Nurseries Act.	Review child care menus for compliance with the Day Nurseries Act. Objective: increase access to healthy food choices.	No
RNAO Best Practices Initiative	One of the public health units has been selected to be a spotlight organization for the implementation of the RNAO Prevention of Childhood Obesity recommendations. This initiative will support the coordination of our obesity strategy.	

Initiative	Description	Evaluated?
Rolling on the Runway	This event is intended to increase family and youth physical activity levels and to increase awareness of safe cycling practices and proper helmet use. Description ▪ The local airport is open to area residents for three hours in May or early June. One runway remains active. ▪ Families are invited to come with bicycles, skateboards, wheelchairs, strollers, scooter, in-line skates or walking shoes and walk and roll on the airport runways.	Yes
Safe Playgrounds	Provide a response to present regulations to ensure the sustainability of safe playgrounds and playground equipment.	No
School Grants	Provide small grants to secondary schools for teacher-led activities that promote healthy eating and physical activity for students.	No
School Health Program	The school health program encompasses several initiatives. The nurse assigned to each school promotes healthy environments using the foundations for a healthy school and youth engagement approaches. Specific initiatives include activities responding to the Champlain Declaration; CHEO common messaging for a healthy body image; the PALS (peer activity leaders) and support for PPM 150 (food in schools) and PPM 138 (daily physical activity).	No
School Nutrition Handbook	The handbook guides the school community through the process of creating a healthy school nutrition environment that encourages young people to eat healthier. The handbook is based on the comprehensive school health model and incorporates the components of the foundations for a healthy school document issued by the Ministry of Education. It also includes the nine essential elements of a healthy school nutrition environment and supports the PPM 150 School Food and Beverage Policy.	No
School Nutrition Policy	The purpose is to support implementation of school board policy and Ministry of Education School Food and Beverage Policy. It involves consultation on school nutrition policy (broader than P/PM 150); participating in the planning and implementation of training opportunities; support for schools (consultation, resource distribution, workshops, engaging secondary students in supporting P/PM 150 (healthy school nutrition grants - small program).	No
School Travel Planning	The school travel planning initiative is a comprehensive community program that addresses the issues around active and safe routes to school. The objectives include increasing the number of students that walk and cycle to school, decreasing the number of parents that drive their children to school, and creating safer routes to and from school. Key activities include a community walkabout with key stakeholders to assess barriers faced by students and families, identifying and promoting safer routes to and from school, making policy recommendations, creating a walking/wheeling Wednesday program at the school, providing health information on the benefits of physical activity to students, parents and school administration, and administering classroom and family surveys.	Yes
School Travelling Project	Worked with pilot school to increase student population to increase active transportation to school (e.g., bike, walk).	Yes
Screen Free Week	Week-long campaign to encourage children and their families to reduce screen time and sedentary behaviour. Provide opportunities to be active through free swim, other suggested activities. Key activities: activity tracking by JK to grade 6 students, contest/prize component, communication campaign.	No
Screen Time Reduction Initiative	One of the public health units became a Registered Nurses Association of Ontario (RNAO) Best Practice Spotlight Organization candidate in 2009, which involved the planning, implementation and evaluation of five best-practice guidelines. One of the guidelines chosen was the Primary Prevention of Childhood Obesity, which is where the Screen Time Reduction Initiative originated from. The Screen-Time Reduction Initiative promotes a decrease in sedentary activities with emphasis on reducing the amount of screen-time use in clients. One screen-time reduction intervention targets parents and caregivers of children ages two to six and is incorporated into the Nobody's Perfect parenting program. PHN's facilitating the eight-week parenting program are provided with a variety of screen-time activities to choose from that encourage group discussion. These activities are based on the existing Nobody's Perfect curriculum, and PHNs can choose activities based on the needs of their group.	No
Self-assessment tool for daycare for physical activity	Looking at self-assessment tools for daycare to look at their facilities in regards to physical activity.	No

Initiative	Description	Evaluated?
