

**INFLUENCES OF OBESITY IN THE SOCIAL AND  
ECONOMIC ENVIRONMENT: THE ROLE OF A  
MULTISECTOR ALLIANCE IN BC**

by

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## **ABSTRACT**

Rapidly rising obesity rates are a major public health concern. Obesity is a well-established risk factor for many chronic diseases, the leading causes of death and disability in Canada with costs estimated at \$4.3 billion per year. The fundamental causes of obesity are believed to be societal, resulting from environments that promote sedentary lifestyles and the consumption of high fat, energy-dense diets.

In 2007, a multisector Alliance was formed in BC to study obesity prevention through policy changes in the built environment. The purpose of this report is to provide a synthesis of the literature looking at influences of obesity in the social and economic environment.

Although more evidence is needed, there is currently enough evidence to support broadening the scope of obesity prevention to include influences within the social environment, including schools, food, and advertising and marketing, and in the economic environment including neighbourhood SES and food costs.

**Keywords:** Obesity; obesity prevention; chronic diseases; social environment; economic environment.

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## INTRODUCTION

Rapidly rising obesity rates are a major public health concern globally in both developing and developed countries. In 2000, the World Health Organization declared obesity a global epidemic. Populations worldwide have experienced rapid changes in diet and physical activity levels leading to increased consumption of energy-dense, high-fat diets and sedentary lifestyles (WHO, 2000). The underlying drivers of these rapid lifestyle changes are social, technological, economic, environmental and political influences (Butland et al, 2007).

The prevalence of obesity in Canada is among the highest in the OECD (Organisations for Economic Co-operation and Development) countries. The prevalence of overweight and obesity has increased in almost all Canadian populations; adult, children, youth, ethnic groups and regionally. In the past 25 years, adult overweight and obesity rates have nearly doubled (LePetit & Bertholot, 2006). More alarming, child and youth obesity rates have nearly tripled over the past 20 years (Shields, 2005). Currently, 60% of adult Canadians (Tjepkema, 2005) and 26% of children and youth (Shields, 2005) are overweight or obese. Canada's Aboriginal populations are at greater risk with prevalence rates often much higher (Shields, 2005; Tjepkema, 2005). Although British Columbia (BC) has the lowest adult obesity rate in Canada, the provincial rate

rose from 14.1% in 1986-1992 to 19.2% in 2004, just behind the Canadian average (Shields & Tjepkema, 2006b).

Obesity is a well-established risk factor for many chronic diseases including cardiovascular diseases, type 2 diabetes, high blood pressure, osteoarthritis, some cancers and gallbladder disease (Raine, 2004; Visscher & Seidell, 2001; WHO, 2002). Chronic diseases are among the leading causes of death and disability in Canada (GPI Atlantic, 2001; Raine, 2004; Tjepkema, 2005). Obesity is also associated with mental health issues in adults and children (Raine, 2004; Wang et al, 2009).

The economic costs of obesity have been calculated at \$4.3 billion per year in Canada (Katzmarzyk & Janssen, 2004). This includes the direct costs of hospitalization and the indirect costs of lost time at work and premature death. With the incidence of obesity expected to continue to increase, some economists warn the costs cannot be sustained by the Canadian health care system (Evans, 2007).

The fundamental causes of the obesity epidemic are believed to be societal, resulting from an environment that promotes sedentary lifestyles and the consumption of high-fat, energy-dense diets (WHO, 2000). We are increasingly living in “obesogenic” (obesity promoting) environments that encourage excessive food intake and discourage physical activity (Raine, 2004; Reidpath et al, 2002). Although physical activity and nutrition are ultimately individual choices, over the past 30 years the public health sector has understood that an individual’s choice is highly affected by the social, physical and economic

environments in which they live. An increasing number of studies internationally have looked at environmental influences on physical activity and nutrition (Raine, 2004; Butland et al, 2007).

In the fall of 2007, researchers, health professionals, and policy makers came together at a research forum in Vancouver, BC to discuss obesity prevention in the province. With recognition that there are many important factors to consider in the built environment, physical activity was identified as a key intervention priority. Specifically, the focus of concern of this group was the impact of land use planning decisions on physical activity opportunities and health outcomes. They called upon land use planners and public health decision makers to form collaborative relationships. In response, the Provincial Health Services Authority formed the Healthy Built Environment Alliance bringing together key stakeholders from multiple sectors across the province to study obesity prevention through policy changes in the built environment.

This paper was generated out of a recognition of a need for the Alliance to consider influences beyond the physical environment. The purpose of this paper is to synthesize the literature on social and economic environmental influences of obesity. This synthesis is expected to be useful to the Alliance to support the next phase of planning to address obesity prevention in the province. The paper begins by defining obesity and how it is measured, followed by a focused literature review on the environmental influences of obesity, concluding with a discussion of the evidence and the identification of priority interventions.

