



CORE

Public Health Functions for BC

Evidence Review:
**Healthy Living –
Physical Activity &
Healthy Eating**

**Population Health and Wellness
BC Ministry of Health**

September 2006

This paper is a review of the scientific evidence for this core program. Core program evidence reviews may draw from a number of sources, including scientific studies circulated in the academic literature, and observational or anecdotal reports recorded in community-based publications. By bringing together multiple forms of evidence, these reviews aim to provide a proven context through which public health workers can focus their local and provincial objectives. This document should be seen as a guide to understanding the scientific and community-based research, rather than as a formula for achieving success. The evidence presented for a core program will inform the health authorities in developing their priorities, but these priorities will be tailored by local context.

This Evidence Review should be read in conjunction with the accompanying Model Core Program Paper.

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TABLE OF CONTENTS

Executive Summary	i
1.0 Overview/Setting the Context.....	1
1.1 An Introduction to This Paper.....	1
2.0 Methodology.....	3
3.0 Background.....	4
3.1 Overview of Healthy Living	4
4.0 Chronic Disease Prevention.....	7
4.1 Integrated Chronic Disease Programs.....	7
4.2 Physical Activity.....	9
4.3 Maintaining Healthy Weights.....	12
5.0 Physical Environment.....	18
5.1 Urban Sprawl and Active Transportation	18
5.2 Urban Form and Physical Activity	19
5.3 Urban Form and Healthy Weights	20
5.4 Urban Form and Safety.....	20
5.5 Urban Form and Psychological Impacts.....	22
5.6 Access to Recreational Areas and Facilities	22
5.7 Urban Air and Water Pollution.....	23
5.8 Overview – Community and Physical Environment Interventions and Models.....	24
6.0 Community	26
6.1 Communities and Social Capital.....	26
6.2 Access to Healthy Food Stores/Restaurants	26
6.3 Overview – Community Interventions.....	27
7.0 Workplace.....	28
7.1 Workplace Healthy Eating/Physical Activity	29
7.2 Workplace Policies to Promote Healthy Weights.....	30
7.3 Overview - Workplace Interventions and Models.....	30
8.0 School	32
8.1 Healthy Eating in the School Environment	32
8.2 Physical Activity in Schools	34
8.3 Coordinated School Health Programs.....	35
8.4 Overview – Interventions and Models for Healthy Living.....	36
9.0 Child Care Programs.....	38
10.0 Home and Family Environment.....	40
10.1 Breastfeeding	41
10.2 Family Modeling.....	42
10.3 Food Prepared Away from Home	43
10.4 Sweetened Drink Consumption by Children	43
10.5 Screen Time	44
10.6 Childhood/Adolescent Disadvantage.....	45
10.7 Mental Health and Healthy Living	46
10.8 Eating Patterns Among Seniors Living in the Community	47
10.9 Eating Patterns Among Aboriginal Peoples	48

Core Public Health Functions for BC: Evidence Review
Healthy Living – Physical Activity & Healthy Eating

10.10	Cultural Differences in Healthy Living/Physical Activity Patterns.....	49
10.11	Other Studies/Interventions – Home and Family Environment.....	49
11.0	Nutrition Environment.....	51
11.1	Impact of Advertising	51
11.2	Food Insecurity	51
11.3	Patterns in Changing Food Supply	53
12.0	Healthy Living Policy Interventions.....	55
12.1	Economic Impact of Obesity	55
12.2	Public Opinion	56
12.3	Dietary and Physical Activity Policy.....	57
12.4	Taxation	58
12.5	Advertising/Media Regulation.....	59
12.6	Labelling and Point-of-Purchase Information	59
12.7	Policy Approaches to Land Use and Transportation Planning	60
12.8	Other Policy Options.....	61
13.0	Conclusion	63
	References.....	64
	Appendix A: Examples of Evaluated Workplace Health Initiatives	82
	Appendix B: Examples of Evaluated School-Based Health Initiatives	83

List of Figures

Figure 1: Overview of Healthy Living Factors.....	4
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EXECUTIVE SUMMARY

This document was prepared to support the development of an evidence-based core public health program in healthy living in British Columbia. The healthy living program focuses on three areas: healthy eating, physical activity and tobacco control. Research on healthy eating and physical activity is included in this paper. The evidence related to tobacco control is presented in a separate evidence review.

A population health approach is reflected throughout the paper to identify the broad range of factors and conditions that influence healthy living. The determinants of health are included, where available, to acknowledge the importance of factors such as income and education level, family structure, gender, ethnicity and environmental conditions. Social and economic determinants in particular are noted as evidence clearly identifies income level as a factor in a family's access to sufficient healthy food (Dietitians of Canada 2002), and income and education level as an indicator of physical activity and healthy weights. Individuals with the lowest income levels tend to be less active than those with higher incomes (Statistics Canada 2006, Canadian Community Health Survey 2.2 – custom tabulation, as cited in Canadian Institute for Health Information [CIHI] 2004); similarly, women and men with high school education, or less, are more likely to be obese than those with post-secondary education (Tjepkema 2005).

The promotion of healthy living is complex and challenging. For example, over the past 20 years, the percentage of Canadian adults who are overweight and obese has more than doubled, while rates have nearly tripled for Canadian children (CIHI 2004). Obesity alone costs the BC economy an estimated \$730–\$830 million a year (Coleman, Dodds and Wilson 2001). The World Health Organization (WHO 2005) states “the impact of the obesity epidemic on non-communicable diseases such as cardiovascular disease, Type 2 diabetes, and cancer, threatens to overwhelm health systems.”

The many interrelated factors that contribute to healthy living in BC include:

- Prevention of non-communicable chronic diseases
- Community and physical environment.
- Workplace.
- School.
- Child care.
- Home and family environment.
- Nutrition environment.
- Healthy living policies.

The evidence on a wide range of initiatives under each of these categories is discussed in this document. Many single-targeted interventions appear to be effective at increasing healthy eating and physical activity, and, in some cases, reducing overweight and obesity. Other interventions that use multiple strategies or have multiple target audiences, such as coordinated school health programs, also appear to be effective in many cases. Overall, the evidence suggests that the most effective interventions to change diet and physical activity patterns at the population level are to:

- Adopt an integrated, multi-disciplinary, and comprehensive approach.

Core Public Health Functions for BC: Evidence Review
Healthy Living – Physical Activity & Healthy Eating

- Involve a complementary range of actions.
- Work at individual, community, environmental and policy levels (Raine 2004).

The success of population-based change strategies requires strong support from all levels to ensure that programs are well resourced and integrated into existing programs and structures. In addition, intersectoral collaboration and community participation are essential to ensure that programs are sustainable, tailored to meet local needs, able to reach more than just the “motivated healthy” and able to capture local opportunities (Raine 2004).

1.0 OVERVIEW/SETTING THE CONTEXT

In 2005, the British Columbia Ministry of Health released a policy framework to support the delivery of effective public health services. The *Framework for Core Functions in Public Health* identifies healthy living as one of the 21 core programs that a health authority provides in a renewed and comprehensive public health system.

The process for developing performance improvement plans for each core program involves completion of an evidence review used to inform the development of a model core program paper. These resources are then utilized by the health authority in their performance improvement planning processes.

This evidence review was developed to identify the current state of the evidence based on the research literature and accepted standards that have proven to be effective, especially at the health authority level. In addition, the evidence review identifies best practices and benchmarks where this information is available.

1.1 An Introduction to This Paper

The British Columbia Ministry of Health has identified healthy living as a core public health program. In March 2005, the ministry released a document entitled *A Framework for Core Functions in Public Health*, prepared in consultation with representatives of health authorities and public health experts.

The process of developing each core program involves two steps. Both are developed through a collaborative process involving representatives of the Ministry of Health, the health authorities and other recognized experts.

- First, an evidence paper is developed to document strategies from the research literature and from accepted standards that have proven to be effective, efficient, appropriate and equitable.
- Second, a model core program paper is developed, based on the evidence, to define the core program elements for implementation and delivery by the health authorities.

Healthy living involves a wide range of interconnected factors. Healthy eating, physical activity and tobacco control are all important elements of healthy living. Healthy eating and physical activity are addressed in this review, while tobacco control is addressed in a separate evidence review (except where tobacco control is referenced as one element in larger integrated healthy living strategies).

In the past, prevention and treatment in clinical settings have been the focus of interventions, but researchers now agree that social and environmental factors need to be understood and modified for effective prevention.

Accordingly, this paper includes a population health approach and focuses on the various environments and settings which influence healthy living, such as the community and physical

Core Public Health Functions for BC: Evidence Review
Healthy Living – Physical Activity & Healthy Eating

environment, workplace, school, child care and home environments. Determinants of health are considered within this context. The clinical aspects of non-communicable chronic disease prevention are addressed as well.

Although the research is not presented in the context of a socioecological framework (McLeroy et al. 1988), program planners may wish to consider the evidence within this model to assess the potential for widespread impact. The socioecological model focuses on the level of influence that programs can have on each of the following: individual, interpersonal, organizational, community and society.

This evidence review reflects the research that has been conducted in the field of healthy living. It is important to note that the research literature is limited in this area. While it covers some topics extensively, others have little attention. For example, there are many studies on obesity and overweight and relatively few in areas such as workplace wellness and effective programs for sub-groups (such as low-income families, Aboriginal communities and other cultural groups). Innovative approaches are being implemented in some areas but evaluations and outcomes have not been conducted. As a result, it will be necessary for planners to consider emerging “promising practices” and new studies as they appear in the literature.

This document is a consolidation of a number of papers that have documented the challenges and results of many interventions in the field of healthy eating and physical activity, nationally and internationally. It is intended to assist representatives of the BC Ministry of Health and the health authorities in identifying effective and/or “promising” elements of a model core program in healthy living.

2.0 METHODOLOGY

A number of documents describing and analyzing factors that contribute to healthy living have been summarized and combined into this document. They include the following:

- *Improving the Health of Canadians: Promoting Healthy Weights* (2006), by the Canadian Institute for Health Information.
- *A Physical Activity and Healthy Eating Plan for British Columbia* (draft) (2005), by the Ministry of Health, Population Health and Wellness Division.
- *Prevention That Works: A Review of the Evidence Regarding the Causation and Prevention of Chronic Disease* (Paper #2) (2003), by the Ministry of Health Planning, Population Health and Wellness Division.
- *Overweight and Obesity in Canada: A Population Health Perspective* (2004), by Dr. Kim D. Raine, for the Canadian Institute for Health Information.
- *Interventions Related to Obesity: A State of the Evidence Review* (2005), by the Heart and Stroke Foundation of Canada.
- *Core Components of Effective Tobacco Control* (2006), by the Centre for Addictions Research of British Columbia, University of Victoria.
- *Population Health and Urban Form: A Review of the Literature* (2004), by Smart Growth BC.
- *Understanding the Forces That Influence Our Eating Habits: What We Know and Need to Know* (2005), Canadian Journal of Public Health.

The document *Improving the Health of Canadians: Promoting Healthy Weights* has served as a framework for some sections of this paper and is extensively quoted. In addition, the section on non-communicable chronic diseases from the following two works has also been extensively quoted: *Prevention That Works: A Review of the Evidence Regarding the Causation and Prevention of Chronic Disease*, and *Overweight and Obesity in Canada: A Population Health Perspective*.

3.0 BACKGROUND

3.1 Overview of Healthy Living

The categories illustrated in Figure 1 provide an overview of the various factors considered in this paper:

Figure 1: Overview of Healthy Living Factors

<p>Chronic Disease Prevention</p> <ul style="list-style-type: none"> • Integrated chronic disease prevention strategies • Physical activity • Maintaining healthy weights <ul style="list-style-type: none"> ○ Healthy eating ○ Cardiovascular disease ○ Type 2 diabetes ○ Childhood obesity • Psychological aspects of overweight/obesity 	<p>School</p> <ul style="list-style-type: none"> • Healthy eating • Physical activity • Coordinated school health programs <hr/> <p>Child Care Programs</p> <ul style="list-style-type: none"> • Healthy eating/physical education in group/family day care 	<p>Nutrition Environment</p> <ul style="list-style-type: none"> • Food insecurity • Patterns in the changing food supply • Energy-dense foods • Fast-food restaurants • Portion size • Advertising
<p>Physical Environment</p> <ul style="list-style-type: none"> • Urban sprawl • Active transportation • Physical activity • Urban safety • Psychological impacts • Access to recreation • Air and water pollution 	<p>Home and Family Environment</p> <ul style="list-style-type: none"> • Breastfeeding • Early childhood motor skill development • Food prepared away from home • Sweetened drink consumption by children • Screen Time • Childhood/adolescent disadvantage • Mental health and healthy living • Eating patterns of seniors living in the community • Eating patterns of Aboriginal peoples • Cultural differences in health living/physical activity 	<p>Healthy Living Policy</p> <ul style="list-style-type: none"> • Economic impact of obesity • Public opinion • Dietary/physical activity • Taxation • Advertising/media regulation • Land use/transportation planning
<p>Community</p> <ul style="list-style-type: none"> • Communities and social capital • Access to healthy food stores/restaurants 		
<p>Workplace</p> <ul style="list-style-type: none"> • Healthy eating • Physical activity • Workplace policies 		

Both physical activity and healthy eating are essential to good health throughout life, to increase resiliency and to protect against disease and disability. They are needed to lower the risk of chronic diseases and promote optimal health. In children, sufficient levels of physical activity and healthy eating are essential for healthy growth and development.¹

An overview of the current status of healthy eating and physical activity, including major challenges, is provided in the sections that follow.

¹ Details on the specific needs of children will be discussed in the Core Program on Early Childhood Development,

3.1.1 Healthy Eating

- The eating habits of adult British Columbians fall substantially short of standards for good nutrition (BC Nutrition Survey 2004). Only 40 per cent of the BC population eats the daily recommended level of fruits and vegetables (2003) (Ministry of Health 2006).
- Approximately 1 in 15 (7 per cent) British Columbians report sometimes or often not having enough food to eat due to lack of money (2003) (Statistics Canada 2003b).
- Adults with post-secondary education tend to report eating fruit and vegetables more frequently than those with less than high school graduation (Perez 2002).

3.1.2 Physical Activity

- Almost half (47 per cent) of adult British Columbians are not active enough to achieve the health benefits of regular exercise (2003) (Ministry of Health 2006).
- More than half (58 per cent) of BC youth aged 12 to 19, and about half (48 per cent) of children and youth aged 5 to 17, were not active enough for optimal growth and development (2003) (Ministry of Health 2006)².

3.1.3 Obesity

- Obesity among Canadian adults 18 years and over has increased from 14 per cent in 1978/1979 to 23 per cent in 2004. Eighteen per cent of Canadian children, 2 to 17 years, were obese in 2004 (Tjepkema 2005). Over the past 20 years, the percentage of Canadian adults who are overweight and obese has more than doubled, while rates have nearly tripled for Canadian children (CIHI 2004).
- Women and men in Canada, aged 25 to 64, with high school education or less were more likely to be obese than those who had completed post-secondary education (2004) (Tjepkema 2005).
- Obesity alone costs the BC economy an estimated \$730–\$830 million a year (Coleman et al. 2001). Researchers estimate that the total direct cost of weight-related major chronic disease in Canada's health system was nearly \$1.6 billion in 2001; coupled with indirect costs, this total was \$4.3 billion (Coleman et al. 2001).
- The human and financial burden of obesity and physical inactivity is expected to escalate. If present trends continue, this increased burden will have a dramatic effect on the future of the health system and society as a whole (Select Standing Committee on Health 2004).

3.1.4 Chronic Diseases

- Over 20 per cent of BC's burden of disease Disability Adjusted Life Years (DALYs) is attributable to obesity and physical inactivity (Ministry of Health 2001).³
- Most people who are obese are at increased risk for a range of preventable chronic diseases (National Institutes of Health 1998; WHO 2003), including, but not limited to,

² The optimal level for growth and development is equivalent to 60 minutes per day of physical activity.

³ This is an underestimate of the full cost associated with unhealthy eating, since it excludes data on nutrition risks not related to obesity.

cardiovascular disease (WHO 2003; Gilmore 1999), hypertension (WHO 2003), Type 2 diabetes (Swinburn et al. 2004), arthritis (Wilkins 2004) and some types of cancer (WHO 2003).

3.1.5 Aboriginal Peoples

- Aboriginal people are at high risk for food insecurity and poor nutritional status. They suffer from higher than average rates of obesity, non-insulin dependent diabetes mellitus and micronutrient deficiencies, all of which are at least partially diet-related (Riches et al. 2004).
- In 2004, off-reserve Aboriginal adults had an obesity rate 1.6 times higher (38 per cent) than the Canadian average (23 per cent) (Tjepkema 2005).

In addressing healthy living, a population health approach is required to acknowledge factors such as income and education level, family structure, gender, ethnicity and environmental conditions. For example, economic determinants are key factors in a family's access to sufficient healthy food (Dietitians of Canada 2002), and income and education level are indicators of physical activity and healthy weights. Information on the social and economic determinants of health are included in this evidence review where they are available in the research literature; however, it is important to note that there is a lack of evidence in this important area. Additional research and surveillance data is needed to determine the healthy living issues and trends for marginalized and vulnerable groups of people.

The Ministry of Health and the Working Group on Healthy Living have recommended the use of an "inequities lens". In *A Framework for Core Functions in Public Health* (Ministry of Health 2005), ways to reduce inequities are proposed including:

- Documenting inequities, reporting on them so as to draw public attention to them and analyzing the factors that contribute to them.
- Working with communities to change the conditions that contribute to inequities in health in their communities.
- Advocating for healthier public policies and changes in social, economic, cultural and environmental conditions that will reduce inequities in health.

A lack of evidence was also noted for healthy living interventions that involve the primary health care sector. Ideally, the involvement and integration of primary care providers into healthy living strategies and services would strengthen and support public health initiatives. Assessment of the linkages between primary health care and public health will hopefully be the focus of future research and evaluation projects.

4.0 CHRONIC DISEASE PREVENTION

Healthy eating and physical activity are addressed in this section from the perspective of their impact on chronic disease. Non-smoking is discussed as one component of integrated strategies that consider the full range of healthy living initiatives. For a full discussion of the research evidence on smoking cessation programs, an important resource is the evidence review on tobacco control.

4.1 Integrated Chronic Disease Programs

The World Health Organization (WHO) adopted a *Global Strategy on Diet, Physical Activity and Health* in May 2004, with an overall goal “to promote and protect health by guiding the development of an enabling environment for sustainable actions at individual, community, national and global levels that, when taken together, will lead to reduced disease and death rates related to unhealthy diet and physical inactivity.” The WHO notes that the role of government is crucial in achieving this goal. Governments are encouraged to establish national policies, strategies and action plans, and to coordinate and facilitate the contributions across government and across sectors.