Self-esteem/Body Image programming for girls (nine to 13 years old)	Objectives a. Increased opportunities for skill development (HE, PA, SE) for priority populations; b. Increased integration of mental health promotion into all healthy weights programming.; c. Decreased dieting behaviours (e.g., restrictive dieting, skipping breakfast, consumption of laxatives); d. Increased skill (HE, active living and positive self-esteem/ resilience) among priority populations (including children and youth).; e. Increased self-esteem, self-acceptance, resilience and positive mental health among children and youth; f. Increased number of opportunities for the general public and priority populations to participate in self-esteem/body image programming. Activities: Peer mentorship model (similar to Go Girls - unfortunately our local BBBS agency is not offering the Go Girls program, therefore we are creating a similar program to be made available to community partners and members).	No
SHAPES survey	Data and recommendations from the 2009 School Health, Action, Planning and Evaluation System (SHAPES) Survey of high school students in the district have helped to inform program development related to mental fitness, smoking, physical activity and healthy eating for youth.	Yes
Share the Road Campaign	To increase awareness and support for active transportation. To increase knowledge and skills of motorists, pedestrians and cyclists on safely sharing the road.	Yes
Silly Band Campaign	It was a fruit and vegetable campaign during which each grade 1 child got a silly band for eating.	Yes
Skill Building Opportunities	Healthy Eating Active Living Program, which targets low-income families and vulnerable groups (e.g., teenagers) to increase knowledge and skill to choose prepare healthy and nutritious foods. We offer this program to enhance community and family skills and knowledge around food and nutrition. We also did a three-year survey in order to direct future programming endeavours. We are in the process of completing this report, for which we collected data on residents' fruit and vegetable consumption, barriers to eating fruit and vegetables and self-rated food skills. In addition to these food questions, the survey also collected data on age group, gender and postal code to assess the demographics of survey respondents.	–
Smart Start for Babies: Canada Prenatal Nutrition Program	A prenatal nutrition program providing hands-on group sessions for high-risk pregnant women. The program provides health teaching, nutritional counselling, food incentives, food demonstrations, prenatal vitamins and supports and links in the community. It has three main focuses: 1) obesity; 2) injury prevention; and 3) mental health. SSFB objectives: 1) to enhance the health and well-being of pregnant women and teens who have limited resources and supports; 2) to set the stage and enhance the growth and development of infants in their first two years of life; 3) to integrate CPNP with appropriate services agencies in the community to sustain learning opportunities for a greater number of pregnant women; 4) establish multiple ways to reach out to pregnant women and invite them to learn about healthy nutrition and to make positive lifestyle choices.	Yes
Sodium Campaign	In 2012, the health unit launched a health promotion campaign to increase awareness about how much sodium you should consume every day.	Yes
Sparking Life Niagara	Sparking Life Niagara (SLN) is based on the research of Dr. John Ratey, Harvard University, who has extensively studied and evaluated the use of physical activity in students and their subsequent academic performance and healthy outcomes. The program uses continuous aerobic physical activity for a minimum of 20 minutes each day, during which students work between 65 and 75% of their maximum heart rate. The program also promotes the participation of shorter exercise boosts throughout the day. What are the benefits of the Sparking Life program? ▪ Improvements in student learning, memory, mood and behaviour; ▪ Improvements in stress tolerance leading to improved physical health and mental resilience; ▪ Improvements in attention and motor control (e.g., decreased symptoms of ADHD); ▪ Improvements in symptoms of anxiety and mood (e.g., less depression); ▪ Improvements in physical activity, less sedentary time and healthier weights; ▪ Improvements in participation rate in extracurricular sport and recreational activities.	No

Initiative	Description	Evaluated?
