



Overweight and Obesity in Canada



A Population Health Perspective

Overweight and Obesity in Canada: A Population Health Perspective

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About the Canadian Population Health Initiative

The Canadian Population Health Initiative (CPHI), a part of the Canadian Institute for Health Information (CIHI), was created in 1999. The mission of CPHI is twofold: to foster a better understanding of factors that affect the health of individuals and communities, and to contribute to the development of policies that reduce inequities and improve the health and well-being of Canadians.

As a key actor in population health, CPHI:

- provides analysis of Canadian and international population health evidence to inform policies that improve the health of Canadians;
- commissions research and builds research partnerships to enhance understanding of research findings and to promote analysis of strategies that improve population health;
- synthesizes evidence about policy experiences, analyses evidence on the effectiveness of policy initiatives, and develops policy options; and
- works to improve public knowledge and understanding of the determinants that affect individual and community health and well-being.

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It should be noted that the analyses and conclusions in the report do not necessarily reflect those of the individual members of the Expert Advisory Group, their affiliated organizations, CPHI, or CIHI.

Executive Summary

The purpose of this paper is to synthesize the current state of knowledge related to: 1) the nature and extent of the problem of obesity; 2) the impact of obesity as a case for prevention and control; 3) a population health perspective on the determinants of obesity; and 4) the effectiveness of strategies for addressing obesity and its determinants. Based upon the synthesis of evidence collected from both research (peer-reviewed) publications (located through health-related searchable databases) and program/policy documents (located primarily through governmental Web sites), a final objective is to identify priorities for future policy-relevant research and present options for promising interventions for reducing population obesity levels.

Impact of Obesity: Case for Prevention and Control

The dramatic increases in overweight and obesity among Canadians over the past 20 years have been deemed to constitute an epidemic. According to the WHO (World Health Organization),¹ 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 need for prevention and control is clear. Given available evidence, the economic impacts of obesity on the Canadian health system could be considerable. Gaps in existing surveillance of obesity, associated non-communicable diseases, and economic impacts limit understanding of the problem based on accurate, accessible, and appropriate data. Addressing these gaps could facilitate adequate understanding of this problem for targeting appropriate, efficacious, and cost-effective public health interventions.

Determinants of Obesity: A Population Health Perspective

Individual/behavioural determinants: diet and physical inactivity. Data available on the energy and nutrient content of the Canadian diet is limited. Although ecological food disappearance data suggests that Canadians consume more food today than they did 20 years ago, nutrition surveys suggest the opposite. Gaps in food and nutrition surveillance data pose a barrier to understanding the determinants of obesity in Canada.

Available data suggests that physical inactivity is decreasing. The majority of the population, however, continues to be sedentary. Limitations of physical activity surveillance pose a barrier to understanding the contribution of physical inactivity and sedentary lifestyle to obesity.

Environmental determinants: the context for individual behaviour. There is general agreement that the current epidemic of obesity is largely related to an environment that, in multiple ways, promotes excessive food intake and discourages physical activity. Social differences between and within countries constitute evidence that may provide important insights into ways of influencing changes that could alter the obesity trend. Lack of available Canadian data on environmental determinants of food consumption and physical activity patterns limits the development of evidence-based recommendations for practice and policy.

Social determinants: socioeconomic status/poverty. The sociocultural context of obesity is less well understood than its behavioural and environmental contexts. Canadian data demonstrate increased risk of obesity among groups with low social status. For adults, education is a strong determinant; for children, household income plays a major role. The mechanisms by which low socioeconomic status (SES) is associated with obesity are complex. There is evidence to suggest that behaviour patterns of people living in poverty are more likely to promote obesity than those of their higher-income counterparts. However, those behaviours are embedded within environmental and social contexts that are well beyond individual control. Availability of low-cost, nutritious food and safe, inexpensive places to be active may be limited for low-income people. Increasing social inequities and associated stress may have biological impacts. Social policies linked to poverty and income inequity may have impacts on health, including obesity.

Addressing Obesity and Its Determinants: An Ecological Approach

The problem of obesity is complex. Ecological approaches to the promotion of healthy weights acknowledge this complexity and recommend action on many levels. Most strategies for promoting changes in dietary and physical-activity behaviour to date have focused on individuals and groups. The review of determinants of obesity, however, suggests a broader change in social environments.

Environmental strategies to promote healthy living. Environmental strategies involve institution- and community-based interventions to promote healthy living. That is, their focus of outcome is not necessarily on weight/obesity per se, but on encouraging healthy eating, increased physical activity, and decreased sedentary living. Implementation of environment-based strategies to encourage and support behaviour change will probably require the involvement of people from relevant sectors outside the obesity field. Schools, worksites, and local municipalities/neighbourhoods are likely settings for change. Existing models and programs provide promising evidence of demonstrated effectiveness in Canada and elsewhere.

Strategies for population-wide structural change. Evidence suggests that most effective interventions to change diet and physical-activity patterns at the population level 1) adopt an integrated, multidisciplinary, and comprehensive approach; 2) involve a complementary range of actions; and 3) work at individual, community, environmental, and policy levels. Ensuring that programs are well resourced and integrated into existing

programs and structures requires political support. Capacity to make large-scale, macrosystem changes in a social environment that promotes obesity depends, in part, upon political will. To that end, there has been a call for policy interventions.

This paper presents many examples of viable policy options for population-based obesity prevention, based upon evidence generated from Canadian and international knowledge and experience with other health issues (such as tobacco). Evaluation of large-scale interventions, including economic-impact evaluations and long-term surveillance of program impacts, are suggested to increase the evidence base for public health decision-making at the policy level and to combat an environment that promotes obesity.