The four main objectives are to:

- Reduce the risk factors for non-communicable diseases that stem from unhealthy diets and physical inactivity by means of essential public health action and health-promoting and disease-preventing measures.
- Increase the overall awareness and understanding of the influences of diet and physical activity on health and of the positive impact of preventive interventions.
- Encourage the development, strengthening and implementation of global, regional, national and community policies and action plans to improve diets and increase physical activity that are sustainable, comprehensive, and actively engage all sectors, including civil society, the private sector and the media.
- Monitor scientific data and key influences on diet and physical activity, to support research in a broad spectrum of relevant areas including evaluation of interventions, and to strengthen the human resources needed in this domain to enhance and sustain health.

An *Integrated Pan-Canadian Healthy Living Strategy* was approved by Federal, Provincial and Territorial Ministers of Health in October 2005. The goals of this strategy are to improve overall health outcomes and to reduce health disparities. “Grounded in a population health approach, the initial emphasis is on healthy eating, physical activity, and their relationship to healthy weights.” Proposed action has developed through intersectoral working groups as a means “to ensure greater alignment, coordination and direction for all sectors”, and to provide a forum for multiple players to work collaboratively to address common risk factors (Intersectoral Healthy Living Network 2005).

Core Public Health Functions for BC: Evidence Review **Healthy Living – Physical Activity & Healthy Eating**

Four working groups, comprised of federal/provincial/territorial members, the private sector and non-profit organizations, are responsible for moving the agenda forward:

- Social Marketing/Public Information Working Group.
- Priorities and Objectives Working Group.
- Research and Surveillance Working Group.
- Intersectoral Fund Working Group.

In BC, the Ministry of Health implemented the *BC Heart Health Project*, as part of a countrywide multi-level strategy for the prevention of cardiovascular disease (CVD), the major cause of death and disability and of rising health care costs in Canada. Heart Health was a 10-year federal/provincial project that took an integrated approach to the control of the multiple risk factors responsible for CVD. The purpose of the BC Heart Health Project was to enhance the existing capacity of health authorities to plan, implement, and evaluate comprehensive community-based approaches to preventing CVD in their regions. To achieve this goal the Ministry of Health identified six cornerstones necessary for successful action: infrastructure; collaboration; evidence base; policy base, technical assistance; and CVD content. The ministry provided technical support in the form of information, resources, standards and guidelines, networking opportunities, consultation and training for interested health authorities (Healthy Heart Society of British Columbia n.d.). The program continues on a community level in some areas.

Prevention That Works describes an “Effective Public Health Practice Project” (City of Hamilton n.d.), which examined 13 heart-health community-based initiatives and concluded that:

- Compared to usual care, community-based heart-health interventions are effective in reducing smoking prevalence in men, adolescents and certain high-risk groups, and in reducing the proportion of the population with an elevated body mass index.
- Compared to routine cardiovascular disease preventive care, heart-health interventions are effective in reducing the proportion of the population with elevated blood cholesterol, increasing awareness of blood cholesterol levels and increasing individual’s awareness of their risk for cardiovascular disease.
- When measured at the community level, heart-health interventions are not effective at changing outcomes such as smoking prevalence, physical activity level, mean systolic and diastolic blood pressure, blood cholesterol, CVD risk factor score and CVD mortality. However, there is evidence suggesting these interventions do have an effect on high-risk groups that is masked when community-level data is used for analysis.
- Community-based heart-health interventions directed at smoking, physical activity, blood pressure, blood cholesterol, CVD risk factor score and CVD mortality should be targeted at specific high-risk populations.

An overall strategy was developed in 2001 by the United Kingdom Health Development Agency to reduce smoking, promote healthy eating, increase physical activity and reduce overweight and obesity. The features of effective interventions in their strategy, entitled *Effective Local Strategies for Reducing Coronary Heart Disease*, include:

- Reducing smoking prevalence
 - Develop smoking cessation services.
 - Reduce smoking in public places including workplaces.
 - Support national media campaigns.
 - Use media advocacy.
 - Reduce sales of cigarettes to children under 16 years of age.
 - Encourage the introduction of smoking policies in schools.
- Improving diet and nutrition
 - School programs.
 - Local/community projects.
 - Workplace programs.
 - Health care programs.
- Increasing physical activity
 - Health care interventions.
 - Exercise referral schemes.
 - Workplace programs.
 - Mass media.
 - School programs.
 - Older people.
 - Physically active transport.

Prevention That Works (Ministry of Health Planning [MOHP] 2003) speaks to the issue of health promotion messages, stating that “while there is often a positive, encouraging health promotion approach in addressing healthy living, there is nonetheless a place for negative or “fear” messages, as a review found in a meta-analysis of the literature. The key findings of that analysis were:

- The stronger the fear appeal, the greater the attitude, intention, and behaviour changes.
- The stronger the severity and susceptibility in the message, the more attitude, intention, and behaviour change.
- The stronger the response efficacy and self-efficacy in a message, the stronger the attitudes, intentions, and behaviours toward the recommended response.
- Higher levels of both threat and efficacy, in their various combinations, lead to more persuasion.
- Response to fear appeals is not affected by personality or demographic traits.
- However, fear appeals produce one of two competing responses: self-protective actions or defensive responses. “As fear appeals increase in strength so do defensive responses.” (MOHP 2003, p. 155).

4.2 Physical Activity

A literature review by Warburton, Nicol and Bredin (2006a) confirmed “there is irrefutable evidence of the effectiveness of regular physical activity in the primary and secondary prevention of several chronic diseases and premature death.” The authors note that there appears to be a linear relationship between physical activity and health status, such that a further increase in physical activity and fitness will lead to additional improvements in health status.

In a second article, Warburton, Nicol and Bredin (2006b) examined current recommendations for exercise, including the intensity, type, time and frequency). The authors found:

- Physical inactivity is a modifiable risk factor for cardiovascular disease and a variety of other chronic diseases, including, diabetes mellitus, cancer (colon and breast), obesity, hypertension, obesity, bone and joint diseases (osteoporosis and osteoarthritis), and depression;
- The prevalence of physical inactivity, among 51 per cent of adult Canadians, is higher than that of all other modifiable risk factors (Statistics Canada 2003b).

With respect to primary prevention, Warburton et al. (2006b) found that:

- Physical activity resulted in greater reductions, than previously thought, in the risk of death for men, from any cause and from CVD. For example, being fit or active was associated with a greater than 50 per cent reduction in risk (Myers et al. 2004).
- Physically inactive middle-aged women (less than one hour of exercise per week) experienced a 52 per cent increase in all-cause mortality, a doubling of cardiovascular-related mortality and a 29 per cent increase in cancer-related mortality, compared with physically active women (Hu et al. 2004).
- A review of randomized controlled trials “concluded that modest weight loss through diet and exercise reduce the incidence of the disease among high-risk people by about 40 to 60 per cent over 3 to 4 years (Williamson et al. 2004).
- It appears that routine physical activity is associated with a reduction in the incidence of specific cancers, in particular colon and breast cancer. Physically active men and women exhibited a 30 to 40 per cent reduction in the relative risk of colon cancer, and physically active women had a 20 to 30 per cent reduction in the relative risk of breast cancer compared with their inactive counterparts (Lee 2003).
- Modest enhancements in physical fitness in previously sedentary people have been associated with large improvement in health status. For example, people who went from unfit to fit over a 5-year period had a reduction of 44 per cent in the relative risk of death compared with people who remained unfit (Blair et al. 1995).

Considering secondary prevention of these chronic diseases, Warburton et al. (2006b) found:

- Exercise interventions are effective in the management of diabetes. One study found that “walking at least 2 hours/week was associated with a reduction in the incidence of premature death of 39 to 54 per cent from any cause, and of 34 to 53 per cent from cardiovascular disease among patients with diabetes” (Gregg et al. 2003).
- Physical activity was associated with a decreased recurrence of cancer and risk of death from cancer. For example, a reduction of 26 to 40 per cent was found in the relative risk of cancer-related death and recurrence of breast cancer among the most active women compared with the least active.
- Physical activity has been shown to be an effective preventive strategy for osteoporosis. For example, a randomized control trial indicated that a 6-month exercise training program was effective in improving bone density in older women (75 to 85 years of age)

with low bone mineral density—results found a “significant increase in cortical bone density” (Liu-Ambrose et al. 2004). Furthermore, a study of post-menopausal osteopenic women revealed that a 2-year intensive training program was effective in attenuating the rate of bone loss (Kemmler et al. 2004).

Prevention that Works reports that the American Heart Association issued a scientific statement (2003) on exercise and physical activity in the prevention and treatment of atherosclerotic cardiovascular disease (Thompson et al. 2003). They also found “conclusive evidence that physical activity reduces the incidence of CVD” by preventing or helping to treat such risk factors as high blood pressure, insulin resistance and glucose tolerance, high levels of triglycerides, low levels of HDL cholesterol, and obesity. The effect of exercise is related to the intensity of the exercise, and can be “significantly magnified by other lifestyle changes” such as low-fat diets and weight loss (Ministry of Health Planning 2003).

Based on this evidence, the American Heart Association recommends that “health care providers support the implementation and maintenance of exercise programs for their patients across the life span.” “Such support includes engaging personally in an active lifestyle, using their influence to encourage and support schools in providing physical education programs, and advocating for changes in organizational practices within work sites and civic and recreational settings that encourage active living (including encouraging the availability of facilities and the engineering of environments to make them safe for physical activity). In their offices, health care providers should take a physical activity history and include it as part of the medical record, and should prescribe 30 minutes or more of moderate-intensity physical activity on most, and preferably, all days of the week” (Thompson et al. 2003).

Prevention that Works also describes the work of the United States Centers for Disease Control and Prevention (CDC). The CDC reviewed the evidence for the effectiveness of interventions to promote physical activity. The following range of initiatives were recommended in their Community Guide (2005) on the basis of strong evidence:

- **Social support in community contexts**, including the creating, strengthening and maintaining of social networks, the use of “buddy” systems, and walking groups. Nine studies reviewed the results of these interventions. Results indicated that a variety of socio-economic groups and settings showed a 44 per cent increase in time spent being physically active and a 20 per cent increase in the frequency of physical activity, as well as improved fitness levels, reduced percentage of body fat, and increased knowledge of health.
- **Individually adapted health behaviour change**, including goal setting and self-monitoring, social support building, behavioural reinforcement, structured problem-solving, and relapse prevention. Of the 18 studies reviewed, there was a median increase in minutes of activity of 35 per cent and a median increase of energy expenditure of 64 per cent, with a weight loss averaging approximately 6 per cent.
- **Community-wide campaigns**, involving large scale, high intensity, high visibility programs; the use of TV, radio, newspaper and information sites; and multi-component, multi-site, “combined package” interventions. Based on 10 studies in a mix of urban and rural communities, these campaigns have resulted in increases in physical activity in the

range of 0 to 25 per cent, with the median estimates of a 5 per cent increase in the proportion of people who are physically active and a 16 per cent increase in energy expenditure.

- **Modified physical education in school**, including modified curricula and policies, modified amounts of physical activity during physical education and modified, more active activities and games. Based on 14 studies, such activities have increased aerobic capacity by a mean of 8 per cent. A separate study found no harmful impact on academic performance.
- **Creating or enhancing access to places for physical activity**, including trails and/or facilities access, reduced safety and affordability barriers, training and incentives, and site-specific programs. Based on 10 studies that were reviewed, the median increase in people exercising at least 3 times a week was 25 per cent, with weight loss or decreases in body fat documented in most studies (CDC 2005a).

In addition to these strongly recommended interventions, one intervention was recommended by the CDC on the basis of sufficient evidence; this intervention was "point of decision prompts", including motivational signs placed by elevators and escalators, and the encouragement of stair use for health or weight control purposes. Six studies in a variety of settings showed a median increase in stair climbing of 54 per cent.

In Britain, the Health Development Agency (2001) has also reviewed the evidence with respect to physical activity and concluded that effective interventions are those that:

- Encourage walking and do not require attendance at a facility; brisk, regular walking can achieve most of the health benefits associated with physical activity.
- Involve environmental modifications, such as signs posted to increase stair climbing.

In Canada, there has been (*Prevention That Works*) "a long history of activity aimed at increasing physical activity, sparked in no small part by the famous observation in the 1970's that the average 60 year old Swede was fitter than the average 30 year old Canadian. ParticipAction and other programs have worked with some success to increase the level of physical activity among Canadians. Over time, the focus has shifted from fitness campaigns emphasizing exercise programs to more broad-based initiatives focused on 'active living'—walking, biking, gardening, using stairs, etc.—and an increasing focus on identifying and addressing the environmental barriers to active living such as urban and suburban design that makes walking, biking and other forms of active living more difficult" (MOHP 2003).

4.3 Maintaining Healthy Weights

Prevention That Work, explains that the impact of overweight and obesity on life expectancy has recently been calculated for the first time, examining the 3,457 participants in the Framingham Heart Study. Participants were aged 30 to 49 at baseline (1948), and were followed through to 1990 (Peeters et al. 2003). The impact is dramatic:

- A decrease in life expectancy of more than 7 years for women who are obese, whether smokers or non-smokers, compared to their respective normal weight group.

Core Public Health Functions for BC: Evidence Review

Healthy Living – Physical Activity & Healthy Eating

- A decrease of 6.7 years and 5.8 years for obese male smokers and non-smokers compared to their respective normal weight groups.
- Overweight non-smokers, both male and female, experienced a decrease in life expectancy of more than 3 years compared to the normal-weight, non-smoking group.

Overweight and Obesity in Canada: A Population Health Perspective notes further that “beyond mortality, an analysis of the impact of obesity on morbidity relative to other risks can assist in developing an understanding of the magnitude of obesity’s impact on health. Examination of data from the 1998 US national telephone survey Healthcare for Communities, with 9,585 adult respondents, revealed that obesity is linked to very high rates of chronic conditions. Compared to normal-weight individuals with no history of smoking or heavy drinking, obesity is associated with a 67 per cent increase in self-reported chronic conditions (such as diabetes, hypertension, asthma, heart disease and cancer).” In comparison, “living in poverty is associated with a 58 per cent increase in chronic conditions and daily smoking among normal-weight adults is associated with a 25 per cent increase in chronic conditions” (Raine 2004).

4.3.1 Healthy Eating

Prevention That Works reports that a United Kingdom Committee on the Medical Aspects of Food and Nutrition Policy recognized the role that diet plays in heart disease, cancer, obesity and diabetes, and recommended the following dietary changes:

- Reducing the amount of fat and in particular, the amount of saturated fat.
- Increasing the amount of fruit and vegetables eaten to at least five portions each day.
- Increasing the intake of fibre-rich, starchy foods, such as bread, potatoes, pasta and rice by half as much again.
- Reducing the average salt intake by around one-third.
- Increasing the amount of fish eaten to at least two portions each week, one of which should be an oily fish.” (Health Development Agency 2001).

The committee also found the following characteristics of effective interventions for promoting healthy eating:

- A focus on diet alone, or diet plus physical activity, rather than addressing a range of risk factors.
- Clear goals for dietary change, linking improvements in knowledge with development of skills and the provision of opportunities to put the knowledge into practice.
- Personal contact with individuals or small groups sustained over time.
- Personalized feedback to participants on changes in their behaviour and risk factors.
- Changes in the local environment, including shops and catering outlets that help people choose a healthy diet” (HDA 2001).

A Cochrane review examined 27 randomized clinical trials of reduction or modification of dietary fats over a period of at least 6 months. Overall, there was "no significant effect on total mortality, a trend towards protection from cardiovascular mortality, and significant protection from cardiovascular events", although on sensitivity analysis this effect became non-significant.

However, "trials where participants were involved for more than two years showed significant reductions in the rate of cardiovascular events." It was concluded that "lifestyle advice to both those at high risk of cardiovascular disease and to lower risk population groups should continue to include permanent reduction of dietary saturated fat and partial replacement by unsaturates" (Hooper et al. 2000).

4.3.2 Cardiovascular Diseases

Overweight and Obesity in Canada: A Population Health Perspective explains that the overall risk of CVD increases with increasing Body Mass Index (BMI)⁴, and high BMI is associated with CVD risk factors, including hypertension, high total and LDL cholesterol, high triglyceride levels, and low HDL cholesterol (Jung 1997). The Canadian Heart Health Survey (CHHS) observed that BMI was strongly related to blood pressure, diabetes and lipid abnormalities as cardiovascular risk factors (Rabkin and Yue 1997). A subset of CHHS data (five provinces, 1990 to 1992) revealed that both BMI and waist-hip ratio (WHR), a measure of abdominal fat distribution, were predictive of all cardiovascular risk factors (hypertension, hyperlipidemia, diabetes) (Ledoux and Lambert 1997), although WHR was a stronger predictor than BMI (Ledoux and Lambert 1997).

Increased CVD risk is not exclusive to adults; obese children and adolescents also demonstrate increased prevalence of hypertension and dyslipidemia (Freedman et al. 1999). Because overweight is associated with various risk factors even among young children, it is possible that the successful prevention and treatment of obesity in childhood could reduce the adult incidence of cardiovascular disease (Freedman et al. 1999, p. 1175). Although comprehensive community and nationwide programs for CVD prevention over the past 30 years have met with varying degrees of success, these programs have not explicitly emphasized obesity, and children have not been the primary focus.

4.3.3 Type 2 Diabetes

Type 2 diabetes appears to be directly correlated with increasing obesity. BMI is a powerful predictor of diabetes risk (Jung 1997). Globally, the increasing prevalence of diabetes closely follows the increasing prevalence of obesity (Kumanyika et al. 2002). The same epidemiological trend is noted in the United States. Using self-reported data from the Behavioral Risk Factor Surveillance System, the prevalence of obesity (BMI over 30) for adults in 2000 was 19.8 per cent (a 61 per cent increase since 1991), and the prevalence of self-reported diabetes was 7.3 per cent (up 49 per cent since 1990) (Mokdad et al. 2001). Data from the CHHS, described previously, observed that measures of obesity (BMI, WHR and waist circumference) were strongly correlated with diabetes among adults (Ledoux and Lambert 1997).

"Once coined "adult-onset diabetes", Type 2 diabetes is being diagnosed at younger ages as childhood obesity increases (Must and Strauss 1999). Some of the first cases of childhood Type 2 diabetes observed were in Aboriginal communities. For example, obese Ojibwa-Cree children in a remote northern Manitoba community were found to be at increased risk of being classified

⁴ Body Mass Index (BMI) is used to identify weight-related health risks among individuals 18 years of age and older; a BMI between 18.5 to 24.9 is normal, under 18.5 is underweight, between 25 and 29.9 is overweight and obese levels are over 30.

as having diabetes or impaired fasting glucose (Young et al. 2000). Among First Nations communities in northwestern Ontario, the age-adjusted prevalence rate of Type 2 diabetes among children was 2.5/1,000 in 1994, the highest reported prevalence known. More than 70 per cent of cases were obese (BMI > 95th percentile) at diagnosis (Harris, Perkins and Whalen-Brough 1996. (*Overweight and Obesity in Canada*).

“As diabetes increases the risk of other disabling conditions, including CVD, renal failure, and blindness, it is a major link between obesity and other non-communicable diseases (Kumanyika et al. 2002). Recent trials have demonstrated the efficacy of lifestyle interventions to prevent Type 2 diabetes among adults with impaired glucose tolerance (Knowler et al. 2002). The author interprets these findings as the basis of considerable evidence to move toward prevention of obesity as a viable policy option for prevention of diabetes and non-communicable diseases” (Raine 2004).