Strategic Area - Physical Activity and Healthy Eating	Purpose: 1. Achieve the healthy eating and physical activity strategic direction for 2012 – 2015. Increase the physical activity and healthy eating of children, youth and adults by: - advocating for and supporting the implementation of municipal policies that facilitate physical activity in the community; - focusing on increasing the number of families that have access to fruits and vegetables, and increasing the skills of families in healthy food preparation. 2. Identify existing activities and, where appropriate, plan and ensure implementation and / or coordination of additional activities. 3. Identify measurable indicators and / or objectives and report performance on these objectives to the senior management team and the board of health	No
Student Nourishment Program	The Student Nourishment Program funded by the Ministry of Children and Youth aims to support communities in providing nutritious food, including breakfast, lunch and/or snacks to children and youth aged four to 24 across Ontario. The objective of the program is to support the healthy development of children and youth. The program supports initiatives to increase levels of school readiness among young people and provide a healthy school nutrition environment. The program also complements efforts to reduce the prevalence of childhood overweight and obesity.	No
Student Nutrition Program	Student Nutrition Programs (SNPs) are community-based meal and snack programs that operate in schools or community sites. These nutritious meals and snacks are provided in a culturally appropriate, non-stigmatizing way. SNPs help ensure that children and youth at risk for poor nutritional intake have access to safe, adequate and nutritious food at school. School food programs have a positive impact on student health by preventing or reducing hunger and promoting optimal physical, cognitive and social growth and development. The programs, which are often located in socially disadvantaged communities, are run locally by students, parents and volunteers, with support from partner organizations committed to optimizing health and education outcomes. A partnership model governs and administers student nutrition programs in Toronto, known as the Toronto Partners for Student Nutrition (TPSN), which oversees the allocation of municipal and provincial funds to eligible SNPs toward the cost of nutritious foods. Core government funding encourages other donors to offer financial and non-monetary support and helps to ensure program stability. It is also important that these programs provide nutritious foods that meet provincial nutrition standards.	No
Student Nutrition Programs	Educational session to provide information to students re the amount of sugar contained in different beverages. It is a hands-on, interactive presentation, generally done in the classroom setting.	–
Sugar beverage education	Provides 90-minute education sessions in local grocery stores to highlight the healthiest choices and teaches consumers, including families and child care providers, how to read labels.	Yes
Support for Canada Prenatal Nutrition Prenatal Program/ Community Action Program for Children and Best Start Hubs	Increase CPNP/CAPC/Best Start Hub staff knowledge/familiarity about various health-related topics and programs in our community; increase community capacity to deliver health-related information to priority populations; - work with community partners to provide priority populations with consistent messaging about health-related topics; - increase knowledge and skills of priority populations to promote healthy living behaviours (including healthy eating) quarterly meetings with CPNP/CAPC staff to discuss programming; - quarterly meetings with CPNP/CAPC staff to provide education on various topics (HE, breastfeeding, growth and development); - delivery of education/skill-building sessions with CPNP/CAPC/Best Start Hub participants on various topics (healthy eating, breastfeeding, growth and development); resource distribution to CPNP/CAPC Programs and Best Start Hubs.	Yes
Support of the Ministry of Education's School Food and Beverage Policy (PPM150)	PPM150 released in early December, 2010 ,by the Ministry of Education and coming into effect on September 1, 2012, requires that food and beverages sold in Ontario's publicly funded elementary and secondary schools for school purposes comply with the requirements set out in the policy ,including specific nutrition standards. Public health units have been providing technical support throughout this process. We have been integral partners at several education workshops and presentations and have been around the table with the school boards to align their independent nutrition policy with the new requirements. We have also created support materials to communicate the policy to schools, parents and students.	No

Initiative	Description	Evaluated?