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Introduction

In Canada and worldwide, rising rates of obesity over the past 20 years have significant public health implications. Addressing obesity, however, requires knowledge of its determinants and root causes. Behavioural determinants of obesity—excess energy intake via diet and decreased energy expenditure via physical inactivity—are well established. However, less well understood are environmental and social determinants of those behaviours, and ways to change behavioural determinants. Applying a population health lens to the problem of obesity may provide insight into potential means of addressing obesity and its determinants through a wide variety of policy options.

The purpose of this paper is to synthesize the current state of knowledge related to: 1) the nature and extent of the problem of obesity, 2) the impact of obesity as a case for prevention and control, 3) a population health perspective on the determinants of obesity, and 4) the effectiveness of strategies for addressing obesity and its determinants. Based upon the synthesis of evidence, a final objective is to identify priorities for future policy-relevant research and present options for promising interventions to reduce population obesity levels.

Search Methodology

The literature collected for this scoping paper included both research (peer-reviewed) publications, located through health-related searchable databases, and program/policy documents (“grey literature”) located primarily through governmental Web sites. Key search terms for research literature and Web searches were guided by the Canadian Population Health Initiative (CPHI) Theme Statement on Obesity, and included: obesity, prevention, social determinants of health (social/economic), health promotion, and policy. Research literature was identified through the MEDLINE, ERIC, PsychINFO, and CINAHL databases. Years searched were 1997 to 2003. Bibliographies of highly relevant papers were also scanned for applicable references, which revealed some seminal references pre-dating 1997. CPHI staff and members of the Expert Reference Group, which guided the development of this paper, were also asked to forward relevant references; most policy-related documents were located through referrals from these key informants.

The Problem: Increasing Prevalence of Obesity

In the discussion of prevalence trends in the sections below, WHO (World Health Organization) guidelines,¹ using Body Mass Index (BMI) calculated from weight and height (kg/m²), were used to classify adults as normal weight (BMI = 18.5 to 24.9 kg/m²), overweight (BMI = 25.0 to 29.9 kg/m²), and obese (BMI ≥ 30 kg/m²). Health Canada, Office of Nutrition Policy and Promotion, has adopted these guidelines.² BMI has limitations, as it classifies obesity based upon weight and height only, not taking into consideration body composition (adiposity vs. lean weight) or fat distribution on the body. Therefore, it may not be an accurate predictor of risk among very muscular individuals, youth who have not yet met their full height potential, and the elderly. Health risks may also vary among different ethnic groups for the same BMI.² However, BMI allows for meaningful comparisons between populations and is relatively easy to ascertain from measured or self-reported data.

Table 1 Body Weight Classifications in Adults	Body Mass Index (kg/m ²)	Classification	Descriptor
	< 18.5	Underweight	May be associated with health problems for some people
	18.5 to 24.9	Normal weight	Good weight for most people
	25.0 to 29.9	Overweight	Increasing risk of developing health problems
	≥ 30	Obese	High risk of developing health problems
Sources: World Health Organization, <i>Obesity: Preventing and Managing the Global Epidemic</i> , WHO technical report series no. 894 (Geneva: World Health Organization, 2000); Health Canada, <i>Canadian Guidelines for Body Weight Classification in Adults</i> (Ottawa: Health Canada, 2003).			

International Trends

At the population level, a review of overweight/obesity prevalence trends reveals consistent increases in industrialized nations, but considerable variability internationally in magnitude of change. Using WHO definitions for adult overweight and obesity, Flegal reviewed English-language publications of large-scale systematic surveys (1989–1998) that included BMI.³ The prevalence of obesity among industrialized nations has risen dramatically (> 5 percentage points) in Canada (limited to self-reported data), Finland (men), New Zealand, the United Kingdom (UK), and the United States (U.S.). Smaller increases have been observed in Australia, Brazil, China (men), Germany, Israel, Mauritius, the Netherlands, and Sweden (self-report). It should be noted that an increase in five percentage points of obesity may represent much higher growth rates in obesity prevalence. For example, among Canadian males in this study, obesity rates increased from 20% to 30%. This increase of 10 percentage points translates to a 50% growth in obesity prevalence.

American Trends

Within a North American context, trends in the U.S. are more readily assessed than those in Canada, owing to the former's more comprehensive surveillance system. Data from successive, nationally representative, cross-sectional surveys (National Health and Nutrition Examination Surveys [NHANES]) from 1960 to 1994, which calculate BMI from measured height and weight, revealed marked increases in the prevalence of overweight and obesity (BMI ≥ 25) among adults during this period.⁴ Prevalence rates were quite stable from 1960 to 1980. As illustrated in Table 2, however, between the 1976–1980 survey (NHANES II) and the 1988–1994 survey (NHANES III), prevalence rates of people exceeding healthy weight standards (BMI ≥ 25) rose from 46.0% to 54.4%, and obesity (BMI ≥ 30) rates rose from 14.5% to 22.5%. Interestingly, the prevalence of overweight (BMI 25 to 29.9) showed little change over the same period (31.5% to 32.0%), while the increase in Class I obesity (BMI 30 to 34.9) rose from 10.1% to 14.4%, and rates of Class II and III obesity (BMI ≥ 35) rose from 4.4% to 8.1%. The age-adjusted total rates of adult (20 to 74 years) overweight and obesity reveal that the majority of the U.S. population (56.3% total; 61.1% of men, 51.2% of women) exceeds current healthy weight standards (BMI ≥ 25).⁴

Table 2 Trends in Prevalence of Overweight and Obesity Among U.S. Adults	Percentage U.S. Adults	
	NHANES II (1976–1980)*	NHANES III (1988–1994)*
Exceed healthy weight standards (BMI ≥ 25)	46.0	54.4
Overweight (BMI 25 to 29.9)	31.5	32.0
Obesity (BMI ≥ 30)	14.5	22.5
Class I obesity (BMI 30 to 34.9)	10.1	14.4
Class II and III obesity (BMI ≥ 35)	4.4	8.1
* Measured height and weight		
Source: K. M. Flegal, M. D. Carroll, R. J. Kuczmarski, C. L. Johnson, "Overweight and Obesity in the United States: Prevalence and Trends, 1960–1994," <i>International Journal of Obesity & Related Metabolic Disorders</i> 22, 1 (1998): pp. 39–47.		