4.3.4 Psychosocial Aspects of Overweight and Obesity

It has been suggested that obese children may be discriminated against by their peers, and this has an impact on emotional development (Must and Strauss 1999). As children enter adolescence, self-esteem and body image may be adversely affected (Must and Strauss 1999). Many overweight adolescents are socially marginalized (Strauss and Pollack 2003). In addition, studies of educational and psychological correlates of obesity suggest that adolescent girls and boys are more likely to report emotional disturbances and difficulties in school than their non-obese counterparts (Falkner et al. 2001). Among a Canadian school-based sample of 12-year-olds, lower self-esteem was noted among students with high BMI (classified as obese; > 95th percentile) (Tremblay, Inman and Wilms 2000).

Further, *Overweight and Obesity in Canada* notes that among adults, social bias against obese people is common in the industrialized world. Such social bias is not a consequence of obesity per se, but of culture-bound values that reject obesity (Stunkard and Sobal 1995). Obesity remains the last socially acceptable form of prejudice, and obese persons remain perhaps the only group toward whom social derogation can be directed with impunity (Stunkard and Sobal 1995, p. 417). The psychological consequences of social bias on obese people include poor body image and disordered eating. Beyond individual psychological consequences, however, evidence of discrimination against obese people has been reported in educational institutions, employment, and even in the practices of health professionals (Stunkard and Sobal 1995). Such discrimination may contribute to reduced access to social, educational, and professional opportunities for obese people, thereby sustaining a vicious cycle in which obesity influences social class, while social class influences the prevalence of obesity (Gorstein and Grosse 1994).

4.3.5 Adult Overweight and Obesity

Prevention That Works notes that the National Institutes of Health in the United States, through the National Heart, Lung and Blood Institute (2003), recently released an evidence-based report on clinical guidelines for the identification, evaluation and treatment of overweight and obesity in adults. They “reviewed almost 400 randomized controlled trials and used the results from 236 of these trials in arriving at the recommendations in broad categories, i.e., identifying the benefits

of weight loss, who is at risk, the goals for weight loss, how to achieve these goals, and how to maintain weight loss.” Their recommendations are:

- The benefits of weight loss:
 - Blood pressure – strong and consistent evidence that weight loss produced by lifestyle modifications can reduce blood pressure levels; this can be aided by increased physical activity (but not by sibutramine, the only weight-loss medication currently approved by the Food and Drug Administration).
 - Serum lipids – strong evidence that weight loss produced by lifestyle modifications can reduce serum triglycerides and increase HDL cholesterol, and produce some reduction in total cholesterol and LDL cholesterol; this can be aided by increased physical activity but not by pharmacotherapy.
 - Blood glucose – strong evidence that weight loss produced by lifestyle modifications can reduce blood glucose levels in people without diabetes and in some patients with Type 2 diabetes.
- Identifying those at risk –BMI should be used both to assess and to classify overweight (BMI > 25) and obesity (BMI > 30) , and sex-specific waist circumference cutoffs (102 cm or 40 in. for men, 88 cm or 35 in. for women) should be used in conjunction with BMI to identify increased disease risks.
- Goals for weight loss – There is strong and consistent evidence that weight loss of as much as 10 per cent of baseline can be achieved in well-designed programs, and there is suggestive evidence that this can be achieved at the rate of 1 to 2 lbs. per week (a calorie deficit of 500 to 1000 kcal/day) for up to 6 months.
- Achieving weight loss:
 - There is strong and consistent evidence that a low-calorie diet (which can be facilitated by a low-fat diet) can result in an average weight loss of 8 per cent over 3 to 12 months;
 - There is strong evidence that physical activity on its own results in modest weight loss, and that the combination of a reduced-calorie diet and increased physical activity produces greater weight loss than either alone. Thus, physical activity should be included as part of a comprehensive weight loss therapy and control program.
 - There is strong evidence that behavioural strategies can increase the weight loss resulting from dietary change and physical activity; no one therapy is clearly superior and multi-modal strategies appear to work best, with greater weight loss associated with greater intensity.
 - In summary, “weight loss and weight maintenance therapy should employ the combination of low-calorie diets, increased physical activity, and behaviour therapy.”
 - While there is strong evidence that pharmacological therapy—generally studied along with lifestyle modification—results in weight loss, only one such drug still on the market is currently approved by the FDA (sibutramine), and it may cause increases in blood pressure and heart rate and is contra-indicated in patients with cardiovascular problems, including hypertension. In particular, the report notes that “weight-loss drugs should never be used without concomitant lifestyle modifications.”

- There is strong evidence that surgical interventions in those with clinically severe obesity (BMI > 40 or BMI > 35 with co-morbid conditions) results in substantial weight loss.
- Maintaining weight loss – Most people who lose weight regain it, once they are no longer in a treatment program. The evidence suggests that an ongoing weight maintenance program, incorporating dietary therapy, physical activity, and behaviour therapy, should be continued indefinitely (National Heart, Lung and Blood Institute 2003).

5.0 PHYSICAL ENVIRONMENT

This section addresses the impact of the following issues on healthy living: urban sprawl and active transportation, urban form and physical activity, urban form and healthy weights, urban form and safety, urban form and psychological impacts, access to recreation areas and facilities and urban air and water pollution.

5.1 Urban Sprawl and Active Transportation

Improving the Health of Canadians: Promoting Healthy Weights discusses the growth of urban sprawl, linking it to increases in automobile use for personal travel (Frumkin 2002), and the associated decrease in physical activity. Frumkin (2002) notes that factors often linked to urban sprawl are:

- Communities that are relatively isolated or not densely populated.
- Development at the edges or outside of the city.
- A lack of well-defined centres of activity.
- Developments in which residents are dependent on their vehicles to travel between homes, shops, services and workplaces.
- Increased commuting times.
- Streets that may pose a safety risk to pedestrians and cyclists.
- Incomplete sidewalk networks.

Further, it explains that there “tends to be very little within easy walking distance in sprawling communities, prompting discussion of “active transportation” and how to encourage people to travel by means other than their automobiles. Active transportation refers to transportation that requires human power, such as walking, cycling, skating, skateboarding, for a cleaner environment and improved personal health” (Go for Green 2003; Cervero and Duncan 2003).

Research suggests that various factors influence active transportation choices:

- Proximity or the distance between trip origin (e.g., home) and destination (e.g., work) (Frank 2000).
- Connectivity, or the ease (or directness) of moving from trip origin to destination.
- Health benefits (e.g., increased positive health outcomes through physical activity) (Go for Green 2003).
- Environmental benefits (e.g., reduced air pollution) (Go for Green 2003).
- Quality of life benefits (e.g., reduced traffic noise and congestion) (Go for Green 2003).
- Cost (e.g., parking prices) (Go for Green 2003).

It is also noted that “where a person lives can be a factor that promotes or impedes active lifestyle choices.” To assess potential links between self-reported BMI and the geographical area in which people live, the Canadian Population Health Initiative (CPHI) of the Canadian Institute for Health Information examined relevant data from the 2003 Canadian Community Health Survey (CCHS) and the 2001 Census. According to these analyses 70 per cent of Canadians live in urban core areas. Those living in urban cores are more likely to report a BMI under 25 than

those living in other urban areas or in rural areas. Women living in the urban core are more likely to report a BMI <25 compared to women living outside the urban core or in rural areas. Similarly, men living in the urban core are more likely to report a BMI <25 compared to men living in rural areas, or men living in the urban fringe (CIHI 2004, p. 24).

5.2 Urban Form and Physical Activity

The relationship between sprawl and physical activity has been studied. In Canada, about 12 per cent of urban trips are made on foot or by bicycle. This is slightly higher than the rate of 7 per cent in the United States, but much lower than rates reported in the Netherlands (46 per cent) and Denmark (41 per cent) (Pucher and Dijkstra 2003). With respect to physical activity itself, new CPHI analyses of physical activity data from the 2004 CCHS indicate that 18 per cent of Canadian adults aged 18 years and over are active, 58 per cent are inactive and the remainder are moderately active (25 per cent).

Unlike sprawling communities, “walkable” neighbourhoods tend to have higher population densities, a greater mix of land use and easier movement between trip origin and destination (Frank et al. 2005). Compared to residents in low-walkability neighbourhoods, residents in high-walkability neighbourhoods report making more trips on foot or by bicycle (Sallis et al. 2004) and are more likely to engage in 30 minutes or more of moderate-intense physical activity on a given day (Frank et al. 2005).

Research comparing older and newly developed communities reports similar findings. Older communities were built on the assumption that few people would own and use personal vehicles. For example, grocery stores were typically located within relatively easy walking distance from most homes. Communities developed before 1946 tend to have more interconnected streets and sidewalks and a greater mix of housing, shops and services (Ewing et al. 2003). Compared to residents living in urban and suburban homes built after 1973, those living in such areas built before 1946 and up to 1973 are more likely to walk 1 mile or more (1.6 kilometers or more) 20 times or more per month (Berrigan and Triano 2002).

As part of its 2005 *Report Card on Canadians’ Health*, the Heart and Stroke Foundation of Canada examined data from the 2000 Survey of Canadian Municipalities. The *Report Card* indicated that larger urban communities tend to encourage:

- Walking or biking by having bike lanes on the road.
- Safe routes for pedestrian and bicycle travel.
- Off-road trails and paths on which motorized vehicles are not permitted to travel (Heart and Stroke Foundation 2005).

The *Report Card* further noted that residents of major urban centres reported higher rates of walking or biking to do daily chores (77 per cent), compared with the rest of Canada (60 per cent) (Heart and Stroke Foundation 2005). Residents of major urban centres also reported higher rates of walking, biking or taking public transit to get to work (34 per cent of residents in major urban centres versus 18 per cent in the rest of Canada) (Heart and Stroke Foundation 2005).

5.3 Urban Form and Healthy Weights

Current research in the United States indicates that for each extra daily hour spent driving a car, the likelihood of being obese increases by 6 per cent (Frank, Andresen and Schmid 2004). The Heart and Stroke Foundation reported a similar finding in its *2005 Report Card on Canadians' Health*, showing that Canadians who are car-dependent get less physical activity and are at increased risk of being overweight or obese. The *Report Card* further showed a 5 per cent reduction in the likelihood of being obese for every additional kilometre walked per day (Heart and Stroke Foundation 2005).

Improving the Health of Canadians: Promoting Healthy Weights notes the recent examination of the influence of neighbourhood and metropolitan characteristics (such as education levels, housing density and urban sprawl), on BMI in urban Canada (Ross et al. 2007). After individual sociodemographics and behaviours were controlled for, it was found that people living in neighbourhoods with a high proportion of less-educated individuals tended to have higher BMI levels than those living in neighbourhoods comprised of more highly educated individuals. For men only, lower BMIs were associated with living in a neighbourhood with a high proportion of recent immigrants, and higher BMI levels were associated with metropolitan sprawl (Ross et al. 2007).

Building on research outlining the positive health outcomes associated with active living choices, CPHI conducted new analyses to examine the link between various modes of transportation (active and inactive) and self-reported BMI, according to the neighbourhoods in which people live. These analyses indicate that Canadians living in neighbourhoods where the majority of residents drive to work are less likely to report a BMI <25 than those living in areas where fewer people drive to work.

CPHI analyses also show that Canadians living in areas where some residents rely on biking or taking public transit to work are more likely to report a BMI <25 than those living in neighbourhoods where fewer people do so. As noted earlier, biking to and from work is a form of active transportation. Some also consider taking public transit to be a form of active transportation, given that it replaces a number of individual vehicles on the road (thereby reducing air pollution and road congestion) (Go for Green 2003) and involves the physical activity associated with walking to and from the transit stop.

5.4 Urban Form and Safety

Research described in *Improving the Health of Canadians: Promoting Healthy Weights* illustrates that feeling safe in one's neighbourhood is linked to active transportation among seniors and children, as well as physical activity among adults and youth. For example:

- Seniors
 - A literature review of 27 studies reported that a neighbourhood's lack of attractiveness and appeal, as well as perceptions of low safety due to unattended dogs and inadequate lighting, is related to decreased physical activity among seniors (Cunningham and Michael 2004).
- Adults

- In 1999, 23 per cent of Canadian adults reported that concerns about safety prevented them from walking or biking. Specific concerns were related to too much traffic, street crime, poor lighting on streets and sidewalks and poorly maintained sidewalks and bike lanes (Cameron et al. 2001a).
- In 2002, 65 per cent of Canadian adults aged 15 and older believed there were many safe places to walk in their local communities, including sidewalks, paths and trails. Thirty-seven percent said there were many safe places to bike in their communities, such as bike paths and lanes (Craig and Cameron 2004).
- Youth
 - In an American study of youth aged 11 to 16, improved neighbourhood social conditions (such as relationships with neighbours and perceived safety) contributed to increased levels of physical activity in different neighbourhoods (Molnar et al. 2004).
 - In another American study, the perception of adults at local facilities (such as gyms, parks and community centres) as trustworthy was related to more frequent physical activity among youth (Romero 2005).
- Children
 - Parents report that barriers to their children walking to school include long distances to school (53 per cent) and weather (11 per cent). Reported barriers to children cycling to school include distance to school (30 per cent), concerns about traffic (26 per cent) and weather (12 per cent) (Go for Green 2003).
 - Thirty-seven per cent of Canadian children aged 5 to 13, and 33 per cent of youth aged 14 to 18, walk to school at least half the time (Go for Green 1998). Although 9 out of 10 children own a bike, only 5 per cent cycle to school most of the time. This number increases slightly to 9 per cent for children living within 1 to 3 kilometres of their school (Go for Green 1998).

Population Health and Urban Form: A Review of the Literature (2004) discusses the issue of traffic crashes and reports that the fear of accidents by parents is the main reason for taking children to school by car. It further explains that this hinders the development of children's independence and reduces their opportunities for social contact (WHO Regional Office for Europe 1999). It also has an influence on children's attitudes towards car use and personal mobility in adulthood. Traffic crashes are a concern for pedestrians and cyclists, as they are major causes of mortality and morbidity. Smart Growth BC (2004) indicates that both increasing use of vehicles and the increasing percentage of trips made by automobile, lead to increased crash-related deaths and injuries.

Urban form can play a key role in traffic accidents. Creating communities where people can walk and bike with ease, leads to fewer crashes. The literature (Smart Growth BC 2004) also indicates that this phenomenon tends to be self-reinforcing: the more people that walk and bike in a specific area, the safer it becomes for all road users. High pedestrian volumes increase the safety for everyone.

5.5 Urban Form and Psychological Impacts

Stress and hypertension are frequently discussed as “urban lifestyle issues”. The factors that contribute to such health problems are many and varied, both personal and environmental. However, some of these factors vary with urban form. Ewing et al. (2003) examined how various health issues, including hypertension, varied by county in the United States, classified on the degree of “sprawl”. “After controlling for demographic and behavioural covariates, the county sprawl index had small but significant associations with minutes walked. Residents of sprawling counties were likely to walk less during leisure time, weighed more, and had a greater prevalence of hypertension than residents of compact counties.”

Road rage is another psychological response. Frumkin (2002) notes “stress at home or work may combine with stress while driving to elicit anger. Data from Australia and Europe suggest that both traffic volume and travel distance are risk factors. Long delays on crowded roads are likely to be a contributing factor.”

5.6 Access to Recreational Areas and Facilities

Rosenberger (2005) studied the linkages between health care expenditures for treatments of circulatory problems, physical inactivity, obesity, and the supply of recreation opportunities. His study concluded that “increasing recreational opportunities have the potential to decrease health care expenditures and rates of obesity through increasing rates of physical activity.”

Improving the Health of Canadians: Promoting Healthy Weights notes that access to recreational facilities, including bike paths, open public spaces, trails and programs; neighbourhood appearance; and support from friends, family or facility staff, is related to increases in levels of recreational physical activity (Humpel et al. 2004). Other factors linked to increased physical activity levels among adults in urban areas are the number of destinations within walking distance (e.g., grocery stores, restaurants and schools), the availability of public transit and the number of active people in the neighbourhood (Hoehner et al. 2005).

Researchers have also focused on the link between access to recreational facilities and children’s recreational physical activity. Studies have “shown what common sense would also suggest: children and adolescents with access to recreational facilities and programs, usually near their homes, are more active than those without such access” (Sallis, Prochaska and Taylor 2000). The more often young adolescents use recreational facilities, the greater their total physical activity, with parks and the neighbourhood most important for boys, and with commercial facilities and the neighbourhood most important for girls (Hoefler et al. 2001). Preschool children are more active when there are more places nearby where vigorous play is welcome and when they spend more time in those places. Studies of preschool children, using direct observation, report that being outdoors is the strongest correlate of children’s physical activity (Sallis et al. 2000).

How accessible facilities are depends on how close they are to children’s homes or schools, how costly they are to use, and how easily they can be reached. At least two American studies found fewer parks, sports fields, fitness clubs, and trails in low-income neighbourhoods than in more affluent ones, suggesting that low-income youth may face barriers to physical activity (Sallis and Glanz 2006). Interestingly, low-income neighbourhoods had relatively fewer free than pay-for-

use facilities, suggesting the possible influence of community tax bases and related spending policies (Sallis and Glanz 2006).

Some 90 per cent of a national sample of American adults supported using local government funds for walking and jogging trails, recreation centres and bicycle paths. People may support spending for recreational facilities because they believe public open space improves their quality of life, but building more and better public recreational facilities could also promote youth physical activity (Sallis and Glanz 2006). Also health care savings could conceivably offset the government's costs of building such facilities. Several American cities have recently taken steps to improve their parks: Voters in Los Angeles approved major bond issues in recent years to upgrade urban parks; Denver's public schools approved converting school playgrounds to community parks; and public-private partnerships in metropolitan Atlanta accelerated the pace of building a regional network of mixed-use walking and cycling paths (Sallis and Glanz 2006).

The *2005 Report Card on Physical Activity for Children and Youth* stated that while 97 per cent of Canadian municipalities reported offering community-based programs for children and youth, fewer (54 per cent) reported providing subsidies for low-income families (Active Healthy Kids Canada 2005). Examining data from the 2000 Survey of Canadian Municipalities, the *Report Card* also stated that there was insufficient data to assess the "walkability" or "playability" of Canadian communities, or to evaluate the quality of sports and recreation programs across the country (Active Healthy Kids Canada 2005).

Research is beginning to emerge on the association between physical activity and climate, particularly cold weather. A study of weather classifications in 355 American counties found that the percentage of adults meeting recommendations for physical activity was highest in summer and lowest in winter (Merrill et al. 2005). Another American study reported that combined moderate-intensity household and leisure-time activity was more than 2 times higher in the summer than in the winter (Matthews et al. 2001). Another American study, which looked only at leisure-time physical activity, reported drops in energy expenditure of 21 per cent in the winter and 16 per cent in the fall among adults, compared to the spring and summer seasons (Pivarnik, Reeves and Rafferty 2003). Looking at BMI and waist circumference, a 4-year Dutch study of adults aged 20 to 59 found that both measures were lower in the summer than in the previous winter season (Visscher and Seidell 2004).