## **BACKGROUND**

### **Defining and Measuring Obesity**

The World Health Organization (WHO) defines obesity simply as “excessive or abnormal fat accumulation in the adipose tissue, to the extent that health may be impaired” (2000). Obesity occurs from an energy imbalance in which the calories consumed exceed calories expended over a sustained period of time. The amount of fat stored as well as the distribution of fat affects the risk and type of diseases that result. Fat distribution is characterized as evenly and peripherally distributed (gynoid) or concentrated in the abdominal region (android obesity). Android obesity is associated with greater risk of developing certain diseases (WHO, 2000). Ethnic differences appear in the risk associated with different waist circumference (WHO, 2000). For example, abdominal fatness is less strongly associated with risk factors for cardiovascular disease and type 2 diabetes in black women than white women. South Asian populations are more at risk than other populations for complications associated with abdominal fat.

In adults obesity is most commonly measured using BMI (Body Mass Index), a ratio of weight to height which is highly correlated with body fat (Tjepkema, 2005). BMI is classified into six categories from underweight to morbidly obese. The WHO developed a graded classification scheme to distinguish the mortality and morbidity risks associated with each range: ‘Underweight’ (<18.5 BMI) is associated with increased risk of developing health

problems; 'Normal' (18.5-24.3) is associated with least risk; 'Overweight' (25.0-29.9) with increased risk; 'Obese – Class I' (30-34.9) with high risk; 'Class II' (35-39.9) with very high risk; and 'Class III' (>40) with extremely high risk. The risk of developing health problems increases even with a small increase above normal BMI (Tjepkema, 2005).

BMI is most widely used in population studies because of the availability of routinely collected weight and height data. It is a good population level obesity indicator to estimate prevalence of obesity and the various risks associated with different levels. At the individual level, BMI is not a good measure of obesity because it does not account for differences in the distribution of fat (gynoid versus android), weight from fat versus muscle, or body build and proportion.

At the individual level, waist circumference, waist to hip ratio (WHR) and skin fold test are better measures of adverse health risk (WHO, 2000). Waist circumference is becoming the more practical and better correlate of disease risk over WHR. Waist circumference is an important measure for individuals with excess abdominal fat who are at particular risk of adverse health outcomes. It is simple and convenient to measure, is unrelated to height and correlates closely with BMI and WHR. Studies have found that changes in waist circumference reflect changes in risk factors for cardiovascular disease and other chronic diseases (WHO, 2000). A grading scheme is needed to capture the risk difference among ethnic populations and between sexes (WHO, 2000).

Where direct measurement is not possible self report is used. Studies have shown that self report is often a flawed measure as individuals tend to

under estimate their weight and overestimate height (Sheilds & Tjepkema, 2006a). In 2003, based on self report data, the obesity rate in Canada was calculated at 15%. A year later using direct measurement of height and weight, the rate increased to 23% (Tjepkema, 2005). Although trends are captured using self report, BMI based on direct measurement is a more accurate measure. The Canadian Community Health Survey completed in 2004 (Tjepkema, 2005) was the first time in 25 years that weights and heights were measured directly for a nationally representative sample versus self report.

Defining obesity in childhood is more difficult because of children's rapidly changing height and body composition. Childhood is also defined differently in different countries depending on the onset of puberty (WHO, 2003). Researchers are calling for a standardized classification system for children that can be used globally.

### **Burden of Disease: Canada and BC**

Using direct measure data from the 2004 Canadian Community Health Survey: Nutrition (CCHS), Tjepkema (2005) calculated the adult (18 or older) obesity rate as 23.1% or approximately 5.5 million Canadians and the overweight rate at 36.1% or 8.6 million Canadians. This was a sharp increase compared to data from the Canada Health Survey in 1978/79. At that time 13.8% of the adult population was measured as being obese. The population with the most significant change was young adults (25 to 34 year olds) where the obesity rate more than doubled from 8.5% to 20.5%. In 2004 the obesity rate for women and

men was similar overall with differences being seen in certain classifications; more women are obese and more men are overweight.

Provincial obesity rates are relatively similar except for Newfoundland and Labrador, Nova Scotia, Manitoba and Saskatchewan which had rates significantly higher than the national average. British Columbia has the lowest adult obesity rate in Canada at 19.2%, just behind the Canadian average, an increase from 14.1% in 1986-1992 (Shields & Tjepkema, 2006b).

In the adult Aboriginal population living off-reserve 38% were obese and 30% were overweight, both higher than the non-Aboriginal population. Obesity rates for young Aboriginal people living off-reserve were two and a half times the national average (Shields, 2005) and 1.6 times the national average for Aboriginal adults living off-reserve (Tjepkema, 2005).