Supportive Environments, Healthy Living - Early Childhood	The purpose of the Supportive Environments, Healthy Weights (Early Childhood Component) Project is to curb the rise of childhood obesity through the use of evidence-informed population health approaches. Our primary goal is to create environments for children zero to six years that encourage healthful eating, participation in physical activity and limited sedentary time. All policy and programmatic activities will be multi-pronged and consider socioeconomic status, ethno-cultural diversity and parent-caregiver engagement. Objectives: 1. to conduct research and policy reviews to identify the most current and high-level evidence regarding effective population health strategies to prevent childhood obesity; 2. to devise and implement programs and policies that create sustainable environments for children to learn lifelong healthy habits regarding healthful eating, physical activity and media use; 3. to engage in Knowledge Transfer and Exchange (KTE) activities to disseminate research findings and ensure uptake of evidence at our health unit and partner organizations; 4. to inform policy and program development related to healthy weights for children zero to six years at the local and provincial level.	No
Surveillance of Healthy Weights/ Teen Questionnaire/ Youth Engagement - Student Health Champion	Surveillance data on prevalence of healthy weight among children (waiting for provincial protocol as previous work was at grade 6 level). Teen questionnaire includes self-reported height/weight, physical activity, vegetable and fruit and breakfast consumption along with alcohol, tobacco, injury prevention and sun safety. Data is shared with school by student health champions who then coordinate health promotion activities in their school.	–
Swim to Survive	A swimming program for grade 3 students. We coordinate the program and provide administrative support. Other physical activity opportunities are also offered as part of the experience. Thousands participate.	No
Take Action	Partnership was formed to support allied health professionals to develop/implement a strategy/program addressing childhood obesity after identified as a priority by Family Health Team Physicians. Goal: to increase community capacity to support a healthy municipality - support community organizations to consider health in their work - engage community members throughout the process - a community report with recommendations was compiled as a result of two community forums; residents provided input into the strengths, barriers and opportunities for change to create healthier communities .	No
Teen Prenatal/ Postnatal Program	This initiative involves monthly visits to a classroom to review healthy growth and development topics, such as nutrition, physical activity, positive parenting. As well, a public health nurse provides multiple site visits per week to a residential home for high-risk, low-income teen mothers to offer a variety of programs and support to encourage healthy lifestyle choices.	No
The 'Focus Community Centre'	Programming is held at a co-op subsidized housing complex that suffers significant problems associated with poverty (largely young families; many single mothers). To address these issues of poverty, various social agencies have come together to create 'Unit 11' at the complex as a hub for delivering programs to address these problems. The RD from public health offers food skill programming (e.g., slow cooker workshops, canning workshops, garden workshops etc.). A public health unit health promoter sits on the focus committee that directs the operations. A public health unit PHN teaches parenting programs, and the dental team gives periodic presentations on dental services for low-income groups. Other services include breakfast clubs, homework clubs, child care, community garden and legal help.	No
Toddler and Preschooler Nutrition Class	This class helps parents understand the eating behaviours of toddlers and preschoolers. It focuses on Eating Well with CFG and outlines the nutritional requirements of children. Practical tips, tactics and child-friendly recipes are also shared to help parents relieve meal-time stress.	No
Trail development and promotion	Pathways for People is a very active local group who promote and advocate for trail development in the county. Much work has happened in the past few years to develop new trails, provide signage and hold promotional events.	No
Triple P: Positive Parenting Program	Triple P is a multi-level system of family intervention for parents of children who have or are at risk of developing behavioural problems. It is a preventatively oriented, early-intervention program which aims to promote positive, caring relationships between parents and their children and to help parents develop effective management strategies for dealing with a variety of childhood behaviour problems and common developmental issues.	Yes

Initiative	Description	Evaluated?