Given the extreme cold weather conditions experienced in parts of British Columbia, some researchers suggest that health promotion campaigns may benefit from attempting to identify ways to promote year-long participation and overcome barriers to physical activity (Matthews et al. 2001). This can be done by providing information about the health benefits of physical activity and options that are tailored by season and climate conditions, and by addressing concerns related to convenience, accessibility, safety and aesthetics (Merrill et al. 2005).

5.7 Urban Air and Water Pollution

Population Health and Urban Form: A Review of the Literature notes that in the discussion of links between health and the physical environment in which people live, the presence of air and water pollution must be acknowledged.

Urban activity involves driving vehicles, which results in emissions and air pollution. The impact of these emissions, and other air pollutants, on the population is clearly documented in the research and policy literature (and addressed in the BC core public health program on air quality). There is little research that addresses the question of whether one urban form produces more air pollution than another. However, there is increasing evidence that children living near major thoroughfares are at increased risk. In a Canadian study, *Kids on the Move in Halton and Peel*, O'Brien and Gilbert (2003) note that "children who live near high-traffic areas (20,000 cars passing per day), may be six times more likely to develop childhood leukemia and other cancers."

Communities rely on rural and environmentally sensitive areas for their water support. The addition of urban development in these areas places pressure on these natural systems, often resulting in water quality concerns and degradation, although not always water pollution. Urban forms that minimize these pressures will also maximize water quality (Smart Growth BC 2004).

5.8 Overview – Community and Physical Environment Interventions and Models

In summary, a number of studies have noted that:

- Some neighbourhood characteristics, such as better street lighting and availability of sidewalks, are associated with increased physical activity and walking, respectively (Addy et al. 2004).
- Availability of, and proximity to, recreational facilities, parks, sports fields and playgrounds is related to increased physical activity (Addy et al. 2004).
- People who live in residential areas in Europe that have more greenery and less graffiti and litter are more likely to be physically active, and less likely to be overweight and obese, than people who live in areas with less greenery and more graffiti and litter. These results held even after people's age, sex, socio-economic status and city of residence were taken into account (Ellaway, Macintyre and Bonnefoy 2005).

According to the Canadian Task Force on Preventive Health Care, evidence on the long-term effectiveness of community-based obesity interventions to prevent and treat obesity in adults is inconclusive. In 1999, the Task Force concluded that community-based obesity prevention programs that made use of seminars, educational packages and social marketing had not been proven effective in achieving weight reduction among adults. However, the Task Force pointed out that methodological problems with the evaluations of the programs prevented any definitive conclusions about their effectiveness (Douketis et al. 1999).

Several models are highlighted in *Improving the Health of Canadians: Promoting Healthy Weights*, including:

- **Saskatoon in motion** – Saskatoon in motion is an example of a community-wide physical activity promotion program that, through partnerships with community sectors, community awareness, targeted community strategies and ongoing evaluation, worked to have all Saskatoon residents integrate regular physical activity into their daily lives

(Saskatoon Health Region 2005). Saskatoon and area residents were surveyed in spring 2000 before the program's launch and then again in 2001, 2002 and 2004. Among the 1,627 residents surveyed in 2004, 50 per cent were active enough to receive health benefits. This was up from 2000 (36 per cent) but about the same as in 2002 (49 per cent). The program has been expanded province-wide (Saskatchewan in motion n.d.).

- **ParticipACTION** – This program, which targeted all Canadians, began in response to concerns about the health and fitness of Canadians and rapidly rising health costs (Edwards 2004). Its goal was to increase public awareness of the benefits of active living, to influence key decision-makers to develop environments that encouraged active living (Bauman et al. 2004), and to motivate all Canadians to be more active (Edwards 2004). Evaluating ParticipACTION's success is difficult. For example, the population was not subdivided into intervention and control groups who received and did not receive ParticipACTION's message. Further, although evidence indicates that mass social marketing campaigns can improve physical activity-related message recall in the short-term (Finlay 2005), no known research speaks to ParticipACTION's impact on long-term behaviour change. Surveys assessing community awareness about ParticipACTION indicate that between 1971 and 2002, Canadian adults recognized the branding and reported being more active since the ParticipACTION campaign. ParticipACTION was discontinued in 2001 (Bauman et al. 2004).

6.0 COMMUNITY

Research on the relationship and influence of the community environment to healthy eating and physical activity behaviours indicates that a number of factors are important. This section considers communities and social capital, and access to healthy food stores and restaurants.

6.1 Communities and Social Capital

Research shows a link between “social quantity” and “social frequency” and physical activity (Spanier and Allison 2001). More specifically, it reveals that physical activity levels are higher among Canadians who report having more friends and family members, and among those who are in more frequent contact with their friends and family. Also, people who say that their neighbours are active also tend to walk more, according to studies conducted in the United States (Addy et al. 2004).

Greiner et al. (2004) examined links between social participation, community levels of trust, and health status in areas with high and low population density. They found that community ratings (trust) linked more strongly to health states and behaviours than to community involvement. Also, they found that “low-density” rural residents are more involved in their communities, while residents of “densely settled” rural areas have the least favourable perceptions of their community. These densely populated areas had significantly lower community ratings, as well as poorer health status, depressive symptoms and higher levels of smoking. Conversely, the low-density rural areas tended to have socially active populations, working to solve problems through community activities; however, this did not appear to directly translate to healthier behaviours or improved health status. The authors further note that consideration of social capital should be balanced by unequal power differentials within and between communities. They suggest that strengthening the economic base of communities (as well as reducing power differentials), and strengthening the basis for social participation within communities, are not mutually exclusive or competing agendas.

A study by Cohen et al. (2005) on the influence of community factors on obesity, found that the majority of variation in weight status is observed as an individual-level phenomenon, while neighbourhood-level factors play a small, but possibly significant and far-reaching, role in determining variation in body mass. Although the study design limited conclusions, the results suggested that future interventions to control weight by addressing the social environment at the community level may be promising.

6.2 Access to Healthy Food Stores/Restaurants

A lack of access to and the high cost of fruits, vegetables, and other nutritious foods may keep children from consuming them.

The community nutrition environment may explain some of the racial, ethnic, and socio-economic disparities in nutrition and health, as there is an increasing prevalence of overweight in low-income children. Supermarkets, for example, are less common in lower-income and minority neighbourhoods than in other neighbourhoods. Some healthful foods, such as low-fat dairy products and fruits and vegetables, have been found to be less available and of poorer

quality in minority and lower-income areas.⁵ Related studies have also shown that food in low-income neighbourhoods may actually cost more than food in middle- or high-income neighbourhoods (Chung and Myers 1999).

Cost concerns and time pressures are factors that can lead parents and their children to rely on convenience foods and fast foods. The increasing popularity of dining out over the past two decades has raised the proportion of nutrients consumed away from home; convenience foods and restaurant meals are typically higher in calories and fat and lower in valuable nutrients than meals prepared at home. Some evidence suggests a higher fast-food restaurant density in minority and lower-income neighbourhoods (Sallis and Glanz 2006). For example, a study in Australia found that people living in poorer areas had twice the exposure to these restaurants. However, other studies have not confirmed this pattern and found only modest differences between neighbourhoods (Sallis and Glanz 2006).

Evidence indicates that there is great deal of support for community-level policies that affect healthy local food environments. In a recent survey in California, 50 per cent of respondents rated their neighbourhoods as being only fair, poor, or very poor in offering healthy food for children, with residents of large cities most likely to give negative ratings. 87 per cent of respondents favoured requiring fast-food and chain restaurants to post nutritional information, and 46 per cent favoured limiting the number of fast-food restaurants in a community (Field Research Corporation 2003).

6.3 Overview – Community Interventions

Improving the Health of Canadians: Promoting Healthy Weights notes that in 2002, the United States Task Force on Community Preventive Services (2002) reported strong evidence for a number of community-based strategies to increase physical activity, including the following:

- Large-scale community-wide campaigns.
- Interventions that build and maintain social networks (such as buddy systems) to support behaviour change.
- New or improved access to places for physical activity (e.g., building trails, reducing facility fees).

Other studies suggest that increasing the number of supermarkets (and the variety of fresh produce they sell) in low-income and minority neighbourhoods could lead to healthier eating behaviours.

⁵ It is interesting to note that several cities have shown that it is feasible to increase the presence of supermarkets in these areas through community action (Sallis and Glanz 2006).

7.0 WORKPLACE

Improving the Health of Canadians: Promoting Healthy Weights notes that international research shows a link between working conditions and overweight and obesity:

- A study in the United States found that people who work in jobs involving high levels of physical activity (e.g., waitressing, construction) have a lower likelihood of being obese (King et al. 2001).
- A study in Italy of chemical industry workers reported that obesity was higher among shift workers than those who worked day shifts only (Di Lorenzo et al. 2003).
- A longitudinal study in Finland that followed a group of men and women from age 14 to 31 reported that women who had been unemployed for longer than a year were at greater risk for obesity at age 31 (Laitinen et al. 2002).
- A study in Switzerland reported that women in low-status employment positions (defined as manual or lower occupation) were at greater risk for being overweight (Galobardes, Morabia and Bernstein 2000).

Breucher and Schroer (2000) identified the following factors as being associated with successful workplace health promotion programs:

- Interdisciplinary effort involving many different players in the company.
- Participation and cooperation of all players.
- A comprehensive approach, combining activities that focus on the individual with those that address the design of the working and organizational conditions.

They also indicate that there is strong evidence for the health effectiveness of both behavioural and structural approaches, for the importance of combining them in a comprehensive program of workplace health promotion, and for benefits to improved productivity and the quality of both product and process in the work site (meaning workplace health promotion has positive economic benefits in addition to its health benefits).

In a review of 15 studies of health promotion interventions in the workplace, the reviewers reported that most evaluations lacked control or comparison groups; however, they provided a number of examples where specific interventions were found to be effective, and concluded that:

- A sustained program based on principles of empowerment and/or a community-oriented model using multiple methods—visibly supported by top management and engaging the involvement of all levels of workers in an organization—is likely to produce the best results.
- A focus on a definable and modifiable risk factor, which constitutes a priority for the specific worker groups, can make an intervention more acceptable and increase the participation.
- Interventions should be participatory and tailor-made to the characteristics and needs of the employees. (Effective Public Health Practice Project 2001).

7.1 Workplace Healthy Eating/Physical Activity

Improving the Health of Canadians: Promoting Healthy Weights notes that occupations vary greatly in their level of physical activity. Some jobs, such as those of bank tellers and cashiers, require employees to stand most of the day. Construction may involve high levels of physical labour. Other jobs involve much sitting at a computer. With technological advances, many work environments that once had high levels of physical activity have since become more sedentary. Research indicates that high levels of on-the-job physical activity, such as manual labour, are associated with a lower likelihood of obesity among employees (Wardle and Griffith 2001).

In addition to looking at the link between physical activity and job-design features, physical activity and healthy eating can also be elements of workplace health promotion strategies. However, there are mixed conclusions from systematic reviews regarding the effectiveness of work site physical activity programs designed to improve employee health (Dishman et al. 1998).

- Some reviews note a lack of studies with methodological soundness (Dishman et al. 1998).
- Other reviews report associations between workplace physical activity programs (such as aerobic exercise and strength training) and increased physical activity (Proper et al. 2003b).
- A randomized control trial reported that personal face-to-face counselling at the work site was associated with increased energy expenditure, reduced body fat and blood cholesterol and improved cardio-respiratory fitness (Proper et al. 2003a).
- Other reviews have not found evidence of a significant positive relationship between workplace physical activity programs and overall health, physical fitness or weight (Proper et al. 2003a).
- Still other reviews, such as one conducted by the United States Task Force on Community Preventive Services, concluded that interventions in the work site that combine diet and physical activity initiatives are effective in helping employees control overweight and obesity (CDC, Community Guide Branch 2005).

These differences in conclusions suggest that a better understanding is needed of the contribution of workplace health promotion strategies to the promotion of healthy weights.

Prevention That Works: A Review of the Evidence Regarding Causation and Prevention of Chronic Disease, discusses the importance—and the benefits—of physical activity at work, and of the benefits of physically active commuting to work and to school. Vuori, Oja and Paronen (1994) demonstrated that physically active commuting to work can be successfully promoted by low-cost measures, and concluded that it may offer substantial potential benefit as a health- and fitness-enhancing measure.

Finally, CPHI analyses show a link between physical activity and income levels. For example adults (18 years of age and over) in the highest household income quintile are less likely to be inactive (50 per cent) than those in the lowest (66 per cent), lower-middle (67 per cent), middle (64 per cent) and upper-middle (58 per cent) household income quintile groups. This trend held

for both men and women (Statistics Canada, Canadian Community Health Survey 2.2 – custom tabulation).

7.2 Workplace Policies to Promote Healthy Weights

Improving the Health of Canadians: Promoting Healthy Weights notes that, from a policy perspective, relatively few companies in Canada have formal policies encouraging physical activity and healthy eating (Cameron and Craig 2004). There is therefore limited information available on evaluated workplace programs that promote healthy weights among Canadians. However, there is information on factors that prevent workplaces from initiating or expanding physical activity programs at work sites. These factors include:

- Lack of space.
- Lack of on-site facilities.
- Insufficient company funds.
- Lack of time due to short lunch breaks (Cameron and Craig 2004).

Although not examined in relation to overweight and obesity among employees, there is also information on the number of Canadian workplaces in 2003 that had various strategies to increase physical activity. Surveys were mailed to small, medium and large workplaces representing companies with 20 or more employees and organizations in the non-government sector (n = 1,782). Workplace strategies ranged from having on-site fitness facilities, to offering employee subsidies or discounts for fitness centres, to hosting recreational activities (Cameron and Craig 2004).

7.3 Overview - Workplace Interventions and Models

Healthy living intervention models for the workplace include:

- **BC Ministry of Health “Stairway to Health”** – The BC Ministry of Health is currently conducting a pilot project for the “Stairway to Health” program developed by the Public Health Agency of Canada. The purpose is to implement and evaluate the impact of stairway-based interventions. It involves beautification of the physical environment of the stairway, “point-of-choice” posters, a stair-climbing challenge, an artwork challenge and communications interventions (newsletter features, etc.). Evidence demonstrates that similar projects have been effective in increasing the use of stairs. For example, a regional airport increased stair use from 8.2 per cent to 14.9 per cent with health promotion signs (Russell and Hutchinson 2000), and a university office building increased stair use from 11.1 per cent to 15.5 per cent with music/art (Boutelle et al. 2001).
- **Husky Injection Molding Systems** – Some workplaces, such as the Canadian-based Husky Injection Molding Systems, provide healthy cafeteria food, incentives for staff that meet fitness level criteria, and rewards for employees who walk, bike, carpool or use public transit to get to work. Although not formally evaluated for its impact on health status and physical activity, Husky estimates a savings of \$8 million in reduced absenteeism (2.25 days per employee in 1999, compared to the Canadian average of 5.7 days), low injury rates (0.77 injuries per 200,000 hours worked in 1998), reductions in employee drug costs (\$153 per employee annually in 1997 compared to the \$495 sectoral

average), higher productivity and better use of resources (Human Resources and Social Development Canada 2001).

- **Walk In to Work Out Program** – “Walk In to Work Out” in Scotland was a self-help intervention in which participants received information on transit routes, personal safety, maps, location of showers and safe bicycle storage information, as well as an activity diary, safety accessories and the contact information for relevant organizations and shops (Mutrie et al. 2002). Intervention materials were sent to 295 employees, who had been identified as thinking about or doing some walking or cycling to work, from 3 medium to large Glasgow workplaces. The majority of employees were women of higher-income households. At 6 months, participants who had received the program materials were almost 2 times more likely to walk to work than participants in the control group. Increases in cycling to work were not observed. Of those who received the intervention at baseline, 25 per cent continued to engage in regular active commuting to work 12 months later. The study did not measure weight change.

Additional examples of evaluated workplace health initiatives (*Improving the Health of Canadians: Promoting Healthy Weights*) can be found in Appendix A.

8.0 SCHOOL

Improving the Health of Canadians: Promoting Healthy Weights discusses school-based interventions for healthy living. Children and youth spend a great deal of their time at school. Schools play a role in children's academic and social development. They also play a role in children's physical development by providing them with physical and health education classes, food choices and services, and access to resources such as gyms, sports equipment and outdoor playing fields (Carrel et al. 2005).

Given these factors, the school setting is an environment in which there are many opportunities to promote healthy weights (Raine 2004). School-based initiatives may focus on one aspect of healthy weights promotion, such as healthy eating or physical activity, or they may focus on specific targeted behaviours such as reducing screen time (e.g., television watching and computer use) among children (see Section 10.0). Other initiatives may focus on both healthy eating and physical activity through a coordinated approach that includes various strategies targeting healthy eating, physical activity, education and the community.

Recent statistics which reflect the need to address healthy eating and physical activity among children include:

- In 2004, almost 60 per cent of Canadian children and youth aged 2 to 17 consumed fruit and vegetables less than 5 times per day. Children and youth who ate fruit and vegetables less than 3 times per day, or 3 or 4 times per day, were significantly more likely to be obese (10 per cent and 9 per cent, respectively) compared to children and youth who ate fruit and vegetables 5 or more times per day (6 per cent) (Shields 2005).
- Measured data from the 2004 CCHS show that rates of overweight and obesity among children and youth aged 2 to 17 have risen by about 70 per cent compared to 25 years ago (Shields 2005).
- In 2003, 76 per cent of boys and 71 per cent of girls aged 12 to 14 were moderately active or active in leisure time physical activity; for youth aged 15 to 19, rates decreased slightly for boys to 74 per cent and decreased significantly for girls to 61 per cent (Statistics Canada 2003b).
- Self-reported data from the National Longitudinal Survey of Children and Youth (Cycle 5) demonstrate an overall increase in rates of overweight/obesity among children and youth aged 8 to 11 between 1986 and 2002. Rates for males increased from 13 per cent to 34 per cent and from 14 per cent to 31 per cent for females.

8.1 Healthy Eating in the School Environment

The school environment can present students with many, sometimes conflicting, messages about food choices and eating patterns. To date, there is little direct evidence regarding the impact of the school food environment on body weight in Canada. Current American research indicates that school foods tend to be non-nutritive and energy-dense, and are sold in vending machines, cafeterias, school stores, snack bars and at fundraising events. Complicating the matter is the fact that many schools rely on revenue garnered through the sales of these products to support sport and extracurricular activities (CIHI 2006).

Although not all school-based programs are successful at promoting healthy weights, a recent synthesis of the literature concluded that school environments that provide healthy food options and limit the availability of non-nutritious foods may promote healthy weights (Raine 2004). Below are examples of programs (*Improving the Health of Canadians*) that introduced healthy food options and obtained positive results.