In children and youth (2- to 17-year olds) the rate of overweight increased from 12% to 18% and the obesity rate from 3% to 8% (Shields, 2005). The combined overweight/obesity rate was about 70% higher from 1978/79 to 2004. In children aged 2 to 5 the overweight/obesity rate remained the same, however for adolescents aged 12 to 17 the rate more than doubled from 14% to 29% and the obesity rate tripled. Aboriginal youth had a significantly higher combined overweight/obesity rate of 41% and an obesity rate of 20%.

Regionally, the combined overweight/obesity rate of children and youth in Newfoundland and Labrador (36%), New Brunswick (34%), Nova Scotia (32%) and Manitoba (31%) was significantly above the national rate (26%). The

provinces of Quebec (23%) and Alberta (22%) were significantly below the national level (Shields, 2005). British Columbia has the third lowest rate at 26%.

The rising rates of childhood obesity are of major public health concern. The adverse physical health effects from obesity are well understood (Raine, 2004; Visscher & Seidell, 2001; WHO, 2000; WHO, 2002). The mental health effects are beginning to be appreciated. A recent Canadian study based on longitudinal data revealed that children who were obese at baseline were more than twice as likely to report low self-esteem four years later (Wang et al, 2009). Poor self-esteem often leads to mental health problems. Childhood obesity tends to persist into adulthood (Shields, 2005). Once an adult gains weight, continued weight gain is likely and very few individuals return to normal weight. In the National Longitudinal study 25% of people moved from overweight to obese over the study period while only 10% moved from overweight to normal (Shields & Tjepkema, 2006a). The prevention of obesity is a priority and must begin at the earliest age.

## **Risk Factor for Chronic Diseases**

Obesity is a well-established risk factor for many chronic diseases including cardiovascular diseases, type 2 diabetes, high blood pressure, osteoarthritis, some cancers and gallbladder disease (Raine, 2004; Visscher & Seidell, 2001; WHO, 2002). According to Butland et al (2007) people who are obese are at a 5 fold risk of hypertension and a 2.25 fold risk of coronary artery disease. Ninety percent of people with Type II diabetes have a BMI above Normal (23 kg/m<sup>2</sup>). Ten percent of cancer deaths among non-smokers are

related to obesity. Chronic diseases are increasingly responsible for disability and premature death in both developed and developing countries. Chronic diseases are among the leading causes of death and disability in Canada (GPI Atlantic, 2001; Raine, 2004; Tjepkema, 2005). Modest mortality risks begin at BMI of 25. At BMI over 30 mortality rates from all causes increase by as much as 50 to 100 percent above normal BMI (20 – 25) (Adams et al, 2006; Jee et al, 2006). Obesity is also associated with mental health issues resulting from discrimination, stigmatization and prejudice (Raine, 2004). Self-esteem issues for children who are obese have been shown to begin in childhood (Wang et al, 2009).

## **Economic Burden**

According to the WHO, the economic costs of managing chronic diseases caused by obesity threaten to overwhelm health systems globally (WHO, 2000). The economic costs of obesity in Canada are estimated at \$4.3 billion (2003\$) which is roughly 2.2% of total health care costs. This is divided into direct costs of \$1.6 billion (obesity related hospital care, drugs, physical care, and other direct health expenditures) and indirect costs of \$2.7 billion (loss of economic output, activity lost due to short and longer term disability and the value of life lost due to premature death) (Katzmarzyk & Janssen, 2004). These are similar to British and Australian estimates. The costs of obesity are expected to rise as prevalence increases. The predicted burden on the health care system in British Columbia due to obesity is said to be \$380 million a year, 4.5% of total direct

health care costs. If indirect costs are included the amount rises to \$730 - 830 million a year or 0.8% of provincial GDP (GPI Atlantic, 2001).

Some analysts claim the obesity epidemic is responsible for rising health care costs and the impending collapse of the publicly funded health care system. However, this proclamation is contested by health economists like Dr. Robert Evans. Evans acknowledges the increasing rate of obesity and resulting chronic diseases but suggests rising health care costs are attributable to changes in patterns of clinical practice, including pharmaceutical prescribing and increasing intensive clinical practice, not obesity (2007). He believes blaming the obesity epidemic for the increasing costs of health distracts from the true reasons for increased costs and from measuring the perceived benefits of these increased costs. Using economics to fuel the call for immediate response is a strategic move but threatens to lay blame falsely on already vulnerable populations. Issues like obesity and the aging population are not solely responsible for the recent rise in health care costs (Evans, 2007).

## **BC Healthy Built Environment Alliance**

At a conference in 2004, Canadian Institute of Health Research (CIHR) and Heart and Stroke Foundation of Canada (HSFC) identified the built environment as a key area of research and innovation in addressing obesity prevention. In the fall of 2007 PHSA hosted forum on health and the built environment. The goals of the Forum were to build relationships between health and non-health sectors, to build a shared understanding of the issues, to identify key messages for stakeholders and resources needed for action, and

determine if there was an interest in establishing a provincial network. The Forum focused on physical inactivity and the associated burden of disease from obesity and related chronic diseases. Forum participants identified the need for partnerships between planning, public health, local government and researchers and a “Centre” for research as priorities for action. Lack of awareness of the influence of the built environment in preventing overweight and obesity, and the lack of local leadership were identified as the key barriers.