Trust Me. Trust My Tummy. (A public awareness and education campaign focusing on the concepts of responsive feeding)	Purpose: to implement a positive comprehensive health promotion key messaging and education campaign in the region aimed at parents and caregivers, promoting the concept of "responsive feeding" and the "division of responsibility". Objectives: 1. parents and caregivers will understand their role as it relates to responsive feeding and the division of responsibility; 2. parents and caregivers will implement responsive feeding and division of responsibility strategies when feeding their young children. Key activities: 1. promoted the key messages of the campaign using an interactive web-based quiz; 2. developed and delivered presentations to child care professionals, early-years educators and parents; 3. developed and distributed promotional materials (posters, snack containers, children's book, information cards, magnets); to places parents of young children congregate; 4. published newsletter articles (print and electronic). TV segment on local daytime show.	Yes
Under Cookstruction	Public health's Under Cookstruction is a four-week food skills program with the primary goal of empowering young people in secondary school with food preparation skills, which will increase their food security. The weekly sessions are 75 minutes and are facilitated by two public health volunteer community food advisors and the school's public health nurse. Public health staff work closely with the school's adolescent care worker or youth care worker.	Yes
Vegetable and Fruit Food Skills Kit	The food skills kit is a guide to selecting, preparing and storing vegetables and fruit. It includes a vegetable and fruit tracker (encourages people to eat more vegetables and fruit by tracking and comparing how many servings they eat as recommended by Canada's Food Guide). It also includes resource cards with kid-friendly food skills tips and recipe cards with kid-friendly vegetable and fruit recipes.	No
Vegetables and Fruit - Real Food. Real Fast. Real Good Communication Campaign	A vegetable and fruit communication campaign was developed and implemented and included billboard, transit shelter and mall advertisements, as well as other communication strategies. The Vegetables and Fruit, Real Food. Real Fast. Real Good Campaign was targeted at mothers of school-aged children.	No
Vegetables and Fruits initiative in daycare setting	Provided daycares with tool kit - activities and games to encourage young children to try new vegetables and fruits while in the daycare setting. Information was also sent home to parents re the initiative and also parenting tips for healthy eating. Kit included sample policies (healthy eating) for interested daycares to implement.	Yes
Walkability	The project is designed to promote a culture of walking; walkability, active transportation and leisure physical activity to regional residents. Using walkability assessments in neighbourhoods to overcome barriers to walking, the program will actively work with partners to eliminate the perceived and real barriers to walking and promote this free activity and create a culture for walking.	No
Walking promotion	Ongoing promotion of opportunities for walking and health benefits. Inventory of indoor walking sites maintained and made available in brochure and on website; offer a pole walking kit and introduction for loan to community groups or workplaces; distribute trail guide in several community sites; pedometer lending kit with manual; promote walking days (e.g., trails day, walk-to-school day, etc.), support individuals starting walking clubs, have offered an indoor walking club at one location over the winter months in conjunction with recreation partner.	-
WalkON	This is a community development program that engages the community, municipal staff and elected officials in the creation of built environments that support walking for active transportation.	No
District School Board Elementary and Secondary Food and Nutrition Policy	The school board has collaborated with public health and has adopted and implemented school nutrition policies that apply to their elementary and secondary schools. The school board Secondary Food and Nutrition Policy was adopted in 2007, and the Elementary Food and Nutrition was adopted in 2009. The school board's school nutrition policies apply to all food and beverages that are sold and offered at school. This approach engages the entire school community in healthy eating.	Yes

Initiative	Description	Evaluated?
Regional Peer Program	Since 1988 the Regional Peer Program has been improving the health of the community through an ongoing partnership between public health and local community organizations. The goal of the peer program is "to use a peer approach to increase the capacity of individuals and communities to improve their physical and social health." Through this program, peer workers are community leaders who share similar life experiences with members of their communities. Peer workers are trained and certified by public health in the skills needed to plan and facilitate neighbourhood-based programs and build knowledge about relevant health issues. The peer workers then go into their own communities and run local programs.	Yes
County Active Transportation Plan	A County Active Transportation Plan was developed to encourage biking and walking on regional roads. This plan will continue into 2012 to inventory existing active transportation and trail facilities, recommend a network of routes and appropriate facility types, develop planning policy, identify priorities for implementation, determine appropriate levels of funding for operations and maintenance, outline potential encouragement and promotion programs, and detail partnership opportunities.	No