The Behavioral Risk Factor Surveillance System (BRFSS) monitored BMI based upon self-reported height and weight from an annual population-based cross-sectional telephone survey of adults (> age 18). From 1991 to 1998, BRFSS revealed a steady increase in obesity (BMI ≥ 30) in all states; for both sexes; and across all age groups, races, and education levels; the highest increases were among the youngest age groups and higher education levels.⁵ The increases in overweight and obesity continued from 1998 to 2001.⁶ From 1991 to 2001, the percentage of overweight (BMI ≥ 25) adults increased from 45% to 58% (65.9% of men and 49.9% of women in 2001).⁶ Of particular concern are the dramatic increases in clinically severe obesity. Self-reports from BRFSS revealed that while obesity rates (BMI > 30) doubled from 10% to 20% between 1986 and 2000, prevalence of BMI > 40 quadrupled, from 0.5% to 2%.⁷ These trends suggest a shift in the population distribution of overweight and obesity rather than simply an increase in the number of cases.

Canadian Trends

Canadian trends rely upon a number of different population-based surveys with varying methodologies (for example, self-reported vs. measured height and weight). Examination of trends for adults (aged 20 to 69) participating in three national health surveys, which shared similarities in context and procedures in that they obtained measured height and weight (Nutrition Canada Survey 1970–1972, Canada Health Survey 1978–1979, and Canadian Heart Health Surveys [CHHS] 1986–1992), provide the most comparable data for assessing changes over time.⁸ These data are summarized in Table 3. For men, overweight and obesity gradually increased, from 47.0% in 1970–1972, to 55.6 % in 1978–1979, to 58.1% in 1986–1992. Similar trends were noted among all age groups. For women, increases in overweight and obesity were observed from 1970–1972 to 1978–1979 (33.9% to 42.3%), but a slight decrease was observed from 1978–1979 to 1986–1992 (42.3% to 40.6%). The decrease can be entirely attributed to the decrease in overweight and obesity among women aged 45 to 69 years (60.9% to 55.1%), while gradual increases were noted through all three time points for women aged 20 to 44 (24.3% to 28.4% to 31.8%).⁸

Table 3 Trends in Prevalence of Overweight and Obesity Among Canadian Adults	Percentage Canadian Adults With BMI ≥ 25*		
	Nutrition Canada Survey 1970–1972	Canada Health Survey 1978–1979	Canadian Heart Health Surveys 1986–1992
Men	47.0	55.6	58.1
Women	33.9	42.3	40.6
* Measured height and weight			
Source: G. M. Torrance, M. D. Hooper, B. A. Reeder, "Trends in Overweight and Obesity Among Adults in Canada (1970–1992): Evidence from National Surveys Using Measured Height and Weight," <i>International Journal of Obesity & Related Metabolic Disorders</i> 26, 6 (2002): pp. 797–804.			

Exploring in more detail the most recent measured data from the CCHS (1986–1992) for adults aged 18 to 74 years, and summarized in Table 4,⁹ 44% of men, 25% of women, and 34% total were classified as overweight, while 13% of men, 14% of women, and 14% total were classified as obese. Total prevalence of overweight and obesity observed was 57% of men, 39% of women, and 48% total. Mean BMI increased with age up to 55 to 64 years, after which it decreased. Obesity associated with very high health risk (BMI > 35) was observed in twice as many women as men (4% vs. 2%). Of demographic variables examined, income, occupation, and employment status were unrelated to obesity, while education was negatively associated with the prevalence of obesity. Of those with elementary education or less, 47% of men and 38% of women had BMI values ≥ 27, while only 26% of men and 19% of women with a university degree had comparable BMI values.

Table 4 Prevalence of Overweight and Obesity Among Canadian Adults		Percentage of Adults (18 to 74 years) From Canadian Heart Health Surveys (1986–1992)*				
		Overweight (BMI 25 to 29)	Class I Obesity (BMI 30 to 34)	Class II and III Obesity (BMI > 35)	Exceeds Healthy Weight Standards (BMI ≥ 25)	BMI ≥ 27 With Elementary Education or Less
Total	34	11	3	48	N/A	N/A
Men	44	11	2	57	47	26
Women	25	10	4	39	38	19
* Measured height and weight						
Source: S. M. Macdonald, B. A. Reeder, Y. Chen, J. P. Despres, "Obesity in Canada: A descriptive analysis," <i>Canadian Medical Association Journal</i> 157, Suppl. 1 (1997): pp. 3–9.						