In response to the Forum, the PHSA undertook to foster the development of the BC Healthy Built Environment Alliance, a network of stakeholders from multiple sectors including planning, health, transportation, education, local government, and community NGOs from across the province. The Alliance was strengthened by the existing networks within member organizations (ex., UBCM, BCRPA and BCHLA). The early focus of the Alliance was on physical activity with recognition there were other important factors to consider in the built environment including access to nutritional foods, air and water quality, safety and injury prevention, and the effect of crime and social issues on mental health (John Millar, Forum speaking notes).

The initial activities undertaken by the Alliance focused on building awareness among public health and planning professionals. “Planning 101”, a project to teach health professionals about land use planning terms and principles, was launched in June 2008. At the same time, consultations with the planning, design, and government sectors were taking place. From these consultations “Health 201 for Planners” evolved. The goal of this project is to aid

planners and design professionals to prepare projects to create healthy built environments. This project is scheduled to be launched in spring, 2010.

The purpose of this paper is to synthesize the literature on social and economic environmental influences of obesity. This synthesis is expected to be useful to the Alliance to support the next phase of planning to address obesity prevention in the province.

## **METHODOLOGY**

This report used a focused review and analysis of the current literature on environmental influences of obesity. The approach was selective rather than exhaustive. Relevant scientific electronic databases (e.g., Pubmed, BioMed Central, Statistics Canada and Google Scholar) and targeted journal databases (e.g., Obesity Reviews, Annual Review of Public Health) were used. The search was restricted to review articles using keywords “obesity”, “obesity prevention”, and “environmental influences of obesity”. Search results were reviewed for social and economic influences. A few seminal review articles were found and their reference lists hand searched for further key articles. In the last five years the body of literature related to obesity has grown exponentially. This review kept a narrow focus in order to remain manageable within the requirements of a master’s level project.

## **RESULTS**

### **Factors influencing weight gain**

Weight gain is influenced by individual and population level factors. At the individual level weight gain is influenced by diet, physical activity, biology and genetics (Herbert et al, 2006). Traditionally, health promotion efforts in the prevention of obesity have focused on individual level behaviours of diet and physical activity. These efforts have for the most part been unsuccessful in preventing the obesity epidemic. A leading obesity research group in the UK recognizes the role of the individual as central to the obesity issue but argues that it is not a matter of personal responsibility but people's lifestyle choices as they are influenced by broader social, economic, physical, cultural and political forces that are beyond an individual's control (Butland et al, 2007). According to the World Health Organization (2000), "the fundamental causes of the obesity epidemic are societal, resulting from an environment that promotes sedentary lifestyles and the consumption of high-fat, energy-dense diets" (p. 240). We are increasingly living in obesogenic (obesity promoting) environments that encourage excessive food intake and discourage physical activity (Raine 2004, Reidpath et al, 2002).

The following section will provide an overview of recent literature on key determinants within the social and economic environment that influence weight gain through the modifiable behaviours of diet and physical activity.

## **Social Environment**

There are proximal and distal factors within the social environment that influence physical activity and diet. Proximally, individuals are influenced by their family, school, neighbourhood and workplace environments. Distally, individuals are influenced by the food environment, and the advertising and marketing environment. The social environment as an influence on weight gain is less understood than individual behaviour and the physical environment (Raine, 2004). This section will examine the social environment as an influence on individual behaviour and decision making. Here, the social environment consists of the immediate environments of schools, families and workplaces, the food environment, and the advertising and marketing environment.

### ***School Environment***

Children spend the majority of their day at school. Schools have been the focus of much recent research and attention as important influences of childhood obesity. Children now have less physical education and therefore less opportunity for physical activity compared to children 20 years ago. Only 20% of school children receive daily physical activity, 41% receive one to two days per week, and 10% receive no physical activity at all (PHAC, 2008). Active transportation to school has also decreased over the past 20 years. Now, one third of children walk to school and less than one in 20 ride a bike. Reasons cited for decreased active transportation include distance to school and perceptions of safety (PHAC, 2008).

Veugelers and Fitzgerald (2005a) studied risk factors for childhood overweight and obesity including dietary habits, activities and the school environment using a sample of 4298 grade 5 students from Nova Scotia, their parents and school principals. They found that students who bought lunch at school were at increased risk of being overweight and students who had physical education classes at school two or more times a week were at decreased risk of being overweight and obese.