- One American study looked at the link between students' dietary practices and the availability of vending machines, à la carte programs and fried potatoes being served at school lunches. The study looked at Grade 7 students (n = 598) at 16 schools in the St. Paul/Minneapolis metropolitan area. Results showed that à la carte availability was negatively related to fruit and vegetable consumption and positively related to fat intake. The availability of vending machines on-site was also inversely associated with fruit consumption. The study found a positive relationship between fruit and vegetable consumption and fried potatoes being served to students during school lunches (Kubik et al. 2003).
- Another American study looked at longitudinal changes in fruit, vegetable, milk and sweetened beverage intake in two cohorts of students (n = 594) during the 1998/1999 and 1999/2000 academic years. The first cohort was in Grade 4 in 1998/1999 and ate only National School Lunch Program (NSLP) meals that provided two servings of fruit and vegetables and eight ounces of milk daily. In 1999/2000 these same students, now attending a fifth and sixth grade middle school, had access to both NSLP meals and a snack bar. The second cohort of students remained in the middle school environment over the two-year period, thereby acting as a control. Students in the first cohort, who had access to snack bars in year two, had a significant decrease in fruit, non-fried vegetable and milk consumption, as well as an increase in high-fat vegetable and sweetened beverage consumption as they transitioned from Grade 4 to 5. There was also a significant decrease in the consumption of NSLP meals among these students in the second year of the study (Cullen and Zakeri 2004).
- In another study, also carried out in the St. Paul/Minneapolis metropolitan area, lower-fat à la carte food options were made available to high school students. Twenty high schools were randomly assigned to either an intervention or a control group for a period of two school years. Students in the intervention group had increased access to lower-fat foods in their school cafeterias and were also exposed to peer-developed advertisements promoting healthier food options. The intervention was assessed by both sales figures (percentage of healthier food items sold) and students' self-reported food choices. The percentage of sales of lower-fat foods was significantly higher in the intervention schools over the two-year period (French et al. 2004).
- A randomized control study (James et al. 2004) in Britain used an educational program to discourage carbonated drink consumption among children aged 7 to 11. Although carbonated drink consumption did not change among children in the control group, it decreased among children who received the intervention. Further, at 12-months follow-up, the average percentage of overweight and obese children decreased in the intervention group by 0.2 per cent compared to an increase among children in the control group of 7.5 per cent. As with many intervention studies, including the others presented in this section, this study did not analyze the direct relationship between soft drink consumption and changes in obesity prevalence. Nonetheless, it indicates that reducing

carbonated drink consumption may be linked to reductions in overweight and obesity among children.

In response to concerns over a perceived unhealthy school environment, some jurisdictions are choosing to modify the content of, or removing, vending machines from schools. For example, British Columbia has introduced guidelines for food and beverage sales in schools to eliminate “junk food”. Activities in other jurisdictions include: in September 2005, the United Kingdom announced a ban on junk food high in fat, salt or sugar in all schools across England within a year (Kelly 2005). In Canada, a number of provinces have introduced nutrition legislation. For example, New Brunswick has adopted a comprehensive policy on food and nutrition to provide students in public schools with healthy food and beverage choices (Communications New Brunswick 2005). Although many jurisdictions are monitoring the impact of such legislation on eating choices and sales data (Messier, Cloutier and Rowe 2004), the impact of these actions on obesity among children and youth is unclear.

8.2 Physical Activity in Schools

The *2005 Canadian Report Card on Physical Activity for Children and Youth* reports that less than half of Canadian children and youth are active enough on a daily basis to meet Health Canada guidelines for healthy growth and development, as measured by the CCHS (Active Healthy Kids Canada 2005). Most Canadian children are neither moderately active (e.g., walking) or vigorously active (e.g., running) for 30 to 60 minutes per day (Active Healthy Kids Canada 2005). *Canada’s Physical Activity Guide for Youth* recommends that, over a 5-month period, youth strive toward increasing the time currently spent each day on physical activity (in increments of at least 5 to 10 minutes) to achieve a total daily increase in physical activity of 90 minutes (60 minutes of moderate activity and 30 of vigorous activity) by the end of the fifth month.

In many Canadian schools, physical education has been an optional part of the school curricula. In BC schools, 150 minutes of physical activity has been mandated for grades up to Grade 9/10. In 2001, 54 per cent of Canadian schools had policies in place to provide students with daily physical education classes; however, only 16 per cent were actually doing so (Cameron et al. 2001b). In response to concern about the prevalence of childhood obesity, some provinces have implemented policies to ensure students receive a minimum level of physical activity. For example, in 2005, the Ontario government announced a policy requiring schools to provide a minimum of 20 minutes of daily continuous physical activity in Grades 1 to 8. Although evaluations of the impact of these policies on children’s obesity rates have not yet been conducted, there have been reports that some jurisdictions (e.g., Alberta) are noting challenges in finding the time and resources to implement the required changes, especially in the junior high setting.⁶ Other experts note the importance of integrating not only physical education not only as a specific component of the curriculum, but also throughout the school day.

Prevention That Works notes “the school is a setting where physical activity is of concern. A review (City of Hamilton n.d.) of 19 evaluation studies of the effectiveness of school-based interventions in promoting physical activity and fitness among children and youth aged 6 to 18

⁶ As shown in an article by D. Howell in the October 15, 2005, edition of the *Edmonton Journal*.

found that such programs are moderately effective in promoting physical activity and increasing the duration of physical activity in children and adolescent girls”, and that adults who participated in such programs in childhood were more active as adults. However, such programs were not effective in altering blood pressure, BMI or most other physiological functions, and these are likely inappropriate measures of effectiveness. The reviewers concluded, based on the evidence, that:

- Since school-based physical activity interventions do not cause harm and do have some positive effects on activity rates and their duration, and on television viewing among children and adolescents, such activities should continue, and should be encouraged by local public health unit staff to local schools and school boards.
- At a minimum, school-based interventions should include printed educational materials distributed to children, adolescents, and parents, as well as changes to other school curricula (including recess, lunch, and activity events) to promote an environment more conducive to increased daily activity.
- School-based physical activity interventions should focus on fostering positive attitudes toward physical activity and be geared toward the developmental level of the participants.
- Teachers and school staff should be encouraged to act as role models by demonstrating more physical activity during the course of the school day.
- Public health staff should work in collaboration with teachers, schools, and school boards to lobby local and provincial policy-makers to increase resources for the promotion of physical activity within the school system.

Finally, *Prevention That Works* notes that Tudor-Locke, Ainsworth and Popkin (2001) suggest that active commuting should apply to children going to school as well as adults going to work. While they note that this “potential source of continuous moderate activity” has been largely ignored, and thus has little supportive evidence, and while parental concerns with respect to personal and pedestrian safety for their children must be taken into account, they suggest there is good reason to believe that active commuting to school would be beneficial, and numerous examples exist of the implementation of such activities.

8.3 Coordinated School Health Programs

Improving the Health of Canadians notes that coordinated school health programs, as recommended by the United States Centers for Disease Control and Prevention (CDC), are comprised of eight interactive components: health education, physical education, health services, nutrition services, counselling and psychological services, healthy school environment, health promotion for staff and family/community involvement. Programs of this nature are designed to engage communities, families, schools and other stakeholders such as health workers, the media, young people, religious organizations and community organizations in supporting healthy eating and physical activity among children and youth (CDC 2005b).

With respect to overweight and obesity, coordinated school health programs are based on the idea that both the school environment and the curriculum play roles in influencing students eating and activity behaviours (CDC 1996). Although long-term outcome results are not yet available, the Annapolis Valley Health Promoting School Project (AVHPSP) is an example of a

coordinated school health program that, consistent with the CDC's recommendations, used many strategies to try to make it easier for students to make healthy choices about food and physical activity including:

- Soliciting input from schools to guide the project's direction.
- Building on the successes of health-promoting activities that were already in schools.
- Introducing new student-developed games at lunch hour and recess.
- Opening school gyms after school for students.
- Developing strategies to sustain low-cost and nutritious recess/lunch programs.
- Providing healthy food options in school lunch and recess programs.
- Using multiple strategies such as education, awareness, leadership development and multi-sectoral partnerships to sustain the program (Annapolis Valley Health Promoting Schools Project 2004).

8.4 Overview – Interventions and Models for Healthy Living

Prevention That Works notes that in a review of seven strong and five moderate quality reviews of school-based strategies for the primary prevention of obesity and for promoting physical activity and/or nutrition, the reviewers concluded that:

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

Examples of successful interventions (*Improving the Health of Canadians: Promoting Healthy Weights*) include the following:

- **Annapolis Valley (NS) Health Promoting School Project**
 - Goals and approach: Participants were children who had taken part in the 2003 Children's Lifestyle and School Performance Study (CLASS)⁷, their parents and school principals. Students attended schools that (a) did not have a nutrition program; (b) had nutrition policies and practices in place; or (c) were participating in the Annapolis Valley Health Promoting School Project (AVHPSP). Each child's height and weight was measured and dietary intake assessed using a version of Harvard's Youth Adolescent Food Frequency Questionnaire (YAQ). Children completed an additional survey designed to measure physical and sedentary activities.

⁷ The CLASS study was a large study of fifth-grade students from 282 public schools in Nova Scotia.

- Results: Rates of overweight and obesity among students from schools participating in the AVHPSP-coordinated program were significantly lower than rates in students attending schools that had nutrition policies only and schools that had no programs at all.
- At the preschool level: Hip-Hop to Health Jr. is a 14-week school-based physical activity program in Chicago, Illinois, that aims to reduce increases in weight among preschool children in the Head Start Program. It includes 20 minutes of teaching about healthy eating and active living and 20 minutes of physical activity. Results show significantly smaller increases in BMI at 1- and 2-year follow-up among children in the program, relative to those who did not take part in the program (Fitzgibbon et al. 2005).
- At the Kindergarten level: The United States Department of Education *Early Childhood Longitudinal Study - Kindergarten Class* (ECLS-K) reported that a one-hour increase in physical education instruction per week was related to a decrease in BMI among overweight and at-risk-for-overweight girls in Grade 1. No significant effect was found among boys. Based on these data, American researchers estimate that the prevalence of overweight among girls could be decreased by 43 per cent by increasing physical education instruction to five hours per week (Datar and Sturm 2004).
- At the elementary school level: A randomized controlled study in the United States reported positive effects for specialized school physical education curricula on health outcomes among children (11 to 13 years old) with BMIs over the 95th percentile. Results showed significant improvements in the cardiovascular fitness levels of children in the lifestyle-focused, fitness-oriented gym classes over the course of one school year. Children in the intervention also showed greater losses of body fat and significant improvements in fasting insulin levels compared to children in standard gym classes only (Carrel et al. 2005).

Other examples of school-based health initiatives, from *Improving the Health of Canadians: Promoting Healthy Weights*, can be found in Appendix B.

9.0 CHILD CARE PROGRAMS

Many children spend a large part of the day in child care settings, whether in preschools or day care settings. Child care providers in group and home day cares have an opportunity to establish and reinforce habits that promote good health. Early childhood is a critical time for the development of motor skills and for establishing food preferences and eating patterns.

Providing children with experiential learning in a fun environment has been recognized as a developmentally appropriate strategy for educating preschool children (Commission on Behavioral and Social Sciences and Education 2000). As well, training of child care providers has been shown to be an effective method for improving the quality of care children receive and increasing their exposure to educational opportunities (DeBord and Sawyers 1996; Kontos, Howes and Galinsky 1996). Hands-on experiential methods during training are an effective way of ensuring that methods taught during training are implemented (Fantuzzo et al. 1996).

The *Environmental Scan – Resources for Healthy Eating in Child Day Care and Early Learning Settings* (Dufresne and Tremblay 2006) notes that:

- Nutrition education for children is a component of child care programs.
- Play activities support the development of positive eating practices.
- Parents need to be involved in nutrition education.
- Child care providers require appropriate training in nutrition and food service.

The *Environmental Scan* further notes “parental involvement is probably the most important component in the success of a nutrition education program for preschoolers. Early parental influence is associated with the development of a child’s relationship with food later in life. There are at least five areas that parents can influence: availability and accessibility of foods, meal structure, adult food modeling, food socialization practices, and food-related parenting style” (American Dietetic Association 2004).

The *Environmental Scan* (Dufresne and Tremblay 2006) provides a wide range of best practices for healthy eating in child care and early learning settings. Provincial, national and international sources for programs and resources are identified in the following categories:

- Food provided.
- Food and mealtime safety.
- Eating environment
- Meal and snack time routines.
- Nutrition learning experiences and education.

A program called “Color Me Healthy” was developed and evaluated by Dunn et al. (2006). It was designed and implemented as a nutrition and physical activity curriculum for children aged 4 and 5 years. It was piloted in child care settings in 47 counties in North Carolina and included: a teacher’s guide, picture cards, classroom posters, music, hand stamp, and parent component. Implementation focused on training (“train-the-trainer”) healthy care professionals in the Division of Public Health to teach child care providers in their community about the program.

Core Public Health Functions for BC: Evidence Review
Healthy Living – Physical Activity & Healthy Eating

The evaluation found that child care providers need educational materials and should be trained to use them. The “train-the-trainer” model was shown to be an effective way to teach public health professionals to train child care providers on the use of curriculum materials about healthy eating and physical activity. Of the child care providers who completed the evaluations: 92 per cent indicated that using the curriculum increased the physical activity of their students; 91.8 per cent indicated that it had increased the children’s knowledge about movement; and 93 per cent indicated that it had increased the children’s knowledge about healthy eating.

10.0 HOME AND FAMILY ENVIRONMENT

A number of aspects related to healthy eating and physical activity can be discussed within the context of the home and family environment. Among these issues are the eating behaviours and physical activity patterns that parents help establish in their children, oftentimes through their own modeling of these behaviours. Other issues specific to the family environment include children's exposure to screen time (e.g., television viewing and computer use) and television advertising.

Improving the Health of Canadians: Promoting Healthy Weights suggests that parents' eating habits and physical activity patterns play a key role in children's behaviour. For example:

- Data indicates that parental obesity is strongly associated with youth obesity (Carriere 2003).
- Adolescents with a parent who was inactive in his or her leisure time were also themselves more likely to be inactive (Carriere 2003).
- Consistent with this, Canada's *2005 Report Card on Physical Activity for Children and Youth* stated that only 43 per cent of parents were regularly active with their children in 2000 (Active Healthy Kids Canada 2005).

Other considerations that impact healthy living in the home and family environment include the following:

- Breastfeeding can be a protective factor against later childhood obesity (WHO 2003).
- Infants identified as obese, or who grew rapidly in infancy, were more likely than other infants to be obese as children, adolescents and young adults (Baird et al. 2005).
- Income level can affect family living conditions, including access to sufficient healthy food (Dietitians of Canada 2002).
- An overview of Statistics Canada data on weight shows a link between education level and obesity among men and women.
 - In 2004, women aged 25 to 64 with less than high school education were more likely to be obese than women with post-secondary education (Tjepkema 2005).
 - In 2004, men aged 25 to 64 with no more than high school education had higher rates of obesity compared to men of the same age who had completed post-secondary education (Tjepkema 2005).
 - Adults with post-secondary education tend to report eating fruit and vegetables more frequently than those with less than high school graduation (Perez 2002).
- The link between body mass index (BMI) and fruit and vegetable consumption differs among the sexes.
 - Men of normal weight eat fruit and vegetables more frequently, compared to men who are obese (Perez 2002).
 - Women who are underweight, normal weight or overweight consume fruit and vegetables more frequently, compared to women who are obese (Perez 2002).
 - Only 31 per cent of adults in British Columbia reported consuming fruit and vegetables at least 5 or more times per day (36 per cent of women and 26 per cent

- of men) (Statistics Canada, Canadian Community Health Survey 2.2, custom tabulation).
- In 2003, 41 per cent of boys and 46 per cent of girls aged 12 to 14 years; and 38 per cent of boys and 45 per cent of girls aged 15 to 19 consumed fruit and vegetables 5 or more times per day (Statistics Canada, Canadian Community Health Survey 2.2, custom tabulation).

A study (Sturm 2005a) on the free time of children has shown substantial reductions in free time in recent years, including: increased time away from home, primarily in school, child care centres, and after-school programs; increased participation in organized activities (including sports); decreased unstructured playtime; decreased sedentary activities like watching television and taking part in other passive leisure activities; and increased homework. Some notable age differences in time use across age groups suggest different levers for interventions by age group:

- For children aged 3 to 5 years and children aged 6 to 8, the largest decline in time use is playtime.
- For children aged 9 to 12 years, the largest decline is in television watching.
- While playtime declined overall, it actually increased among children aged 9 to 12. This increase may reflect more use of videogames and computer games among this age group. While the largest decline for children aged 9 to 12 was in television watching, household conversations and other passive leisure also declined more in this group than in other age groups (Sturm 2005a).

10.1 Breastfeeding

Control over children's food intake can come in many forms, one of which is exclusive breastfeeding versus mixed breastfeeding (breastfeeding plus other liquids or solid foods). The World Health Organization (WHO) recommends breastfeeding exclusively for a period of at least six months (Kramer and Kakum 2002).

Improving the Health of Canadians: Promoting Healthy Weights discusses a number of systematic reviews indicating that breastfeeding can be a protective factor against later childhood obesity (WHO 2003). In 2003, 85 per cent of Canadian women aged 15 to 55 reported initiating breastfeeding; 19 per cent did so for at least 6 months exclusively (Statistics Canada 2003a). In terms of supporting breastfeeding, the Canadian Task Force on Preventive Health Care indicates that structured breastfeeding education in the first 2 months postpartum, as well as telephone or in-person postpartum support, are effective at improving both initiation and continuation of breastfeeding (Palda et al. 2004). The Task Force found no evidence supporting the effectiveness of written materials alone or commercial discharge packages (Palda et al. 2004).⁸

As children get older, the link between children's BMI and parental control over children's eating habits is less clear. Some research suggests there is a higher likelihood of weight problems among children whose eating is highly controlled by parents (Birch and Fisher 2000). In these cases, researchers believe that too much parental control may interfere with children's ability to

⁸ Information on breastfeeding will be covered in greater detail in the evidence review for early childhood development core program.

self-regulate their energy intake. In contrast, a study of Grade 3 children with diverse ethnic and socio-economic backgrounds reported that findings were different for girls than for boys. Parents who reported greater control over their children's food intake had daughters who were less likely to be overweight; results were not statistically significant for boys (Robinson et al. 2001).

10.2 Family Modeling

In recent years, there has been concern that family meals are declining, although data on the exact number of times that a family eats dinner together is elusive. It appears that most families eat dinner together 4 or 5 evenings a week, with about 10 per cent of families eating together 2 or fewer days a week. Families with younger children seem to eat together more often than families with older children. Families with teenagers eat together less often because the teens have more evening activities than younger children (Marino and Butkus n.d.).

The concerns around family meals reflect the importance of family modeling; extensive research shows a linkage between family meals and better school performance, better adjustment, and better nutrition. Family meals appear to give children an edge in the classroom. In a 1994 survey of 2,000 high school seniors, students who regularly ate dinner with their families 4 or more times a week scored better than those who ate family dinners less often (Marino and Butkus n.d.). These results crossed racial lines and were a greater indicator than whether the child was in a 1- or 1- parent family.