Although there has been no systematic surveillance of obesity in Canada using measured stature and body mass since the CHHS,¹⁰ a variety of surveys have used self-reported height and weight data to calculate BMI. These self-reported data provide some more recent temporal trends, but are likely conservative estimates, as body weights tend to be underreported.¹⁰ Prevalence of obesity (BMI ≥ 30) among Canadian adults from self-reported weights and heights in the 1985 and 1990 Health Promotion Surveys (HPS) and the 1994, 1996, and 1998 National Population Health Surveys (NPHS) (Table 5) reveal that the overall national prevalence of obesity increased across all surveys, more than

doubling from 1985 to 1998. For the years 1985, 1990, 1994, 1996, and 1998, adult obesity rates were 5.6%, 9.2%, 13.4%, 12.7%, and 14.8%, respectively.¹¹ More recent self-reported data from the Canadian Community Health Survey (CCHS) 2000–2001¹² revealed the national average of obesity (BMI ≥ 30) for adults aged 20 to 64 as 14.9%. In 1998, more than half of the Canadian population (50.7%; 61.2% of men and 39.9% of women) exceeded recommended guidelines for healthy weight.¹³ These rates fell slightly by 2000–2001 to 47.4% of the population (55.6% of men and 39.2% of women).¹²

Table 5 Prevalence of Self-Reported Obesity Among Canadian Adults	Percent Obese (BMI ≥ 30)					
	HPS 1985	HPS 1990	NPHS 1994	NPHS 1996	NPHS 1998	CCHS 2000–2001
	5.6	9.2	13.4	12.7	14.8	14.9
HPS: Health Promotion Survey NPHS: National Population Health Survey CCHS: Canadian Community Health Survey Sources: P. T. Katzmarzyk, "The Canadian Obesity Epidemic, 1985–1998," <i>Canadian Medical Association Journal</i> 166, 8 (2002): pp. 1039–1040; Statistics Canada, "Canadian Community Health Survey: A First Look," <i>The Daily</i> (May 8, 2002).						

In 1985, all provinces reported obesity rates of less than 10%, while in 1994, all provinces reported rates greater than 10%, with the Atlantic provinces, Manitoba, and Saskatchewan reporting rates ≥ 15%. By 1998, all provinces except British Columbia and Quebec reported obesity rates ≥ 15%. Unfortunately, data were unavailable for the northern territories.¹¹ These data are consistent with regional variations in measured data from the CHHS (1986–1992),¹⁴ which reported the highest prevalence of obesity in Atlantic Canada, and lower levels in B.C. compared to the Prairie provinces. In western Canada, rural men and women were significantly more likely to be obese than their urban counterparts, although this observation did not hold for other regions in Canada.¹⁴ In the 2000–2001 CCHS, most of the Atlantic provinces, northern Ontario, the Prairie provinces, Nunavut, and the Northwest Territories had obesity rates significantly higher than the national average of 15%.¹² Unfortunately, as the following sections will detail, surveillance of behavioural determinants of obesity in Canada is currently unable to explain the regional variations in prevalence.

Vulnerable Groups: Children

The rising prevalence of overweight and obesity in Canada is not restricted to the adult population. Data for children are summarized in Table 6. Although prevalence data for children may be somewhat variable due to a number of different methods for assessing childhood obesity,¹⁵ all trends are consistent in showing rapidly increasing rates of overweight and obesity among Canadian children.¹⁶ Data from the 1981 Canada Fitness Survey (measured height and weight for children aged 7 to 13) and from the 1996 National Longitudinal Survey of Children and Youth (NLSCY) (parental-reported height and weight for children aged 7 to 13) were used, with overweight and obesity defined using international age- and sex-specific cut-offs.¹⁷ The corresponding increases were from 10.6% to 32.6% in boys and from 13.1% to 26.6% in girls for overweight (including obesity), and from 2.0% to 10.2% in boys and from 1.7% to 8.9% in girls for obesity. Over the 15-year period, prevalence of overweight and obesity tripled among boys (10.6% to 32.6%) and doubled among girls (13.1% to 26.6%). Growth in prevalence of obesity among both sexes was dramatic, increasing up to five-fold.¹³ Using the same survey data, but arbitrary cut-offs for overweight (85th percentile) and obesity (95th percentile) at 1981 as a baseline, prevalence of overweight more than doubled among boys (15% to 35.4%), and doubled among girls (15% to 29.2%). Increases in prevalence of obesity were even more dramatic, tripling from 5% to 16.6% in boys and 5% to 14.6% in girls. The greatest increases in overweight and obesity among both boys and girls occurred in the youngest age groups (7 to 9 years).^{18, 19} As all 1996 data involve parental- or self-report, while baseline data were measured, estimates are likely conservative.

Overweight and obesity rates among children may have stabilized in the last few years. According to CCHS 2000–2001 data, prevalence of overweight (not including obesity) among children (7 to 13 years) was 20% for boys and 17% for girls. Obesity prevalence also remained stable at 9% among boys and 10% among girls.²⁵⁴

Table 6
Prevalence of
Overweight
and Obesity
in Canada
Among Children

Percentage of Children 7 to 13 Years						
	Overweight (Includes Obesity)			Obese		
International Standards ¹³	1981*	1996**	Increase 1981–1996	1981*	1996**	Increase 1981–1996
Boys	10.6	32.6	208%	2.0	10.2	410%
Girls	13.1	26.6	103%	1.7	8.9	424%
Percentiles¹⁹						
Boys	15	35.4	136%	5	16.6	232%
Girls	15	29.2	95%	5	14.6	192%

*Canada Fitness Survey, measured height and weight
 **National Longitudinal Survey of Children and Youth parental- or self-reported height and weight

Sources: M. S. Tremblay, P. T. Katzmarzyk, J. D. Willms, “Temporal Trends in Overweight and Obesity in Canada, 1981–1996,” *International Journal of Obesity* 26, 4 (2002): pp. 538–543; M. S. Tremblay, D. J. Willms, “Secular Trends in the Body Mass Index of Canadian Children (correction),” *Canadian Medical Association Journal* 164, 7 (2001): p. 970.