### ***Home Environment***

According to research done by the UK Foresight group (Butland et al, 2007) parental obesity increases the risk of childhood obesity by 10% and is the strongest predictor of childhood obesity. This is a result of various biological, social and environmental factors. Today, the home environment is characterized by more time engaged in sedentary activities like TV and computers (French, Storey & Jeffery, 2001). Working parents have less time and energy to participate in physical activities with their children and perceptions of danger keep children from playing outdoors. In recent studies home and family environments have been shown to have an impact on children's overweight and obesity status. In studying the home environment, Veugelers and Fitzgerald (2005a) found that children who had supper with their family three or more times per week were at less risk for being overweight or obese.

### ***Workplace Environment***

Adults spend the majority of their day at work. Workplaces are becoming increasingly sedentary settings. Workers are spending more time at their desk and working longer hours. Hu et al (2003) found that each 2 hour per day increment spent sitting was associated with a 5% increase in obesity and 7% increase in diabetes. Even jobs requiring manual labour including farming, construction, and manufacturing are becoming more automated.

Workplace environments offer an opportunity for workers to be influenced by the types of food available in workplace cafeterias, vending machines and shops in close proximity to the workplace. Increased car use and longer distances commuting to the workplace have resulted in increased physical inactivity in the adult population (Frank, Andersen and Schmid, 2004).

### ***Food Environment***

Today's food environment is characterized by convenient, fast and cheap food available away from home in restaurants, schools, workplaces, and grocery stores. In Canada, eating outside the home increased from 25% to 30% between 1989 and 2001 (Statistics Canada, 2001). The number of fast food restaurants grew by 89% from 1972 to 1995 and the number of meals consumed increased by 200% from 1977 to 1995 (French, Story & Jeffery, 2001). It is believed that eating at fast food restaurants significantly impacts eating behaviour and is associated with higher energy and fat intake and weight gain (French, Story & Jeffery, 2001).

Convenient food tends to be lower in nutrients and higher in calories, fat and salt compared to food available at home (French, Story & Jeffery, 2001). People are eating significantly more calories than ever before and far more than are needed given the overall decrease in energy expenditure. The consumption of added fats doubled between 1909 and 1998 and the consumption of pop increased by 131% from 1977 to 1996 (French, Story & Jeffery, 2001).

Larger serving sizes are believed to be a significant contributor to the increased consumption of high energy and fat foods (French, Story & Jeffery, 2001). Portion sizes have increased in restaurants as well as pre-packaged foods like bagels and muffins which have doubled in size in the past 20 years. A “child size” pop at McDonalds today was a “king size” in the 1950’s (French, Story & Jeffery, 2001). Researchers have found that larger packaging encourages over consumption compared to smaller packaging (French, Story & Jeffery, 2001).

Increased availability, increased affordability, and increased portion sizes are all factors that contribute to a food environment that leads to over consumption of energy dense, nutrient poor, high fat, high sodium food.

### ***Advertising and Marketing Environment***

The consumer is more than ever exposed to advertising of convenience foods including fast food restaurants, pop and pre-packaged convenience foods. The internet has been added as a source of advertising along with traditional forms of TV and billboards. TV is the largest venue for mass media advertising.

There are more homes with TVs and people are spending more time in front of the TV. In 1997, the food industry spent 97% of their advertising budget on TV advertisements (French, Story & Jeffery, 2001). Food manufacturers, retailers and services in the US spent \$11.6 billion on mass media and advertising campaigns in 1997, whereas the USDA spent \$333 million on nutritional campaigns (French, Story & Jeffery, 2001).

There seems to be evidence of a relationship between advertising and consumption; the foods most advertised are those most consumed (snacks, convenience foods, soft drinks and alcoholic beverages) and the inverse is also true, the foods less advertised are the least consumed (fruits and vegetables). Evaluation data from a national advertising campaign by the USDA to increase the consumption of fruits and vegetables demonstrated an increased awareness and consumption of these foods after the campaign (French, Story & Jeffery, 2001). In studying children's food preferences, Robinson et al found a significant difference in preference if children perceived the food to be from McDonalds (2007).

## **Economic Environment**

There are various proximal and distal factors in the economic environment related to obesity – proximally these influences include individual purchasing decisions and family SES. Distally influences include availability, affordability and access to healthy foods. At the policy level influences include price incentives and disincentives. This section will review neighbourhood SES as a proximal factor and food costs as a distal factor influencing obesity.

### ***Neighbourhood SES***

Inequities in health outcomes related to SES have been established for many chronic diseases related to overweight and obesity including diabetes and heart disease. A clear social gradient appears for these diseases whereby people with lower SES have higher prevalence of disease. The relationship between SES and obesity appears more complex. A social gradient appears but is mediated by gender where the relationship appears for women but not men. Women with middle and lower income and men with the highest income are more likely to be obese. Mediating factors may include food security and access to recreation facilities. At the neighbourhood level there appears to be a clear social gradient, where neighbourhoods with higher material deprivation (educational attainment, unemployment rates, percentage of households living below LICO [Low Income Cut Off]) are associated with higher BMI (Drewnowski & Specter, 2004; Oliver & Hayes, 2005; Oliver & Hayes, 2008).