Bowden and Zeisz (1997) looked at which activities most fostered healthy child development, including play, storytime, events with family members, etc. Family dinners were a key factor. Teens who were well adjusted ate a meal with an adult in their family an average of 5.4 days a week, compared to 3.3 days for teens who did not show good adjustment. The well-adjusted teens were less likely to use drugs or to be depressed, were more motivated at school and had better relationships. Adjustment was correlated more to shared meals than to any other factor, including gender, age or family type.

Others studies reveal that students who ate dinners with their families consumed more vegetables, more fruit and juice, and less soda. When children ate with their families, they used more low-fat practices (Marino and Butkus n.d.).

Another key area that influences children's eating behaviours is the preparation of school lunches. A 2005 study reported that children in Nova Scotia who purchased lunch at school were 39 per cent more likely to be overweight than children who brought their lunch from home (Veugelers and Fitzgerald 2005). In addition, children who ate supper at home with their families at least three or more times per week were less likely to be overweight. Although this research adjusted for such risk factors as dietary habits, activities, socio-demographic factors and school-based factors, it was not able to examine the types and quality of food in purchased or packed lunches. Nonetheless, it speaks to a potentially interesting aspect of to the home and family environment in promoting healthy weights.

10.3 Food Prepared Away from Home

One of the most notable changes in the food habits of Americans has been the shift away from home-prepared food (Bowers 2000). Increasingly, even meals consumed at home may be purchased from a restaurant or fast-food establishment to take home, or be delivered. In 1999, the portion of the food dollar spent on food prepared away from home reached 47.5 per cent, the highest point to date (Clauson 2000). This shift away from home food preparation has been fueled by numerous social changes. Increasingly, women (including women with children) work outside the home. An increasingly sophisticated food industry has also played a role as affordable and convenient fast-food, take-out, and home-delivery options has proliferated.

Data gathered by the United States Department of Agriculture (Guthrie, Biing-Hwan and Frazao 2002) revealed that:

- Between 1977/1978 and 1994/1996, the percentage of food prepared away from home, rose from 18 per cent to 32 per cent of calories for all individuals over 2 years of age. The increase was seen in all age groups but was highest in younger adults.
- In 1994-96, males 18 to 39 years of age ate 39 per cent of calories away from home, compared to 23 per cent in 1977/1978. Females 18 to 39 averaged 37 per cent of calories away from home, compared with 21 per cent in 1977/1978.
- In 1977/1978, adults obtained roughly the same proportion of their calories at fast-food establishments, restaurants, and other places, such as cafeterias. By 1994/1996, the largest proportion of their “away” calories came from fast-food establishments (12 per cent of total calories), followed by restaurants (10 per cent).
- Among children, school/day care was by far the most important source of “away” food in 1977/1978. In 1994/1996, however, fast-food establishment rivaled school/day care in importance—the proportion of total calories obtained from all non-home sources increased from 9 per cent to 22 per cent (10 per cent of calories were from fast-food establishments).
- Meals and snacks based on food prepared away from home contained more calories per eating occasion, and “away” food was higher in total fat on a per-calorie basis than at-home food. “Away” food contained less dietary fibre, calcium and iron on a per-calorie basis. Among adults (but not children), food prepared away from home was more sodium- and cholesterol-dense.

10.4 Sweetened Drink Consumption by Children

A study (Mrdjenovic and Levitsky 2003) of excessive sweetened drink consumption (more than 12 oz/per day) by 6- to 13-year-old children revealed that these drinks were strongly associated with a decrease in milk consumption (sweetened drinks included carbonated and non-carbonated fruit-flavoured drinks). Caregivers tended to serve less milk when they served sweetened drinks, and children often chose sweetened drinks when both milk and sweetened drinks were offered simultaneously. However, when milk was served, it was not consumed at only 4 per cent of meals. Milk was consumed at 42 per cent of all meals when milk was served simultaneously with sweetened drinks, albeit in smaller amounts than when no sweetened drinks were served.

The study measured the nutritional consequences of excessive sweetened drink consumption: lower daily protein, calcium, magnesium, phosphorus, and vitamin A intakes. Also, because children failed to reduce consumption of solid foods to compensate for the caloric contribution of sweetened drinks, higher daily energy intakes were observed. Consequently, the greater the sweetened drink consumption, the greater the weight gain compared with children who consumed less than 12 oz/per day.

The reports of the effects of excessive fruit juice consumption in younger children, 2 to 5 years old, are controversial. Some authors reported short stature and obesity, some failure-to-thrive, while others did not find any association between high consumption of fruit juice and children's growth (Mrdjenovic and Levitsky 2003).

10.5 Screen Time

“Screen time” refers to time spent watching television, playing video games and using the computer. Researchers suggest that increased screen time can have an impact on weight by:

- Displacing physical activity.
- Promoting an increased intake of calories as a result of food advertising or eating while watching television (Vanderwater 2003).

Based on data analyses from the National Longitudinal Survey of Children and Youth (NLSCY), CCHS and the Health Behaviour in School-Aged Children Survey (HBSC), Canada's 2005 *Report Card on Physical Activity for Children and Youth* (Active Healthy Kids Canada 2005) stated the following:

- Half of Canada's children and youth watch up to two to four hours of television each day.
- The time spent using computers by Canadian children and youth is among the highest in the world.
- Although girls report less daily physical activity than boys, they also report less television and computer use than boys.
- Higher television time was noted among children of lower-income families.
- In international comparisons, Canadian girls and boys aged 11 to 15 rank in the top quartile for weekend computer use.

Recent studies (*Improving the Health of Canadians: Promoting Healthy Weights*) using both self-reported and measured Canadian data show a link between screen time and overweight and obesity. Analyses of self-reported data from the NLSCY showed that video game use and television watching were risk factors for overweight and obesity, while physical activity was protective against becoming overweight or obese (Tremblay and Willms 2003). Measured data of height and weight for Canadian children and youth indicate that in 2004, children aged 6 to 11 who engaged in more than 2 hours of screen time per day were twice as likely to be overweight or obese compared to those who logged 1 hour or less per day (35 per cent versus 18 per cent) (Shields 2005).

These recent studies are a contrast to earlier studies which had shown mixed evidence on the relationship between screen time and body weight. For example:

- Some researchers report no link between television use and weight status (Vanderwater 2003) or a very weak link (Marshall et al. 2004).
- Some report strong links between weight status and both television viewing and video game use (Robinson 1999).
- Others report strong links between weight status and television viewing only (Gortmaker et al. 1996).

A randomized control study (Robinson 1999) conducted in 1996/1997 showed significant decreases in BMI, tricep skinfold thickness, waist circumference and waist-to-hip ratio among Grade 3 and 4 children who had received a school-based curriculum to decrease television, videotape and video game use at home. This same research reported significant decreases in television viewing and the frequency of eating meals in front of the television, among children who participated in the curriculum. This research points to the school and home as potentially interrelated environments, which could effectively target one factor (screen time) affecting healthy weights among children.

Prevention That Works notes that the CDC reports “few studies have explored strategies for reducing children’s TV viewing, and more testing and development of such strategies is needed before firm recommendations can be made” (CDC 2003) However, the CDC does note that school-based programs have shown promise. In a review of interventions for weight loss and weight gain prevention among youth, Fulton et al. (2001) note that one study that specifically worked to reduce time spent viewing television showed significant mean decreases in BMI in both boys and girls. While the authors are uncertain whether this is due to reduced food intake or increased physical activity, Dietz and Gortmaker (2001) comment that “television viewing affects both energy intake and energy expenditure, and therefore represents a logical target for interventions”

10.6 Childhood/Adolescent Disadvantage

A systematic review of qualitative evidence on childhood disadvantage and health inequalities was conducted to provide policy-makers and researchers with information on the coping strategies that children use in adversity, which allow them to adjust to social “risk”, and experience fewer negative outcomes (Attree 2003). Identifying factors that help children overcome a disadvantaged start in life is crucial to understanding what interventions might make a difference. The results of the review indicated:

- The main sources of support described by disadvantaged children and young people were their families, friendships, and social networks in neighbourhoods. However, these may also be conflictual and a source of psychosocial stress.
- The majority of children turn to their immediate families, especially their mothers, if they need help. Family relationships, particularly the emotional aspects of parents’ caregiving, contribute to children’s feelings of personal security, and help to protect children’s psychosocial health and well-being.

- Friends are as significant to the majority of young people as their families.
- Living with disadvantage for some young people may mean becoming accustomed to economic and social restrictions, thus reducing immediate expectations, and limiting aspirations for the future.
- Children may cope with disadvantaged circumstances in several ways, including: social comparisons with others seen as worse off, reduction of stigma through shared experiences of hardship, and displays of indifference.

Drukker et al. (2006) found that neighbourhood environment per se does not contribute to change in quality of life during the transition to early adolescence. However, adolescents living in families whose socio-economic status deviates from the mean level of socio-economic deprivation in the neighbourhood may be negatively affected.

10.7 Mental Health and Healthy Living

Improving the Health of Canadians: Promoting Healthy Weights notes that a number of studies have shown that obesity (BMI >30) and severe obesity (BMI >40) are associated with depressive symptoms and major depressive disorders. A Canadian study reported a greater risk of depression among obese adults than non-obese adults (Johnston et al. 2004). Two American studies noted this association particularly among women. In one study, obese women had a 37 per cent higher probability of being diagnosed as depressed, while obese men had a 37 per cent lower probability of being diagnosed as depressed; interestingly, men who were underweight were at increased risk for being diagnosed as depressed (Carpenter et al. 2000). Another study reported an association between obesity and “past-month depression” in women; the association was also significant among men who were severely obese (Onyike et al. 2003). The direction of the relationship between obesity and depression is unclear. Are obese individuals more likely to be depressed or are those who are depressed more likely to be obese?

The connection between mental health and unhealthy weights is not restricted solely to obesity. As noted above, it can also be an issue for those who are underweight. In their *Report on Mental Illnesses in Canada*, Health Canada (2002) addresses this subject by looking at a number of issues surrounding eating disorders (anorexia, bulimia and binge eating disorders). Highlights from this report show that:

- Throughout the course of their lives, roughly 3 per cent of women will be affected by an eating disorder.
- These disorders have an effect on girls and women more than boys and men.
- Society’s endorsement of thin body images, as well as both biological and individual factors, can be risk factors for the onset of eating disorders.
- Hospitalizations for eating disorders in general hospitals rose by 34 per cent among girls under 15 from 1987 to 1999; these rates also increased by 29 per cent among 15- to 24-year-olds over the same period.

The Canadian Institute for Health Information’s Canadian Population Health Initiative (CPHI) notes in *Improving the Health of Young Canadians* (2005) that social ties with family (parental nurturance and monitoring), friends (connectedness to peers), school (engagement at school) and

the community (volunteerism) were related to youths' (aged 12 to 17) self-rated health, self-worth and use of tobacco, alcohol and marijuana. CPHI examined how these ties were linked to physical activity and positive physical image (liking the way they look):

- Youth reporting high levels of peer connectedness also tended to report higher levels of participation in unorganized sports (at least four times per week).
- Youth who reported higher levels of parental nurturance and monitoring, school engagement and peer connectedness were more likely to report a positive physical image than youth reporting medium or low levels.
- Among females, 48 per cent of normal weight, 37 per cent of overweight females and 38 per cent of obese females reported a positive physical image.
- Males of normal weight (66 per cent) were more likely to report a positive physical image compared to overweight (54 per cent) and obese males (49 per cent). Comparisons between males and females or between BMI levels were not conducted.

10.8 Eating Patterns Among Seniors Living in the Community

An article by Payette and Shatenstien (2005) discusses the determinants of eating in seniors living in the community. It notes that “aging is generally believed to alter nutrient requirements for energy, protein and other nutrients because of changes in lean body mass, physical activity and intestinal absorption. Energy needs decline with age because of decreased basal metabolism, reduction in lean body mass or sarcopenia and a more sedentary lifestyle. Total energy intake generally decreases with age and results in concomitant declines in most nutrients.”

Further, among elderly persons, food-related activities are greatly affected by health status and functional abilities. For instance, the ability to procure and prepare nutritious food and eat independently, the availability of dietary assistance when needed, and appropriate meal environment and food presentation will contribute to an adequate diet. On the other hand, a poor diet can contribute to frailty, which complicates functional limitations and can lead to loss of muscle mass, metabolic abnormalities and diminished immunity (Payette and Shatenstien 2005).

Individual determinants of healthy eating include age, sex, education, physiological and health issues, psychological attributes, lifestyle practices, and knowledge, attitudes, beliefs and behaviours. In addition other universal dietary determinants such as income, social status and culture, also play an important role. A study of Quebecers aged over 65 showed that the strongest correlates of diet quality were the degree of attention paid to keeping a healthy diet, along with higher education, being a city dweller, being a non-smoker and regular exercise (Bertrand 1990).

Collective determinants of health are varied. Food choice in seniors is motivated by individual attributes that are mediated in the larger arena by familial, social and economic factors. In older people, collective determinants of healthy eating, such as accessible food labels, an appropriate food shopping environment, the marketing of “healthy eating” messages, adequate social support and provision of effective community-based meal delivery services, have the potential to foster healthy eating (Payette and Shatenstien 2005).

The research on the relation between dietary quality, social support and living arrangements is controversial, as some studies have found positive relationships, while other have not. However, food consumption research does suggest that widowhood confers potentially negative effects on food intake through weight change, and increased adverse health outcomes, including depression and diminished “nutritional self-management”. This is particularly evident among men over the age of 75 with low incomes. Indeed, there is a strong relation between living alone and dietary intakes among older men, but these findings have not been consistent and are less so among women (Payette and Shatenstien 2005).

10.9 Eating Patterns Among Aboriginal Peoples

Payette and Shatenstien (2005) discuss the current dietary practices of Aboriginal peoples noting that these practices “pose significant health risks. Interventions to improve the nutritional status of Aboriginal peoples must reflect the realities of how people make food choices and therefore should be informed by an understanding of contemporary patterns of food procurement, preparation and distribution.”

“Partly because of the substitution of traditional foods with market foods, the current diet of Aboriginal peoples is often low in iron, folacin, calcium, vitamin D, vitamin A, fibre, fruit and vegetables; high fat and sugar intakes are commonly reported (Wein 1996; Trifonopoulos, Kuhnlein and Receveur 1998). The transition from traditional to market food has been a multi-dimensional, dynamic and complex course. The decision-making process about consuming traditional or market food is made at multiple levels of influence: societal, individual, socio-economic, and environmental, all which may overlap and interact” (Payette and Shatenstien 2005).

Factors, identified in various studies (Payette and Shatenstien 2005), that may influence Aboriginal peoples’ eating patterns include:

- In some Aboriginal communities, the cultural preference for body size may influence eating behaviour; for example, Ojibway-Cree in northern Ontario show a preference for large body size, and Cree communities in northern Quebec consider extra weight a sign of robustness and strength.
- Cultural identity informs personal knowledge, attitudes and beliefs about food and food choice. For example traditional foods are often associated with good health, whereas non-traditional food is considered by some Aboriginal people as polluting or weakening.
- Aboriginal families are over-represented among those experiencing hunger in Canada. As a result of pervasive poverty in many Aboriginal communities, income and food costs may be more potent determinants of food selection than considerations of healthfulness, social desirability and the taste of food. The availability of nutritionally adequate and safe foods is limited or uncertain.
- In remote and northern communities, the high cost, poor quality, lack of variety and lack of availability of perishable foods are barriers to the purchase of fresh fruits and vegetables.
- Reduced availability of traditional animal and plant species have resulted through changes to the physical environment. When species decline or become contaminated,

Aboriginal people may switch to hunting and fishing different species, reduce intake, or maintain the status quo.

Willows (2005) notes that although national survey data is lacking, the available evidence suggests that Aboriginal children and youth living in Canada have a high rate of overweight and obesity. “Childhood obesity is associated with health problems such as Type 2 diabetes, high blood pressure, high levels of fat and insulin in the blood, joint problems, gallstones, and breathing problems when sleeping. Considering the high rate of Type 2 diabetes in Aboriginal communities, the health risks associated with obesity in childhood may be high for Aboriginal children. Available evidence suggests the need for programs to prevent obesity in children in Aboriginal communities. The development of programs requires a better understanding of the biological, community-level, cultural and social contributions to obesity in children” (Willows 2005).

10.10 Cultural Differences in Healthy Living/Physical Activity Patterns

Rozin (2005) discusses a number of cross-cultural perspectives on eating and well-being. He notes that humans are biologically adapted to their ancestral food environment, in which foods were dispersed and energy expenditure was required to obtain them. The modern world has developed a surplus of easily accessible, calorie-dense foods, which has resulted in increased overweight among the population. “The French culture has coped with this mismatch better than Americans. Although at least as healthy as Americans, they focus more on the experience of eating and less on the health effects of eating. They spend more time eating, but they eat less, partly because of smaller portion sizes. French transitions of moderation (versus American abundance), focus on quality (versus quantity), and emphasis on the joys of the moment (rather than making life comfortable and easy) support a healthier lifestyle. The French physical environment encourages slow, moderate social eating, minimal snacking, and more physical activity in daily life” (Rozin 2005).

A cross-cultural study (Yan and McCullagh 2004) comparing cultural influences on youth motivation and participation in physical activity found that children and adolescents in different cultures may be subject to socio-cultural influences, resulting in culture-associated differences in the motivation to participate in physical activity or sports. Comparisons revealed different motivations (e.g., American children participated for competition and skill improvement, while Chinese children participated for social affiliation and wellness; American-born Chinese participated because of travel, equipment use and having fun). The researchers concluded that “understanding the cultural influence on youth’s participatory motives may facilitate organizing physical activities that offer children or adolescents expected sports experiences and movement learning outcomes in a multicultural society.”

10.11 Other Studies/Interventions – Home and Family Environment

Prevention That Works: A Review of the Evidence Regarding the Causation and Prevention of Chronic Disease identified a number of studies that discuss interventions involving the home and family environment.