Supporting the assumption that self-reported data are likely conservative are results from a recent study of physical activity and obesity among Nova Scotia schoolchildren.²⁰ In 2001–2002, a representative sample of Nova Scotia schoolchildren were weighed and measured as part of the study. Using standardized cut-offs (> 95th percentile NHANES II), 19.2%, 20.4%, and 16.2% of Grade 3, 7, and 11 boys respectively, and 19.9%, 19.4%, and 7.9% of Grade 3, 7, and 11 girls respectively, were classified as obese. All of these rates are significantly higher than those from self-reports.

Although data are limited, children in low-income, multi-ethnic, urban neighbourhoods appear to be at particular risk for obesity. A 1993 survey of 9- to 12-year-old schoolchildren from an inner-city Montréal neighbourhood revealed measured rates of overweight (> 85th percentile NHANES II) as 39.4% (41.8% of boys and 36.9% of girls).²¹ In 1997, the prevalence of overweight for schoolchildren from the same neighbourhood was even higher. Using data limited to 10- to 12-year-olds, the prevalence of overweight increased from 35.9% in 1993 to 41.2% in 1997 (34.9% to 41.6% in girls; 36.9% to 40.9% in boys).²² The 1998–1999 NLSCY found that among children aged 2 to 11, those who lived in families with incomes below the low-income cut-offs (LICO) were more likely to be obese (25% prevalence) than those living in families with incomes above the LICO (16% prevalence).²³

Vulnerable Groups: Aboriginal Populations

Epidemiological data on the prevalence of overweight and obesity for Aboriginal populations in North America are limited.²⁴ However, as Aboriginal populations comprise a large percentage of the population in the northern territories, the above-average rates of obesity observed in the northern territories in the 2000–2001 CCHS¹² suggest higher obesity rates in Aboriginal populations. One small study of adults in two Ojibwa communities revealed a 29% prevalence of obesity (BMI > 30)²⁵—twice the current Canadian average. Several smaller, community-specific studies of childhood obesity in Canadian Aboriginal communities suggest very high rates of overweight (defined as BMI > 85th percentile for age- and sex-specific reference data from NHANES III) among boys (27.7%) and girls (33.7%) in non-specified Aboriginal communities.²⁶ In a remote northern Ojibwa-Cree community, rates of overweight were much higher (64% of girls and 60% of boys) using the same standard.²⁷

Summary and Author's Policy Options

The WHO^{1, 28} refers to the escalating global epidemic of obesity as “globesity.” The dramatic increases in overweight and obesity among Canadians over the past 20 years, and the significant proportion of the population affected, have been deemed to constitute a Canadian epidemic. Epidemiological evidence suggests that the increased prevalence of obesity is accompanying a rise in the mean BMI of the population. The increasing weights of the population have implications beyond the clinical impact of obesity for a public-health approach to prevention. A comprehensive, coordinated surveillance system is a policy option that would enable Canada to monitor ongoing rates of obesity and the impacts of interventions. There have been no measured, population-based data on overweight and obesity for adults since the 1986–1992 CHHS and no measured, population-based data for children since 1981. Data on Aboriginal populations are limited to community-specific studies. Current surveys that rely upon self-reported heights and weights are more readily available and allow for assessment of trends, but have limitations of reporting bias. The author identified the current system of surveillance of obesity and the resulting lack of a national baseline description of the problem based on accurate, accessible, and appropriate data as a major gap. Addressing surveillance is one policy option to facilitate adequate understanding of this problem for targeting appropriate and effective public health interventions. The announcement that the CCHS Cycle 2.2, beginning in 2004, will include physical measures is a positive step in this direction.²⁴⁹

Impact of Obesity: Case for Prevention and Control

“The effect of overweight and obesity in adulthood on life expectancy and premature death is striking.”²⁹ (p. 29) Analyses of data from 3,457 participants in the Framingham Heart Study, who were 30 to 49 years old at baseline and followed through the prospective cohort study from 1948 to 1990, showed large decreases in life expectancy associated with overweight and obesity. Overweight (BMI = 25 to 29.9) was associated with a loss of more than three years of life for both male and female non-smokers. Obesity (BMI > 30) at age 40 was associated with a loss of 7.1 years of life for females and 5.8 years for men. Obese smokers lost more than 13 years of life compared to normal-weight smokers.²⁹ Although less powerful than the prospective cohort study, a cross-sectional analysis of existing health data sets in the U.S. revealed similar results, with increasing estimated years of life lost (YLL) accompanying any degree of overweight, particularly among younger adults.³⁰

In Canada, overweight and obesity prevalence data from six cross-sectional national surveys between 1985 and 2000 were linked with a prospective cohort study on overweight, obesity, and mortality to determine the number of deaths attributable to overweight and obesity nationally. Results revealed that between 1985 and 2000, the population attributable risk (PAR) of death associated with overweight and obesity increased from 5.1% to 9.3% of all deaths among 20- to 64-year-olds. Over the 15-year period, more than 57,000 deaths were attributed to overweight and obesity.³¹ As the prevalence of overweight and obesity increases, the implications in terms of premature death and burden of obesity on the Canadian health system becomes more acute, and a case for developing policy options to enhance prevention strategies becomes more apparent.

Beyond mortality, however, 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 U.S. 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% increase in self-reported chronic conditions (such as diabetes, hypertension, asthma, heart disease, and cancer). Living in poverty is associated with a 58% increase in chronic conditions, and daily smoking among normal-weight adults is associated with a 25% increase in chronic conditions. After controlling for chronic conditions, obesity was also associated with worse physical health-related quality of life at a level comparable to poverty’s impact.^{32, 33} The high prevalence of obesity combined with the effects on morbidity suggest a need for public health policy to address obesity.