There is some evidence of an association between neighbourhood SES and food security and physical activity. Research suggests that people living in deprived neighbourhoods have increased access to fast food restaurants, fewer grocery stores with affordable healthy foods (Oliver & Hayes, 2005). Research has shown that in higher income neighbourhoods less energy dense food is purchased than in lower income neighbourhoods. This may be related to a number of factors including the types of food available, advertising of foods and purchasing power in those neighbourhoods.

Oliver and Hayes (2005) used cross-sectional data from the National Longitudinal Survey on Children and Youth to study neighbourhood socio-economic status and the prevalence of overweight and obesity in Canadian children and youth. They found a social gradient with the prevalence of overweight and obesity and SES; as neighbourhood SES decreased the odds of being overweight increased (OR=1.29). They found that as neighbourhood SES decreases, fewer children participated in *organized* physical activity. There was no difference with *unorganized* physical activity. The relationship between organized physical activity and SES is unclear and may be due to lack of facilities, lack of resources or lack of awareness or interest in available resources (Oliver & Hayes, 2008). Lower SES neighbourhoods were also associated with perceptions of unsafe playgrounds and parks.

In 2008 Oliver and Hayes conducted a similar study again using data from the National Longitudinal Survey on Children and Youth. In this study they found children living in the poorest neighbourhoods had an increasing BMI over time compared to those living in middle income neighbourhoods. They conclude that there is evidence to support that neighbourhood disadvantage has an effect on children's BMI between childhood and early adolescence. Both of these studies suggest the need to focus policies to reduce childhood obesity on neighbourhood environments.

### ***Food Costs***

When considering the role of food cost on obesity there are a number of considerations including how cost impacts purchase decisions at the individual

level and the impact of the greater affordability of energy-dense foods versus the cost of healthy foods.

At the individual level, food costs appear to influence food purchases. Studies done in the US in schools and workplaces demonstrated that a reduction in cost of low-fat snacks in vending machines consistently increased purchases. Other studies have demonstrated the same affect with fruits and vegetables, i.e., as price decreased purchases increased (French, Story & Jeffery, 2001). Food prices have been decreasing over the years and this greater affordability is believed to contribute to over consumption of energy dense foods (French, Story & Jeffery, 2001). Drewnowski and Specter (2004) found an inverse relationship between energy density and energy cost whereby as energy-density increases price decreases. This makes unhealthy foods the most affordable for the consumer. Food pricing has the potential to effect food purchases and thus eating behaviour.

The effect of food pricing on consumption is similar to research done with tobacco and alcohol. As prices increased consumption decreased. Increasingly, the food industry is being compared to the tobacco and alcohol industries which have built a business model on supplying populations with unhealthy products at reduced cost in return for significant corporate profits.

## **Limitations in Research**

Until very recently there was little epidemiological data to support evidence of the environmental influences on obesity. There was limited

surveillance data on physical activity and limited data on energy and nutrient content of food in the Canadian diet (Raine, 2004). Advancements in a number of scientific fields including better epidemiological evidence on obesity risk factors, results from clinical controlled trials, and interventions that demonstrate a reduction in risk are helping to build the evidence base (WHO, 2003). Despite recent advancements, establishing a relationship and determining the strength of the relationship between environmental factors, and between these factors and obesity risk remains a key methodological challenge (Raine, 2004). More robust evidence is needed to build the evidence base.

Many factors are related to individuals' lifestyle choices, for example, a person's choice to walk instead of driving may be influenced by their perception of safety, perception of convenience, the street design and visual aesthetics of their neighbourhood, and their physical ability. The number of influencing factors makes it difficult to draw causal relationships. A further difficulty is the amount of time needed to appreciate the impacts of environmental interventions. Policy interventions can take decades before outcomes are realized, making it difficult to build the evidence base in the short-term. Longitudinal studies are better at determining associations, yet much of the current research in this area is based on cross-sectional studies. Longitudinal studies are needed to assess changes in health related outcomes before and after exposure to changes in environments.

Although the evidence is weak, small effects from environmental interventions can translate into significant impacts as they reach a large proportion of the population. Environmental interventions are focused at the

population level and thus impact behavioural decision making in the context in which decisions are made. Environmental interventions are the most effective at promoting healthy behaviours and thus at disease prevention.

## **DISCUSSION**

### **Intervention Priorities**

The above literature review provides an overview of influences associated with obesity within the social and economic environment. Using the evidence from above, the following discussion will highlight promising areas for intervention within these environments. The cost-effectiveness of these interventions is not discussed and would need to be considered to identify implementation priorities.