- Schuit et al. (2000) reviewed the evidence on proven effective health promotion and disease prevention strategies related to nutrition and found that dietary choices in the home and community, and cultural beliefs and values, play an important role in establishing food choices. Furthermore, “because of the many opposing forces in people’s daily lives (time pressures, economic constraints, food advertising, limited access—economically or socially—to healthy foods) an integrated approach is needed that combines education with structural measures, environmental and social changes that reinforce behavioural change, and involvement of the food industry. A community coalition may be a useful strategy to apply.”
- In a 1998 review of 12 studies of the effectiveness of interventions to promote healthy eating in pre-school children aged 1 to 5 years, the reviewers found that while rewards targeted at individual children are not effective once the reward is removed, “traditional, video or computer-based teaching methods were successful at increasing nutrition knowledge.” They also found that parental involvement with children in learning about healthy eating, as well as via one-on-one parental counselling, workshops and newsletters, enhanced the effectiveness, and that “preschool and day care centres are likely to be appropriate settings for nutrition interventions” (City of Hamilton n.d.).
- A review (City of Hamilton n.d.) of interventions to enhance fruit and vegetable consumption in people 4 years of age and older examined 18 strong or moderate quality studies of community intervention programs that were intended to increase fruit and vegetable consumption by school children, adolescents and adults with no diagnosis of disease. They found that the most effective interventions:
 - Gave clear messages about increasing fruit and vegetable consumption.
 - Incorporated behavioural theories and goals, providing a consistent framework for implementation and evaluation.
 - Provided longer, more intensive interventions rather than one or two contacts;
 - Actively involved influential people such as family members.
 - Had a greater impact on those people whose knowledge or intake was lower at the beginning.
- The CDC notes “multiple approaches are needed that engage a wide range of community partners in a comprehensive approach that addresses the physical, social, political, and cultural environments affecting community members” (CDC 2003).
- The United Kingdom's Health Development Agency (2001) reviewed the evidence with respect to obesity, and concluded that effective strategies to reduce obesity include:
 - Reduce sedentary behaviour (or promote active living) in obese children.
 - Use diet, physical activity and behavioural strategies for adults, in combination where possible.
 - Use maintenance strategies such as continued therapist contact.
 - Use a gradual, incremental stepwise approach.
 - Integrate lifestyle changes over a long period of time.

Other findings include:

- Family therapy is essential in treatment with younger children.
- Habitual physical activity is important both for losing weight and for keeping weight off.

11.0 NUTRITION ENVIRONMENT

Healthy eating is a broad concept within the larger nutrition environment. The nutrition environment refers to issues such as food accessibility, affordability and quality. This section looks at the following topics: food insecurity, cost of and access to food, food expenditures, energy-dense foods, proximity of fast-food restaurants and portion size.

11.1 Impact of Advertising

With respect to advertising targeted toward children, *Improving the Health of Canadians: Promoting Healthy Weights* notes that researchers have looked at the content of television viewing, specifically food advertisements. In Australia, food advertisements account for approximately one-third of all advertisements broadcast during children’s television viewing hours (Neville, Thomas and Bauman 2005). Many advertisements are for high-fat or high-sugar products, with fruit and vegetables being the least-advertised food product (Neville et al. 2005). Studies conducted in the United Kingdom on children’s choices indicate that obese and overweight children tend to recognize more food advertisements than do non-obese and non-overweight children (Halford et al. 2004). Children exposed to advertising also tend to choose advertised food products at higher rates than do those who are not exposed (Borzekowski and Robinson 2001).

It should be noted, however, that “the direct effects of advertising on children’s food choices are difficult to untangle from the many other influences to which children are exposed, such as their peers” (Office of Communications 2004).

A number of governments have imposed restrictions on television advertising to children, and several target food advertising. Bans on advertising to children are in place in Quebec, Norway and Sweden; however, evaluations of the impact of legislation to restrict food advertising on children’s eating habits and weight are limited (Hawkes 2004).

In addition to the question of the nutritional influence on the body, there are negative influences of advertising on body image. A meta-analysis of 25 studies (Groesz, Levine and Murnen 2002) conducted in the United States examined the effects of the “thin beauty ideal” on perceptions of body image by females. After viewing “thin media images”, females viewed their body image more negatively than after viewing images of average-sized models, plus-sized models, and control images.

11.2 Food Insecurity

“Community food security exists when all citizens obtain a safe, personally acceptable, nutritious diet through a sustainable food system that maximizes healthy choices, community self-reliance, and equal access for everyone” (Bellows and Hamm 2003). *Improving the Health of Canadians: Promoting Healthy Weights* notes “there are three dimensions underlying food insecurity:

- Not eating the desired quality or variety of foods (compromised quality).
- Being concerned about not having enough to eat.
- Not having enough to eat” (Ledrou and Gervais 2005).

Studies have identified specific demographic indicators that point to populations that are potentially vulnerable to food insecurity; factors such as household income, housing costs, age, disability, ethnicity and social capital all play a role in the ability to access affordable, quality food. For example:

- In BC, 46 per cent of low-income and 14 per cent of middle-income individuals are food insecure, according to a Statistics Canada (2005) report.
- 27 per cent of Aboriginal people living off-reserve in Canada reported at least some food insecurity, and 24 per cent experienced a compromised diet (Che and Chen 2001).
- 7 per cent of seniors in Canada reported food insecurity in 2004 (Statistics Canada 2005).
- Low income mothers with poor nutrition have an increased likelihood of having low-weight babies, a high-risk indicator for potential health problems (Toronto Food Policy Council 1996).
- 32 per cent of single-mother households in Canada reported being food insecure to some extent, and 28 per cent reported their diet had been compromised (1998/1999) (Statistics Canada 2001).

Food security is a public health concern as many diseases are diet-related and found to have a higher prevalence in food-insecure populations. For example:

- Food-insecure adults have been shown to be 2.5 times more likely to suffer from heart disease and 1.6 times more likely to have high blood pressure (Statistics Canada 2001).
- Food-insecure people with diabetes have more costly and life-threatening complications of their illness, requiring more physician visits and medical care than food-secure persons with diabetes (Nelson et al. 2001).
- Canadian children are consuming excessive amounts of packaged, processed, simple-carbohydrate and high-fat foods (Starkey, Johnson-Down and Grey-Donald 2001). It has been shown that inadequate nutrition during early childhood may lead to permanent cognitive damage, or problems such as aggression, anxiety and irritability (Alaimo, Olson and Frongillo 2002).
- Aboriginal people are at high risk for food insecurity and poor nutritional status. They suffer from higher-than-average rates of obesity, non-insulin dependent diabetes mellitus and micronutrient deficiencies, all of which are at least partially diet-related (Riches et al. 2004).

These factors can be exacerbated by the following issues:

- Foods with little nutritional value are more affordable than high-quality, nutrient-rich food. Foods with high-fat and high-sugar content are among the least expensive foods (Drewnowski 2000).
- Food-related illness and disease is costly. Nutritional risk is an important predictor of physician and emergency room visits, hospital readmission and increased length of stay (Chima et al. 1997).
- Food in low-income neighbourhoods may actually cost more than food in middle- or high-income neighbourhoods (Chung and Myers 1999).

- The dominance of large farms and consolidated food stores “leaves the local food economy somewhat vulnerable to corporate decisions” (Harry Comings and Associates 2003), and appears to reduce the ability to support locally-grown and processed foods (Winston 1993).

Social capital, at both the household and community levels, is significantly associated with household food security. Studies (Martine et al. 2004) show that households with an elderly member are over two-and-a-half times more likely to have high social capital than are households without an elderly member (after controlling for socio-economic status). Having a household member who participates in a social or civic organization is also significantly associated with having higher levels of social capital. Households may have similarly limited financial or food resources, but those with higher levels of social capital are less likely to experience hunger.

There is evidence that food policies can have a major impact. Lang (2002) noted that Finland has had a food policy council since the early 1970s; during that time the Finns have doubled their consumption of vegetables, increased fruit and berry consumption and decreased the consumption of fat. There was a 55 per cent decline in Finnish male mortality from coronary heart disease between 1972 and 1992.

Lang (1999) also observed that malnutrition in the United Kingdom was virtually eliminated during WWII when food-related policies supported community food self-sufficiency and equitable distribution of food. Another initiative involving an urban food security policy and coordinated program delivery in Belo Horizonte, Brazil (Roche 2001), has demonstrated some success in reducing malnutrition among low-income families and their children.

In addition, several studies point to shifts in attitude as a result of educational interventions. For example, a five-a-day fruit and vegetable program in Michigan increased the consumption of fruits and vegetables among low-income women (Anderson et al. 2001). Also, California-sponsored community garden initiatives increased public consciousness about public health and strengthened community building skills (Twiss et al. 2003).

11.3 Patterns in Changing Food Supply

Findings from Canada’s Family Food Expenditure Survey, as well as studies conducted in the United States, indicate that many low-income individuals live in areas where there is limited access to a wide range of nutritious foods at a reasonable cost. Canadian households with lower incomes spent less money on food at both restaurants and stores than households with higher incomes. Compared to higher-income households, lower-income households also purchased fewer servings of both fruit and vegetables and milk products (Kirkpatrick and Tarasuk 2003). Changing patterns in food sources and supply include:

- Energy-Dense Foods – American data (Drewnowski and Spector 2004) indicate that energy-dense foods composed of refined grains, added sugars, or fats may represent the lowest-cost options to the consumer; and that poverty and food insecurity are associated with lower food expenditures, low fruit and vegetable consumption and lower-quality

diets. Such diets are more affordable than healthier diets based on lean meat, fish and fresh vegetables and fruit (Drewnowski and Specter 2004).

- **Fast-Food Restaurants** – A cross-sectional study in the United States reported a correlation between the number of residents per fast-food restaurant and state-level obesity prevalence, which ranged from 17 per cent to 28 per cent (Maddock 2004). States that ranked low in obesity tended to have more residents per fast-food restaurant. Given its cross-sectional and correlational nature, conclusions about causality cannot be made. To date, Canadian research shows increased mortality rates and admissions for acute coronary syndromes in Ontario regions with greater numbers of fast-food restaurants (Alter and Eny 2005).
- **Portion Size** – Analyses of three nationally representative American studies reported that between 1977 and 1996, portion sizes (with the exception of pizza) had increased both inside and outside the home. From 1977 to 1996, there was an increase in energy intake and portion size in hamburgers by 97 kcal, fries by 68 kcal and soft drinks by 49 kcal. From 1994 to 1998, the largest portion sizes for salty snacks, soft drinks, fruit drinks and fries were found at fast-food restaurants (Nielsen and Popkin 2003).

Sturm (2005b) found that in the United States, the percentage of disposable income spent on food has declined continuously since the early 1980s, and almost all the decline has been represented by food consumed at home; yet today's disposable income buys more calories than it has in the past. He notes that relative prices have encouraged shifts across food types. From a baseline of 100 during 1982 to 1984, the price index for fresh fruits and vegetables increased to 258 by 2002 (far exceeding general inflation), whereas the price index for soft drinks increased only to 126 by 2002 (below general inflation).

12.0 HEALTHY LIVING POLICY INTERVENTIONS

A number of documents examine potential options for population-wide policy interventions. *Overweight and Obesity in Canada* notes

the capacity to make large-scale, macrosystem changes in the social environment which reduces obesity depends, in part, upon political will. To that end, there has been a call for policy interventions (Nestle and Jacobson 2000). Although some would argue that the increasing prevalence of obesity is adequate impetus for policy recommendations, others suggest that the current state of evidence calls not for the adoption of a specific policy initiative, but instead that policy research, based on viewing obesity as a public health problem, become a central focus of research (Wadden, Brownell and Foster 2002). Based upon evidence of the environmental determinants of obesity discussed in previous sections, and the status of current policies related to obesity, some recommendations may be tenable. One of the challenges in implementing such policies, however, is the need for political support across jurisdictions (municipal, provincial/territorial, and federal).

The next sections discuss the evidence related to policy interventions both in Canada and internationally.

12.1 Economic Impact of Obesity

Cost analyses most often include direct costs to the obese individual and to the health care system. Direct costs of management and prevention, and intangible costs incurred outside the formal health system, are less frequently included. Many international studies of the economic cost of obesity are, therefore, conservative estimates (WHO 2000).

Using a cost-of-illness approach that parallels a variety of international economic studies to assess the impact of obesity on health care expenditures, Birmingham et al. (1999) calculated the direct costs of obesity and co-morbidities to the Canadian health system in 1997. Direct costs included hospital care, services of physicians and other health professionals, drugs, other health care, and health research. Using a generous definition of obesity (BMI over 27), derived from self-reported data in the National Population Health Survey, and co-morbidities derived from well-validated studies (post-menopausal breast cancer, colorectal cancer, coronary artery disease, endometrial cancer, gallbladder disease, hyperlipidemia, hypertension, pulmonary embolism, stroke, and Type 2 diabetes), the total cost to the Canadian health system exceeded \$1.8 billion, or 2.4 per cent of the total health care expenditures. The three largest contributors to total cost were hypertension (\$656.6 million), Type 2 diabetes (\$423.2 million), and coronary artery disease (\$346 million). Calculating the “population attributable fraction” to allocate the proportion of each disease/co-morbidity attributed to obesity in Canada, 50.7 per cent of the costs of Type 2 diabetes were attributable to obesity, as were 31.6 per cent of the costs of hypertension, 29.8 per cent of the costs of pulmonary embolism, and 26.6 per cent of the costs of endometrial cancer (*Overweight and Obesity in Canada*).

In BC, obesity-related illnesses were estimated in 2001 to cost the provincial health care system \$380 million annually, or 4.5 per cent of total direct health care costs. When productivity losses due to obesity, including premature death, absenteeism and disability are added, the total cost of obesity to the BC economy is estimated at between \$730 million and \$830 million a year, equal to 0.8 per cent of the province's Gross Domestic Product (Colman 2001).

Similar methodologies have been used in other industrialized countries using definitions of obesity ranging from BMI >25 to BMI 30, revealed a range of health costs. For example, New Zealand (2.5 per cent), Australia (2 per cent), France (2 per cent) and the Netherlands (4 per cent) (Colman 2001).

In the United States, the direct costs of health care expenditures for obesity were estimated to be 5.7 per cent in 1995, or \$99.2 billion. In the U.S., 61 per cent of the costs of Type 2 diabetes were attributable to obesity, as were 17 per cent of the costs of hypertension, 34 per cent of the costs of endometrial cancer, and 30 per cent of the costs of gallbladder disease. The three largest contributors to total cost were Type 2 diabetes (\$32.4 billion), coronary heart disease (\$6.99 billion), and hypertension (\$3.23 billion) (Wolf and Colditz 1998). Although a similar cost-of-illness approach was taken, the American study analyzed costs of obesity additionally, as well as independently, from co-morbidities. That is, the cost of obesity as a disease was also considered separately from its role as a risk factor for other diseases. The direct costs of obesity were, in fact, similar to those of Type 2 diabetes, and 1.25 times greater than the direct costs of heart disease. Although critics of the 5.7 per cent estimate of obesity costs in the United States suggest that when the obesity-related mortality is accounted for, estimates decrease to a maximum of 4.32 per cent of health care costs (Pucher and Dijkstra 2003), others argue that new methods need to be developed to assess the economic impact of obesity in terms of personal costs and quality of life (Kumanyika et al. 2002) (*Overweight and Obesity in Canada*).

When the American study also assessed indirect costs associated with lost productivity and restricted activity, direct costs of obesity accounted for 52 per cent of expenditures, while indirect costs accounted for 48 per cent of the total (Wolf and Colditz 1998). One may infer, therefore, that including indirect costs of obesity would double the costs of obesity to the Canadian system. Indeed, when one Canadian province (Nova Scotia) extrapolated the findings of Birmingham et al. (1999) and calculated the direct costs of obesity and co-morbidities to the provincial health system, direct costs of obesity-related illness to the annual provincial health expenditures were \$128 million. Adding indirect costs (including decreased productivity, absenteeism, and disability) brought the total costs to \$268 million per year for the Nova Scotia economy (Colman 2002). In this Canadian context, indirect costs of obesity to the economy exceed direct health care costs.

12.2 Public Opinion

As public opinion is a major consideration in the discussion of policy options, an overview of a public opinion survey by the Canadian Public Health Initiative is presented (*Improving the Health of Canadians: Promoting Healthy Weights*):

- 39 per cent of adults think living in communities with recreational spaces is very important in preventing obesity.
- 46 per cent of adults think living in communities that are safe for walking and playing is very important in preventing obesity.
- 39 per cent of adults believe encouraging the development of communities where cars are not always needed to get around is very important to the health of the people in their communities.
- 41 per cent of adults believe having access to public transportation is very important to the health of people in their community.
- 52 per cent of adults believe providing adequate sidewalks and bicycle paths that reduce car travel is very important to the health of people in their community.
- 57 per cent of Canadian adults strongly support offering incentives to employers who provide fitness facilities or programs to their workers.
- 72 per cent of adults strongly support encouraging more non-competitive and recreational programs in schools.
- 85 per cent strongly support encouraging more school-based nutrition and physical education programs in schools.
- 78 per cent of adults strongly support future initiatives that would ensure people have access to reasonably priced healthy foods.
- 68 per cent of Canadian adults strongly support requiring fast-food companies to provide nutritional information about each product they sell.
- 24 per cent of Canadian adults strongly support charging more tax for less healthy food choices.

12.3 Dietary and Physical Activity Policy

Some of the less controversial and well-established policy approaches to the promotion of healthy eating and active living involve dietary and physical activity guidance. Health Canada promotes the health and well-being of Canadians by collaboratively defining, promoting, and implementing evidence-based nutrition and physical activity policies and standards, including recommendations and guidelines such as *Canada's Food Guide to Healthy Eating*, *Canada's Physical Activity Guide to Healthy Active Living*, *Canada's Guidelines for Healthy Eating*, *Promoting Healthy Weights: A Discussion Paper*, and *Canadian Guidelines for Body Weight Classification in Adults*. These documents underpin nutrition, physical activity, and health policies, standards and programs across the country, and serve as a basis for a wide variety of healthy-living initiatives (*Overweight and Obesity in Canada*).

The national plan of action on nutrition, *Nutrition for Health: An Agenda for Action* (Office of Nutrition Policy and Promotion 1996), builds on the population health model and sets out strategic directions to encourage policy and program development that: is coordinated and intersectoral; supports new and existing partnerships; promotes the efficient use of limited resources; and strengthens research to improve the nutritional health of Canadians.

These standards and recommendations could all be used as a foundation for consumer education about portion sizes and the labelling of nutritional content of foods. Health Canada announced

new mandatory nutrition labelling in January 2003 to help Canadians make informed choices about healthy eating (Health Canada 2003).

The United States *Surgeon General's Call to Action to Prevent and Decrease Overweight and Obesity 2001* is a useful model, as it incorporates several levels of the ecological model (individual, interpersonal, institutional, and community). Its recommendations, however, do not include population-based policy interventions, such as taxation and regulation of advertising. Proposals for taxing or restricting the advertising of unhealthy foods raise contentious issues of choice and regulation (Eckersley 2001).

12.4 Taxation

Economic incentives and disincentives are a potential addition to the array of public policy instruments available to encourage healthy eating. Some researchers have proposed combining taxation of less healthy options with subsidies for healthier alternatives such as fruits and vegetables, as a potentially effective strategy in improving diet quality and health outcomes.

Advocates have suggested that food taxes on unhealthy foods may prompt changes in eating behaviours, which contribute to changes in population consumption patterns, which then contribute to obesity and chronic disease. This approach is often promoted as part of a broader comprehensive health promotion strategy, citing the experience of cigarette taxation as a component of the tobacco control strategy. The tax could consist of a manufacturer's tax, or a wholesaler's and distributor's tax. However, there is no clear empirical evidence available to assess the merits of taxation of unhealthy foods.