Non-Communicable/Chronic Diseases

Overweight (BMI > 25) is a major determinant of many other NCDs [non-communicable diseases] including NIDDM [Type 2 Diabetes], CHD [coronary heart disease] and stroke, and increases the risk of several types of cancer, gallbladder disease, musculoskeletal disorders and respiratory symptoms. . . . The costs attributable to obesity are high not only in terms of premature death and health care but also in terms of disability and diminished quality of life.¹ (p. 240)

Mortality rates from non-communicable diseases increase with BMI and are markedly increased at levels designated as obese (BMI \geq 30).³⁴ Using self-reported data of weight and height for calculation of obesity, and self-reported physician diagnoses of non-communicable diseases and their risk factors, an American survey (1994–1996) revealed increases in diabetes, hypertension, and high serum cholesterol with increasing body weight. Disease burden increases with increasing obesity.³⁵ Obesity is strongly associated with many of the major chronic diseases Canada confronts today—cardiovascular diseases (CVD), Type 2 diabetes, and some cancers.³⁴ The metabolic syndrome characterized by overweight and abdominal fat distribution, mild dyslipidemia, hypertension, and disturbed glucose and insulin metabolism is associated with both CVD and Type 2 diabetes.³⁶ This metabolic syndrome is indicative of the interrelationships among chronic disease risk factors and the difficulty of separating out obesity's unique impact on chronic disease prevalence.

Cardiovascular Diseases

The overall risk of CVD increases with increasing BMI, and high BMI is associated with CVD risk factors, including hypertension, high total and LDL cholesterol, high triglyceride levels, and low HDL cholesterol.³⁴ Canadian Heart Health Survey (CHHS) data from 10 provinces from 1986 to 1992 observed that BMI was strongly related to blood pressure, diabetes, and lipid abnormalities as cardiovascular risk factors.³⁷ A subset of CHHS data (five provinces, 1990–1992) 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),³⁸ although WHR was a stronger predictor than BMI.³⁹ Using the same data, multivariate analyses revealed that waist circumference (WC), a measure of abdominal fat distribution, is the anthropometric measurement most highly correlated with blood pressure and serum lipid levels.⁴⁰

Increased CVD risk is not exclusive to adults; obese children and adolescents also demonstrate increased prevalence of hypertension and dyslipidemia.^{16, 41, 42, 43, 44} “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.”⁴² (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,⁴⁵ and children have not been the primary focus.

Type 2 Diabetes

Of common non-communicable diseases, Type 2 diabetes appears to be most directly correlated with increasing obesity. BMI is a powerful predictor of diabetes risk.³⁴ Globally, the increasing prevalence of diabetes closely follows the increasing prevalence of obesity.⁴⁶ The same epidemiological trend is noted in the U.S. Using self-reported data from the Behavioral Risk Factor Surveillance System, the prevalence of obesity (BMI \geq 30) for adults in 2000 was 19.8% (a 61% increase since 1991), and the prevalence of self-reported diabetes was 7.3% (up 49% since 1990).⁴⁷ Data from the CHHS, described previously, observed that measures of obesity (BMI, WHR, and WC) were strongly correlated with diabetes among adults.^{38, 39, 40}

Once coined “adult-onset diabetes,” Type 2 diabetes is being diagnosed at younger ages as childhood obesity increases.⁴¹ 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 as having diabetes or impaired fasting glucose.²⁷ 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% of cases were obese (BMI > 95th percentile) at diagnosis.⁴⁸

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.⁴⁶ Recent trials have demonstrated the efficacy of lifestyle interventions to prevent Type 2 diabetes among adults with impaired glucose tolerance.^{49, 50, 51} 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.

Psychosocial Impact and Costs of Obesity

Reviews of social consequences of childhood obesity suggest that obese children may be discriminated against by their peers, which has an impact on emotional development.⁴¹ As children enter adolescence, self-esteem,^{41, 44} and body image may be adversely affected.⁴¹ Many overweight adolescents are socially marginalized.⁵² 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.⁵³ 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).⁵⁴

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.⁵⁵ "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."⁵⁵ (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.⁵⁵ 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.⁵⁶

Economic Impact of Obesity

The economic impact of obesity is usually estimated from cost-of-illness studies. Cost analyses most often account for 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.¹

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. calculated the direct costs of obesity and comorbidities to the Canadian health system in 1997.⁵⁷ 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 ≥ 27), derived from self-reported data in the National Population Health Survey, and comorbidities (postmenopausal breast cancer, colorectal cancer, coronary artery disease, endometrial cancer, gallbladder disease, hyperlipidemia, hypertension, pulmonary embolism, stroke, and Type 2 diabetes) derived from well-validated studies, the total cost to the Canadian health system exceeded \$1.8 billion, or 2.4% 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 (\$346.0 million).⁵⁷ Calculating the population attributable fraction (PAF) to allocate the

proportion of each disease/comorbidity attributed to obesity in Canada, 50.7% of the costs of Type 2 diabetes were attributable to obesity, as were 31.6% of the costs of hypertension, 29.8% of the costs of pulmonary embolism, and 26.6% of the costs of endometrial cancer.