### **Social Environment**

#### ***School Environment***

Schools offer the best opportunity for public health interventions as early influences on childhood overweight and obesity. They are ideal setting as children spend the majority of their day in school, it is a somewhat 'controlled' environment, and widespread policy interventions are possible through school board regulations. When planning a school-based intervention there are a number of possible foci: physical activity and nutrition interventions alone or combined; formal physical education classes; opportunities for physical activity during the school day and before and after school; the food environment including the food served in school cafeterias, vending machines, and the food available near the school grounds, as well as school gardens. School-based

interventions can also be combined with community interventions. Unfortunately, the evidence base for school-based interventions remains small due to few studies and poor methodologies (Kropski, Keckley, & Jensen, 2008).

In a recent systematic review of school-based interventions to prevent childhood obesity, Brown and Summerbell (2009) found that interventions that combined physical activity and diet may have helped to prevent childhood obesity in the long-term. Interventions focused only on physical activity were suggestive of the prevention of childhood obesity in the short-term, especially in girls. Veugelers and Fitzgerald (2005b) found that students from schools that followed a coordinated comprehensive program for school-based healthy eating programs had significantly lower rates of overweight and obesity, consumed more fruits and vegetables, had less calorie intake from fat and higher dietary quality, and reported more physical activities and less participation in sedentary activities than students from schools without nutrition programs.

Other studies have found that comprehensive school-based programs that involved community interventions have been successful in the prevention of childhood obesity (Economos et al, 2007; Romon et al, 2008). A longitudinal study conducted with school children in France included a school-based program along with a community-based program that was conducted in two towns over a period of 12 years from 1992 to 2004 (Romon et al, 2008). In 2004, the prevalence of childhood obesity in the intervention towns was significantly lower than the comparison towns (8.8% compared to 17.8%). School-based programs

combined with community-based programs seem to suggest the most successful outcomes towards preventing childhood obesity.

### ***Home Environment***

There is a serious lack of evidence for obesity prevention interventions in home and workplace environments. The home environment is difficult to control therefore difficult to study, relying on self-report and recall which are subject to much possible bias. Widespread policy interventions are not possible in private homes. Workplaces however offer a better environment for interventions as there is better opportunity for control and widespread corporate policies.

### ***Workplace Environment***

Workplaces have a role to play in obesity prevention and offer many opportunities for interventions focused on physical activity and nutrition. Employers can offer incentives for active transit, ex., subsidize bus passes, provide safe bike storage facilities and showers, improve stairwell aesthetics and provide prompts to encourage use, provide kitchen facilities to support healthy diets, and provide healthy choices in vending machines.

The evidence supporting the long-term benefits of workplace interventions is poor as there are few good studies that focus on workplace interventions (Benedict & Arterburn, 2008). In a systematic review, Benedict and Arterburn (2008) found 11 RCTs (randomized control trial) that focused on education and counseling to improve diet and physical activity. Methodologies were poor and the varied designs did not allow for quantitative analysis. Despite these

methodological flaws, the intervention groups lost significantly more weight than the controls, indicating moderate short-term benefits in body weights. Evidence supporting long-term benefits was lacking. More and better studies focusing on both short-term and long-term health and economic benefits are needed.

Benedict and Arterburn (2008) suggest studies that focus on comprehensive interventions including educational, behavioural, environmental and economic supports.

### ***Food Environment***

The food environment offers many opportunities for policy interventions. Given the increased number of fast food restaurants and the increased amount of time spent eating in fast food restaurants restrictions on the number and location of restaurants should be considered. This could be accomplished through land-use planning policies and municipal by-laws restricting zoning. This is especially important in deprived neighbourhoods and near schools where access to full service grocery stores is often limited. This intervention must be combined with increasing the availability of healthy foods at affordable prices and within walking distance for all neighbourhood residents.

Portion sizes must return to be in line with caloric needs. Society needs a reversal of the 'supersize' culture which is influenced by marketing techniques, packaging and ultimately consumer values and behaviours. Policies to control portion sizes in restaurants and manufacturing industries should be considered. Decreasing portion sizes would not negatively impact these industries as fewer

ingredients would be needed for the same retail price. This intervention would need to be associated with changing societal perceptions of value for money.

### ***Advertising and Marketing Environment***

The advertising and marketing environment influences behaviour and thus offers a good venue for interventions to both restrict advertising of junk food and increase advertising of healthy foods. Advertising restrictions on TV, and increasingly on the internet, should be considered especially during children's programming. The province of Quebec is the only jurisdiction to institute a total ban on junk food advertising to children on TV.

Studies have shown that residents in deprived neighbourhoods are disproportionately exposed to junk food advertising on billboards (Yancey et al, 2009). With obesity rates higher in lower SES populations, policy makers should consider advertising restrictions in certain neighbourhoods. To encourage advertising of healthy foods, policy makers need to consider providing incentives through advertising subsidies to the manufacturers and sellers of healthy foods.