An analysis carried out for the Danish Food and Resource Economic Institute indicated that differential taxes based on total fat, saturated fat or sugar could have an impact on consumption of fats and sugars and on overall calories for some groups, although with no "particularly advantageous effects" for the socio-demographic groups amongst which obesity and unhealthy diets are of the most concern (Smed, Jensen and Denver 2005). The authors suggest that combining economic instruments with public information campaigns may be a fruitful avenue for further exploration.

A United States Department of Agriculture model suggests that small taxes on snack foods would be ineffective in changing patterns of consumption and would have little impact on diet quality or health outcome. Moreover, there is no guarantee that any consumption changes prompted by such taxes would be nutritional beneficial (Kuchler, Tegene and Harris 2005).

In 1991, California enacted an 8.25 per cent "Twinkie Tax" on non-essential foods. Although the tax generated \$200 million in revenue and decreased snack sales by 10 per cent, it was met with significant resistance due primarily to the arbitrariness of the tax, its regressive nature (penalizing those without access to fresh food), and the difficulty in implementation. Californians repealed the tax one year later (Battle Horgen and Brownell 2002). Since that time, 18 states and one major city have begun to levy special taxes on soft drinks, candy, chewing gum, or snack foods. The tax rates appear to be too small to act as a disincentive to purchase the products and thus may not have a direct impact on dietary intake. However, about \$1 billion is

raised annually from these taxes nationally, and revenues are, in some cases, used to fund health promotion programs (Jacobson and Brownell 2002).

In Canada, the GST/HST have been in place for more than a decade. The GST is a 7 per cent national goods and services tax, while the HST is a 15 per cent regional harmonized sales tax that integrates the federal GST with provincial taxes in the Atlantic region (except Prince Edward Island). The GST/HST functions as a “sin tax” for food, as basic groceries are exempt (zero-rated), while other foods are taxed, such as: foods prepared by eating establishments, catered, or found in vending machines, and specific foodstuffs such as alcoholic beverages, soft drinks and snack foods. Although initially the GST/HST may have acted as disincentives to purchasing those foods that promote obesity, over the long term there does not seem to be an impact on purchasing. Revenues from the GST/HST on foodstuffs currently are returned to general revenues and are not earmarked for health promotion, as is the case in some American states. (*Overweight and Obesity in Canada*)

12.5 Advertising/Media Regulation

Given the extent of food advertising, mostly for foods of lower nutritional quality, restrictions on advertising may be a viable policy option. However, potential opposition by corporations and civil libertarians to restrictive advertising is to be anticipated; public support for such policy initiatives is essential (Battle Horgen and Brownell 1998). It is of interest to note that increasing threat of litigation against fast-food companies may have had an impact on fast-food marketing (Daynard, Hash and Robbins 2002). McDonald’s France has started an advertising campaign that suggests to consumers that “once a week is enough”. (*Overweight and Obesity in Canada*)

The Centre for Science in the Public Interest (CSPI) is a non-profit consumer health advocacy organization specializing in nutrition issues, with offices in Ottawa and Washington. DC. In Canada, CSPI’s health advocacy is funded by over 100,000 subscriptions to the Canadian edition of *Nutrition Action Healthletter*. CSPI promotes the distribution of reliable information to the public. They have urged Health Canada to mandate labelling for prepackaged foods and support other regulatory initiatives regarding the sale of high-calorie, nutrient-poor foods, and products that promote sedentary living. For example, they promote: a ban on the use in food of trans-fat laden, partially hydrogenated, vegetable oil; improved labelling on food packages and restaurant menus; restriction of advertising directly to children; control of the mass-marketing of breastmilk substitutes. They also advocate for truth-in-advertising regarding the long-term safety and effectiveness of weight-loss products and programs.

In 2004, CSPI recommended that the federal government adopt: the taxation of unhealthful foods; increase income-tax deductions for advertising expenses by food companies who promote healthy foods; increased funding for preventive nutrition counselling and lactation counselling services; and funding for mass media campaigns to promote healthy eating and physical fitness.

12.6 Labelling and Point-of-Purchase Information

On-package food symbols that highlight healthy food choices have been implemented widely. For example, the heart associations in a number of countries, including Canada, have approved the use of a symbol on food products that meet a set of criteria, generally a reduced level of total

fat, saturated fat, cholesterol, and sodium levels. A Glycemic Index (GI) was launched in 2002 by Diabetes Australia. The United Kingdom is proposing a unique multiple traffic light symbol scheduled to be introduced in 2006. Calling it a signposting program, the symbol will have a separate high, medium or low rating, and corresponding red, amber or green colour to indicate levels of fat, saturated fat, salt and sugar (Dietitians of Canada 2006).

There appears to be some confusion for consumers, however, as an increasing number of symbols developed by governments and non-profit associations are matched by food labelling initiatives undertaken by individual manufacturers and retailers. The United Kingdom Food Standards Agency has faced some challenge from industries, which have started their own labelling systems. This is being done in spite of research that indicates that one-third of consumers from lower socio-economic groups or ethnic minority groups were unable to use this information effectively (Dietitians of Canada 2006).

Overall, “point-of-purchase” nutrition information initiated by governments and non-profit associations have goals related to population health promotion. Programs designed by industry tap into the consumer trend of wanting healthier foods, and help consumers identify healthier choices in their product line. In 2005, products catering to health and convenience were among the fastest-growing categories in the food and consumer products industries.

There is some evidence that “point-of-purchase” information has the potential to influence the choices made at cafeterias. For example, a recent study of six high schools in Pennsylvania found students in schools that posted nutrition information chose more healthful foods than students in schools where there was no information available (Conklin, Cranage and Lambert 2005). Posting calorie and fat levels in entrees appeared to be especially persuasive, compared to providing information on vitamins and minerals.

Ontario’s *Eat Smart! School Cafeteria* program exemplifies the multi-sectoral collaboration—local public health units, school boards, individual schools and food services operators—needed to make schools a supportive environment for healthy food choices. The program was initially created by a partnership among the Heart and Stroke Foundation of Ontario, Canadian Cancer Society and the Ontario Public Health Association’s Nutrition Resource Centre (Dietitians of Canada 2006).

12.7 Policy Approaches to Land Use and Transportation Planning

The relationship between increases in car travel and decreases in active commuting and “urban sprawl” may provide sufficient justification for applying a public health lens to urban planning, in order to promote mixed land use and planning for active transportation. In this context, it is helpful to know that 82 per cent of Canadians believe that government should support spending on bike lanes (Go for Green 1998).

Zoning laws can be used to require certain types of destinations to be within walking distance of most residences, to limit the number of convenience stores and fast-food restaurants, or to encourage farmers’ markets and family-style, sit-down, or “slow-food” restaurants (Sallis and Glanz 2006).

12.8 Other Policy Options

Dr. Kim Raine, the author of *Overweight and Obesity in Canada*, suggested in this document that a number of “viable policy options for Canadian population-wide policy interventions include:

- Consider legislation to regulate portions of a “reasonable” size and to enforce disclosure of the nutritional content of snack and fast foods at point of purchase and on product labels.
- Develop a complementary strategy to the GST/HST to subsidize the cost of low-energy, nutritious food with taxes of sufficient magnitude to affect sales of high-energy, low-nutrient foods. The effect would be a changed price structure for food that favours purchase of more nutritious choices.
- Taxation policies that could potentially promote physical activity would include the removal of sales taxes on exercise equipment and the offering of tax incentives to employers who provide employees with fitness facilities.
- Taxes that would discourage urban sprawl, such as congestion/traffic taxes, rush-hour tolls, subdivision fees, and gasoline taxes may also work to promote physical activity by encouraging densification and active commuting.
- Considering the evidence presented earlier that links lower SES and social inequity to obesity and its comorbidities, policies that support adequate income can contribute to health, and present a policy option for consideration.
- As children may be particularly vulnerable to advertising of energy-dense foods and marketing of fast foods, the following policy options are directed at children’s media:
 - Restrictions on advertising of “junk” foods during peak TV viewing times for children.
 - Regulating advertising time to ensure promotion of healthy foods receives equal time.
- Facilitate active transportation by creating streets that incorporate pedestrian use (connecting pathways, sidewalks, crosswalks) and bicycle facilities (lanes or paths) and that are “calmed” (that is, discourage high-speed vehicle traffic through the use of speed bumps and obstacles)” (Raine 2004, pp. 54-55).

In light of WHO statements (2000) that “the impact of the obesity epidemic on non-communicable diseases such as cardiovascular disease, Type 2 diabetes, and cancer threatens to overwhelm health systems”, Raine further suggests the importance of improved surveillance and analysis of obesity in Canada. She notes there are “identified gaps in existing surveillance of obesity, associated non-communicable diseases, and economic impacts of obesity, which limit understanding of the problem based on accurate, accessible and appropriate data.” She suggests that the following policy options be considered (Raine 2004, pp. 57-61):

- Develop a comprehensive, coordinated surveillance system to monitor ongoing rates of obesity, the costs of obesity, and impacts of interventions.
- Build upon current commitments to food and nutrition surveillance, including eating patterns and nutrient intake physical measures, through the Canadian Community Health Survey.

- Develop a comprehensive, coordinated surveillance system to monitor physical activity among Canadians.
- Exploit opportunities for analysis of currently available surveys and develop surveillance mechanisms to fill current gaps in data gathering, in order to monitor social trends such as recreation patterns, television viewing, food purchasing patterns, food supply, and marketing strategies related to food and physical activity that contribute to the understanding of environmental determinants of obesity.
- Conduct health impact analyses of social policies influencing income equity/financial security to assist in developing an understanding of socio-economic determinants of obesity.
- Develop policies supportive of weight management for individuals at risk for health problems due to obesity.
- Work with education ministries and school boards to promote healthy weights through schools. Policies that could be considered include:
 - Incorporate quality daily physical education to a standard of 150 minutes per week from Kindergarten to Grade 12.
 - Develop school food policies that promote the sale and consumption of healthy foods and discourage non-nutritive, high-energy-density foods.
 - Promote safe and active routes to school.
- Work with private- and public-sector employers to develop a workplace environment that promotes healthy weights. Policies that could be considered include:
 - Develop comprehensive work site health promotion programs as an investment in employee health.
 - Incorporate supports for active commuting, on-site physical activity, and healthy food choices in workplace environments.
- Based upon extensive evidence generated from knowledge and experience with other health issues in Canada (such as tobacco) and from other countries, apply promising practices for population-based policy change to promote healthy weights. Policies that could be considered include:
 - Implement community-wide public health campaigns (media, support groups, risk screening, partnerships with schools and work sites, local policy, etc.) to promote healthy eating and active living.
 - Build upon successful policy approaches to the promotion of healthy eating and active living through dietary and physical-activity guidance.
 - Expand food and nutrition labelling to food-service operations, including fast food.
 - Examine means of utilizing GST/HST revenues from soft drinks and snack foods to subsidize the low-energy, nutritious food and to fund health promotion initiatives.
 - Support tax policy that promotes social equity to address low socio-economic status as a determinant of obesity.
 - Regulate media promotion of “junk” food by banning advertising to children during peak viewing times, or by legislating equal time for promotion of healthy foods and physical activity.
 - Regulate land use and transportation policy to promote active transportation, such as walking and cycling.

- Evaluate and measure outcomes of programs and interventions using common indicators of success to increase the evidence base for future public health initiatives.

13.0 CONCLUSION

Many single-targeted interventions appear to be effective at increasing healthy eating and physical activity and, in some cases, reducing overweight and obesity. Other interventions that use multiple strategies or have multiple target audiences, such as coordinated school health programs, also appear to be effective in many cases. Overall, the evidence suggests that the most effective interventions to change diet and physical activity patterns at the population level are to: adopt an integrated, multi-disciplinary, and comprehensive approach; involve a complementary range of actions; and work at individual, community, environmental, and policy levels.

A review of population-based change strategies reveals that their success requires strong support at all levels to ensure that programs are well resourced and integrated into existing programs and structures. In addition, intersectoral collaboration and community participation are essential to ensure that programs are sustainable, tailored to meet local needs, able to reach more than just the motivated healthy, and able to capture local opportunities.

The challenges of large-scale interventions include limited action by policy-makers who may not have sufficient evidence upon which to base decisions for such interventions in the absence of community demand. Evaluation of large-scale interventions, including economic-impact evaluations and long-term surveillance of program impacts, are needed to increase the evidence base.

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Core Public Health Functions for BC: Evidence Review
Healthy Living – Physical Activity & Healthy Eating

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APPENDIX A: EXAMPLES OF EVALUATED WORKPLACE HEALTH INITIATIVES

Program Goals and Approach	Health and Health-Related Benefits
<p>Heartbeat Award (Leicester, UK) The Heartbeat Award is a national nutrition labelling initiative that encourages caterers to reduce total fat, sugar and salt and increase the availability of fibre-rich foods they provide to work sites (Holdsworth, Raymond, and Haslam 2004). Method: Four work sites received the intervention (n = 453) and two were controls (n = 124).</p>	<p>Relative to control sites, there were increases in consumption of fruit, decreases in consumption of fried foods and sweet puddings and a change to lower-fat milk among intervention sites.</p>
<p>Treatwell 5-a-Day (Massachusetts, US) Treatwell 5-a-Day Program is a cancer-prevention initiative that aimed to increase consumption of fruit and vegetables (Sorensen et al. 1999). Method: Twenty-two work sites were randomly assigned to one of three groups: work site intervention group (n = 7); work site plus family intervention group (n = 7); or control group (n = 8) (September 1994 to April 1996).</p>	<p>Increases in fruit and vegetable consumption among the work site plus family intervention group (19 per cent).</p> <p>Differences in fruit and vegetable consumption between the work site intervention group and control group were not significant.</p>
<p>The Working Healthy Project (Rhode Island and Massachusetts, US) The Working Healthy Project (WHP) is an intervention aimed at multiple risk factors that targets physical activity, nutrition and smoking. WHP was part of the Working Well Trial, a multi-centre, randomized, national work site intervention trial involving 114 work sites. Interventions included individually focused activities, as well as strategies targeted at the social norms and health-related policies at the workplace (Emmons et al. 1999). Method: Implemented in 26 work sites, over 2.5 years using a randomized matched pair design.</p>	<p>Physical activity outcomes 30 per cent increase in self-reported physical activity in the intervention group compared to a 4.3 per cent increase among the control group.</p> <p>Nutrition outcomes Marginally significant increases in fruit, vegetable and fibre consumption among intervention sites.</p>

APPENDIX B: EXAMPLES OF EVALUATED SCHOOL-BASED HEALTH INITIATIVES

Program Goals and Approach	Health and Health-Related Benefits
<p>Action Schools! BC (British Columbia, Canada) Action Schools! BC is a project designed to assist elementary schools in creating action plans to integrate healthy eating and a minimum of 150 minutes of weekly physical activity among students in Grades 4 to 7 (n = 515). Based on information from its project report, Action Schools! BC has been evaluated for health-related outcomes. Method: Stratification and random assignment of 10 schools (3 control and 7 intervention schools [4 liaison and 3 champion schools]) from February 2003 to June 2004.</p>	<ul style="list-style-type: none"> • Girls in the liaison schools reported a 32 per cent increase in moderate to vigorous physical activity compared to an increase of 18 per cent among girls in the control schools. Results were not significant for boys. • While girls in the control schools decreased their number of pedometer-measured steps per day by 8 per cent, girls in the liaison schools increased their steps by 25 per cent. Results were not significant for boys. • Changes in BMI among students in the intervention schools were not significant.
<p>Planet Health (Massachusetts, U.S.) Planet Health integrated interventions into the major subject areas and physical education classes of Grade 6 to 8 students (n = 1,295). It focused on four behavioural changes:</p> <ul style="list-style-type: none"> • Reducing television viewing. • Increasing moderate to vigorous physical activity. • Decreasing consumption of high-fat foods. • Increasing consumption of fruit and vegetables to five a day or more (Gortmaker et al. 1999). <p>Method: 5 intervention and 5 control schools (Fall 1995 to Spring 1997).</p>	<ul style="list-style-type: none"> • No difference in prevalence of obesity among boys. • Obesity prevalence decreased among girls in the intervention schools (24 per cent to 20 per cent) and increased among girls in the control schools (22 per cent to 24 per cent). • Relative to control schools, children in the intervention schools watched less television per day (-0.40 hours for boys and -0.58 hours for girls).
<p>Eat Well and Keep Moving (Baltimore, U.S.) This program integrated materials and messages into the classes of Grade 4 and 5 students (n = 336). It focused on decreased consumption of high-fat foods, increased intake of fruit and vegetables, reduced television viewing and increased physical activity (Gortmaker et al. 1999). Method: 6 intervention and 8 control schools (Fall 1995 to Spring 1997).</p>	<ul style="list-style-type: none"> • Relative to control schools, there were statistically significant reductions in percentage of total fat intake (-1.4 per cent) and increases in fruit and vegetable intake (0.36 servings/4,184kJ) among students in intervention schools. • There was some reduction in television viewing (-0.55 hours/day) among intervention students relative to control schools. • BMI change was not measured.

Core Public Health Functions for BC: Evidence Review
Healthy Living – Physical Activity & Healthy Eating

Program Goals and Approach	Health and Health-Related Benefits
<p>Active Programme Promoting Lifestyle Education in School (APPLES) (Leeds, UK) APPLES aimed to reduce risk factors for obesity among 7- to 11-year-olds (n = 634) through teacher training, modification of school meals and action plans that targeted the curriculum, physical education and playground activities (Sahota et al. 2001). Method: 5 intervention and 5 control schools (September 1996 to July 1997).</p>	<p>Some outcomes were as expected:</p> <ul style="list-style-type: none"> • A modest, but significant increase in vegetable consumption among students in the intervention schools (50 per cent of baseline intake). • Obese children in the intervention schools reported higher “global self-worth” than those in the control schools. <p>Some outcomes were not as expected:</p> <ul style="list-style-type: none"> • Fruit consumption among obese children in the intervention schools fell to lower than those in the control schools. • There was a significant increase in consumption of high-sugar foods and drinks among overweight children in the intervention schools compared to control schools. • Changes in growth, BMI or physical activity were not significant.
<p>Child and Adolescent Trial for Cardiovascular Health (CATCH) (California, Louisiana and Minnesota, US) CATCH was a cardiovascular disease prevention program aimed at the Grade 3 curriculum (n = 5,106) and both the school and family environments. Interventions included: modification of menus, food service personnel training, physical education interventions and teacher training (Luepker et al. 1996). Method: Randomized control trial (28 schools received school intervention only, 28 schools received school and family interventions; and 40 were control schools). (Fall 1991 to Spring 1994).</p>	<ul style="list-style-type: none"> • There was a significant decrease in total fat in cafeteria-prepared lunches in intervention schools (39 per cent to 32 per cent) compared to control schools (39 per cent to 36 per cent). • There was a significant decrease in total fat intake (33 per cent to 30 per cent of energy consumed) among students in the intervention schools compared to students in the control schools (33 per cent to 32 per cent). • No significant differences between intervention and control schools in students, blood pressure, body size or cholesterol. • Relative to the control schools, there was a significant increase in the intensity of activity among students in intervention schools.