Similar methodologies in other industrialized countries using definitions of obesity ranging from BMI ≥ 25 to BMI ≥ 30 revealed comparable proportions of health costs for New Zealand (2.5%), Australia (2.0%), and France (2.0%).⁵⁷ The Canadian estimate is lower than the proportion reported for the Netherlands (4%).⁵⁷ At 5.7% of health care expenditures in 1995,⁵⁸ the share of direct costs of obesity in the U.S. are more than double those of the Canadian study. In absolute dollars, this value represents \$99.2 billion. In the U.S., 61% of the costs of Type 2 diabetes were attributable to obesity, as were 17% of the costs of hypertension, 34% of the costs of endometrial cancer, and 30% 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).⁵⁸ Although a similar cost-of-illness approach was taken, the American study analyzed costs of obesity additionally, as well as independently, from comorbidities. 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% estimate of obesity costs in the U.S. suggest that when the obesity-related mortality is accounted for, estimates decrease to a maximum of 4.32% of health care costs,⁵⁹ 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.⁴⁶

When the American study also assessed indirect costs associated with lost productivity and restricted activity, direct costs of obesity accounted for 52% of expenditures, while indirect costs accounted for 48% of the total.⁵⁸ 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.⁵⁷ and calculated the direct costs of obesity and comorbidities 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/year for the Nova Scotia economy.⁶⁰ In this Canadian context, indirect costs of obesity to the economy exceed direct health care costs.

The significant health impact and associated costs of overweight and obesity to people in terms of quality of life and to society in terms of financial burden for treatment of associated diseases makes a compelling case for prevention and control.

Summary and Author's Policy Options

The impact of obesity and comorbidities, particularly non-communicable diseases, on health is well established and has been extensively reviewed in previous sections. As the prevalence of overweight and obesity increases, the implications in terms of premature death and burden of obesity on the Canadian health system becomes more acute, and a case for developing policy options to enhance prevention strategies becomes more apparent. In the Canadian context, the author identified the following data gaps and policy options:

- Surveillance of non-communicable disease risk, and its association with obesity, will help to inform evidence-based action upon obesity. The Canadian Community Health Survey and the National Diabetes Surveillance System are positive steps toward filling data gaps.
- The lack of data available on the health of Canadian children also limits sound evidence-based decision-making about viable courses of action.
- Gaps in knowledge about the psychosocial consequences of obesity have implications for the development of optimal interventions.
- Given available evidence, the economic impacts of obesity on the Canadian health system are considerable and likely to increase. Analysis in one provincial context revealed that the impact of obesity's indirect costs to the economy through lost productivity and quality of life exceed the direct costs of obesity.
- A viable policy option is the commitment of resources to exploit opportunities for data collection, analysis, interpretation, and reporting so that the problem of obesity and its multiple impacts can be better understood and addressed, and so that the effectiveness of interventions can be assessed.

Determinants of Obesity: A Population Health Perspective

A population health perspective examines the interactions among the range of individual/behavioural and environmental (social, physical, global) determinants of health. Using a population health lens to examine obesity has significant implications for both defining and addressing the problem of obesity. This section will review the current state of knowledge of individual/behavioural and environmental determinants of obesity. Plausible mechanisms underlying the interactions among determinants will be explored.

Individual/Behavioural Determinants: Diet and Physical Inactivity

It is beyond the scope of this paper to discuss the genetic factors related to obesity. However, it is important to note that obesity would not be possible if the human genome did not have the genes for it. Genes make obesity possible, but positive energy balance over time is necessary to realize that potential.⁶¹ Genetic contributions are estimated to contribute from 20% to 75% of variability in body weight and composition within a population.⁶² In some populations, particularly the Canadian Aboriginal population, the gene-environment interaction may be particularly strong. The “thrifty gene hypothesis”⁶³ suggests that people developed strong biological mechanisms for conserving energy as fat to enable their survival in times of periodic famine. In times of plenty, such as the present day, the thrifty gene promotes obesity. The impact of the thrifty gene is particularly evident among Aboriginal populations who have made rapid social transitions from active hunter-gatherers to sedentary consumers. Expanding upon the thrifty gene hypothesis, Canadian researchers noting high birth weights among Aboriginal populations hypothesize that current high rates of Aboriginal obesity may have origins in a maternal environment that promotes fetal weight gain—a biological mechanism, or “hefty fetal phenotype,” that would have promoted successful pregnancies in times of scarcity.⁶⁴ The complex gene-environment interaction is clearly implicated in the obesity epidemic, as the rapid increase in obesity suggests an environment that promotes obesity more so than in the past.⁶² According to the WHO (World Health Organization), however, “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.”¹ (p. 240) The following sections will discuss the behavioural determinants of positive energy balance—diet and physical inactivity. Then, behaviours will be situated within the environmental contexts that promote them. The environmental contexts that promote these behaviours will also be explored.

Diet

Obtaining data on secular trends in energy intake is difficult, owing to the variety of data-collection methods used and to self-reports of individual intake. However, some trends are worth noting.

The crudest estimates of energy intake come from ecological data. Ecological data estimate types of foods and nutrients available for consumption from food disappearance data [(production + imports + starting inventory) – (exports + industrial uses + ending inventory)]. Per capita disappearance data overestimates consumption as it does not account for spoilage or waste. However, assuming spoilage and waste remain constant over time, ecological data are valid indicators of trends in consumption over time. Data from the U.S. Food Supply Series reveal that per capita, per-day food availability increased by 15.2% from 1970 to 1994.⁶⁵ Canadian food statistics reveal a similar increase in energy available. From 1976 (3,171 kcals/day) to 1991 (3,167 kcals/day), per capita energy availability per day stayed relatively stable. The 1990s saw dramatic increases in food availability, with per capita energy availability per day rising to 3,674 kcals by 2001, a 16% increase over 10 years.⁶⁶ Recently, Health Canada, Statistics Canada, and Agriculture and Agri-food Canada have adjusted these ecological data for waste to represent a better estimate of apparent per capita energy consumption. While apparent energy consumption remained quite stable from 1976 to 1992, at approximately 2,350 kcals/day, the decade 1992–2002 saw a dramatic increase to approximately 2,800 kcals/day (a 19% increase).⁶⁷ The analysts caution interpretation as methodological changes in the measurement of fats and oils occurred in 1995, the time of the sharpest increase. Nonetheless, apparent energy consumption was on the rise before 1995 and continues on an upward slope.