### **Economic Environment**

There are two predominant themes within the economic environment, socio-economic disparities and the increased affordability of junk food.

#### ***Neighbourhood SES***

Neighbourhood SES has been shown to be associated with food insecurity and less access to recreational facilities (Oliver & Hayes, 2005). In

some studies it has also been associated with BMI and with obesity (Oliver & Hayes, 2008). With increased availability and affordability and increased exposure to advertising of junk food lower SES populations are at the greatest risk for overweight and obesity. Therefore, to tackle the inequitable prevalence of obesity policy makers must consider interventions that focus on these target populations to increase the availability and affordability of healthy foods. Ultimately, to have the biggest impact on obesity and disease prevention, policy makers must consider poverty reduction strategies. This topic is outside of the scope of this paper however has the potential for the greatest societal benefits.

### ***Food Costs***

The greater affordability of energy-dense, nutrient poor food is considered a significant influence on the over-consumption of junk foods. Food pricing has been shown to have an impact on food purchases (French, Story & Jeffery, 2001). In order to limit junk food purchases, a tax on junk food has been proposed as a possible intervention.

Taxes can take two forms, an excise tax, or a sales or “sin” tax. An excise tax works at the level of the manufacturer and a “sin” tax works at the level of the individual. An excise tax would impose a levy on ingredients that are added to foods like sugar, salt and fat. This type of tax is meant to act as a disincentive to manufacturers who use these ingredients in their processing. Ultimately, this type of tax is passed on to the consumer in the price of the good. A sales tax is levied at the point of purchase. It is considered a “sin” tax on the consumer how is the most penalized in this scenario.

Taxes work as disincentives for undesired behaviours while subsidies work as incentives for desired behaviours. At the same time taxes are levied on unhealthy foods, policy makers should consider subsidies for healthy foods. Subsidies can be offered to growers, distributors or sellers of healthy foods with the ultimate goal being a reduction in the cost of healthy foods for the consumer. If subsidies are not possible, removing taxes on consumer products that support healthy lifestyle choices including food should be considered.

The interventions described above require further research to assess feasibility, impact and cost-benefit within the BC context. Although more research and better methodologies are needed to strengthen the evidence, there is enough evidence to take immediate action.

## **CONCLUSION**

The rising rates of obesity are a major public health concern due to the proportion of populations affected (especially vulnerable populations – children, low SES and Aboriginal populations), the resulting health impacts, the direct and indirect costs of obesity and the preventable nature of the problem. Isolated initiatives have not worked. Due to the complex nature of obesity a comprehensive, integrated and long-term solution is required (Butland et al, 2007).

Three predominant themes emerged from the review of the literature; the need for comprehensive strategies, intersectoral action, and a focus on decreasing disparities. Comprehensive strategies involve interventions across multiple environments, social, economic and physical, and levels within those environments: individual, family, community, organization, and political spheres. Researchers suggest effective solutions demand changes in behaviour at the individual, family, community, organization and economic levels (Butland et al 2007; Kumanyika, 2001). The social ecological model (Bronfenbrenner, 1979) suggests the need for interventions at all levels as interrelationships between levels means that changes in one environment impacts outcomes in other environments. Interventions at one level act as an influence and reinforcement in another. Intersectoral action requires the engagement of stakeholders from multiple sectors including education, transportation, public health, land-use

planning and community capacity building. Approaches in one sector or “siloes” approaches in more than one sector have not worked. All sectors are required to be engaged and to work collaboratively. Finally, the inequitable distribution of obesity prevalence requires a focus on the causes of obesity within at-risk populations and strategies that target the identified causes. In this arena public health has much to contribute.

The BC Healthy Built Environment Alliance has many of the beneficial components needed to lead a comprehensive and integrated obesity prevention strategy; many of the relevant sectors are involved, working relationships have been established, and many of the members share a mandate for healthy living strategies that include obesity prevention. However, currently the focus of the Alliance is the built environment. To include a comprehensive obesity prevention agenda the mandate of the Alliance would need to be expanded to include influences of obesity outside of the physical environment. This may prove to dilute the current focus of the Alliance.

The BC Healthy Built Environment Alliance can however serve as a model of a multisector alliance. It can also serve as a platform to invite members who represent many of the key stakeholder groups from government ministries, community-based NGO's and the health sector that would need to be involved in a provincial obesity prevention strategy. In order to broaden the focus to include influences of obesity within the social and economic environment membership would need to be expanded to include the food, education, municipal and financial sectors.

Obesity is a societal problem caused by a complex web of factors related to rapid lifestyle changes and an increasingly obesogenic environment. A complex problem requires a complex solution. Obesity requires a whole of society approach rooted in population health and social justice principles.

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