Wellness Clinic for Tots (18 and 36 Month Enhanced Well Baby Visit)	Child health staff have been actively promoting and supporting monitoring the implementation of the 18- and 36-month enhanced well-baby visit with family health teams and family physicians. It is an opportunity to: ensure a child's growth and development is on track, identify potential concerns early, link a child to appropriate local services if needed and discuss any parental concerns.	No
Wheeling to School	This project assesses barriers to cycling for elementary schoolchildren and teaches bicycle safety skills aimed at reducing the risk of injury while increasing daily physical activity. The objectives of this initiative include increasing the number of students who ride their bike to school and during after-school hours, increasing students' and parents' knowledge of cycling safety and creating cycling to school routes. It also addresses the built environment as it relates to child- and family-friendly bicycle routes in the community.	No
WHO Growth Charts	Copies of the growth charts for healthy-term infants suggested for use in primary health care settings were distributed to physicians in the spring of 2011. They are available for order through the family health order form. A consumer fact sheet, "Is My Child Growing Well?," targeted for parents and caregivers, is distributed through Reproductive Child Health programs and Ontario Early Years Centres. WHO growth charts are the only growth charts we use during well-baby visits, home visits, community clinics, etc. Staff organized a dinner training event for health care providers in our county to educate about WHO growth charts and how to use them when monitoring a child's growth. The presentation was completed by our Medical Officer of Health. Staff organized training and implemented a policy about monitoring a child's growth and how to speak to families when there is a concern. Training online is available through Dietitians of Canada, which staff are aware of.	Yes
Wiiding Out Drugs	An annual event for grades 4 and 5 students that uses interactive pit stops to educate students about chronic disease and injury prevention topics (with a focus on substance use). An interactive nutrition station is part of the event.	Yes
Workplace Health	A comprehensive health promotion approach is used to increase the capacity of workplaces to develop and implement healthy policies and programs, and to create or enhance supportive environments to address healthy weights. The workplace wellness team public health nurse consults with the health unit expert (e.g., registered dietitians) when necessary.	No
Workplace health promotion	Provide consultation and resource materials to workplaces to support their programming on physical activity, healthy eating and healthy weights. Resource list on website.	No
Workshops for Cooks and ECE in Daycares	Interactive workshops cover menu planning, healthy eating, portion size and eating habits of toddlers and preschoolers.	No
Food for Learning	Food For Learning is a diverse community partnership that supports student nourishment programs, which enhance learning and health. Food For Learning provides expertise, funding and resources to develop and sustain breakfast and snack programs.	No
Forestry and Public Health working together	Our partnership is to increase public awareness of the importance of physical activity within the 2,257 hectares of regional forest and accessible trails available to the public. Currently we post monthly health messages on all 21 trail boards within the forest which link the benefit of physical activity with health.	No

Initiative	Description	Evaluated?
Physical Activity Network (YRPAN)	This is a collaborative network with affiliates working to promote physical activity, healthy living and quality of life in the region. Membership includes representation from all nine municipalities, with most members working in the parks and recreation sector.	No
Young Moms Working Out	Provide fitness classes for teenage mothers. Also includes session on healthy eating.	No
Young Parents Connection	The goal of the Young Parents Connection program is to support young parents in improving the health and well-being of their families by providing them information, skill-building activities and social support through a weekly event in which partner agencies collaborate. The young parents receive a YMCA family membership in order to access the YMCA facility seven days per week. The young parents participate in a community kitchen once per month, where they learn to prepare healthy, nutritious food for their family. After the parenting program portion of YPC, they have access to YMCA facility, pool area, fitness with their children or individually.	Yes
You're the Chef	You're the Chef is a cooking/food skills program designed to increase the skills and confidence necessary for youth ages 10 to 14 years to prepare healthy and tasty recipes (safely), emphasizing vegetables and fruit. Registered dietitians train volunteers (parents, teachers, community members, agency staff, specialist high-skills major hospitality students) to deliver the program to children ages 10 to 14 years. The program is delivered in schools at lunchtime or after school as well as in community settings (e.g., YMCA summer day camps).	Yes
Youth Friendly Communities	Staff of public health works with community partners to enhance factors that enable youth to participate actively in their communities. Youth leaders demonstrate preparation of healthy snacks for their peers and facilitate workshops to learn new sports, such as boxing.	No
Youth Project- Photo Voice	Students took pictures around their community of the barriers and enablers to physical activity. Used project to advocate for more active routes.	No

Public Health Ontario
480 University Avenue, Suite 300,
Toronto, Ontario
M5G 1V2

647.260.7100
communications@oahpp.ca
www.publichealthontario.ca