The ecological trends in increased food availability are not always consistent with data from food consumption surveys. In the U.S., three nationally representative surveys of food intake by individuals aged 2 years and up were conducted between 1977 and 1996; the surveys collected food consumption data using repeated, interviewer-administered 24-hour recalls. Overall, there were statistically significant increases in energy intake with each subsequent survey period. In the 1977–1978 survey, the mean energy intake for the entire sample was 1,791 kcals/day, with a slight increase to 1,795 kcals/day in 1989–1991, and a mean intake of 1,985 kcals/day in 1994–1996 (an 11% increase).⁶⁸ Over a 20-year period, the increase in energy intake of nearly 200 kcal/day is statistically significant. Since even small increases in energy intake in excess of energy expenditure can lead to considerable weight gain over time, there is also a practical significance to this small increase.

In Canada, the data are much less complete, making trends in energy intake very difficult to assess. The only national nutrition survey spanning all age groups took place more than 30 years ago (Nutrition Canada 1970–1972). Provincial nutrition surveys of adults were undertaken in the 1990s, but survey results have been reported only for Nova Scotia (1993),⁶⁹ Quebec (1995),⁷⁰ Saskatchewan (2001),⁷¹ and Prince Edward Island (2002);⁷² all

other survey reports are in preparation. Data from the Nova Scotia Nutrition Survey⁶⁹ reveal an average reported energy intake for all age-sex groups (18 to 74 years) as 2,070 kcals/day—approximately 10% lower than energy intakes reported from Nutrition Canada. In Saskatchewan, energy intake was analyzed separately for males and females.⁷¹ Mean reported energy intake for men in all age groups was 2,707 kcals/day; for women it was 1,762 kcals/day. Compared to the 1970–1972 Nutrition Canada data for the three Prairie provinces, reported energy intake among men was lower by 8% to 15% in all age groups except > 65 years. For women, mean reported energy intake was within 2% of what Nutrition Canada had reported in 1970–1972, except for the 40-to-64 age group, where reported intake had increased by 8%. One small national “Food Habits of Canadians” survey of 1,544 adults and 178 adolescents was conducted in 1997–1998.⁷³ Consistent with the provincial nutrition surveys, reported energy intake for all age-sex groups except women aged 40 to 64 was lower in 1997–1998 than in 1970–1972. Of particular note was the decrease in total fat consumption and percent energy from fat. The mean reported intake of fat as a percentage of energy intake decreased by approximately 10 percentage points in all age-sex groups, such that the mean reported intake in 1997–1998 was consistent with recommendations of $\leq 30\%$ energy. One other source of food-specific, population-level consumption behaviour is the Canadian Community Health Survey (CCHS) (Cycle 1.1; 2000–2001), which included questions on self-reported fruit and vegetable consumption. These data revealed that the frequency of fruit and vegetable consumption is negatively associated with overweight.⁷⁴

Physiologically, one would expect that a reduction in dietary fat intake would result in a negative energy balance and a corresponding decrease in obesity, owing to the energy density of high-fat diets.⁷⁵ Yet, dietary intake data from the U.S. give rise to the “American paradox,” which refers to the observation that obesity is increasing while the proportion of energy from fat in American diets is decreasing.^{62, 75} Based on limited data from the Canadian nutrition surveys described above,⁷³ the same paradox could be true for Canada. The paradox could potentially be explained by a reporting bias related to increasing awareness of recommendations to decrease fat intake. The limited available nutrition surveillance in Canada supports this possibility, particularly in light of the observation that the fat available in the Canadian food supply has increased over the past decade.⁶⁶ However, in the U.S., reported food-consumption data suggest otherwise. Absolute dietary fat intake in the U.S. has remained constant over time, while total energy intake has increased, leading to a decrease in percentage energy intake from fat,⁶² but a positive energy balance. This trend is particularly evident among children. Using U.S. Department of Agriculture (USDA) food-consumption survey data, average fat intakes of children aged 2 to 17 declined from 36% of energy intake in 1987 to 33% in 1995.⁷⁶ However, total fat intake (in grams) has not decreased, while total energy intake has increased, mostly from carbohydrate sources. Specifically, this increase in energy intake can be attributed primarily to increased soft-drink consumption.⁷⁶ Indeed, in a prospective, 19-month observational analysis of children in Grades 6 and 7, sweetened soft-drink consumption was associated with increased BMI and frequency of obesity after controlling for baseline obesity status, maturational changes, physical activity, and

other dietary factors.⁷⁷ Although there is virtually no large-scale food and nutrition surveillance of children in Canada, limited data from adolescents in the “Food Habits of Canadians” study indicates that 13- to 17-year-olds consume more carbohydrates, energy, and fat from “other” foods (those that do not comprise one of the recommended food groups in Canada’s Food Guide to Healthy Eating) than other age groups.⁷⁸ Increased soft-drink consumption is supported by food disappearance data in Canada. In 1972, 55.1 litres/person were available to the Canadian population, while by 2001, that number had more than doubled to 113.3 litres/person.⁶⁶

Physical Inactivity

Indirect evidence from cross-sectional and population studies shows a protective effect of physical activity against obesity.⁶² Total daily energy expenditure is the sum of resting metabolic rate + thermal effect of food (obligatory energy expenditure) + energy expended in physical activity. Any significant decreases in daily energy expenditure contributing to rising rates of obesity are likely to be attributed to decreases in physical activity. Changes in physical activity patterns may be related to leisure-time physical activity, or to activities of daily living, including, but not limited to, work.⁶²

American data suggests that leisure-time physical activity has remained quite constant over the past 25 years.^{62, 79} The same cannot be said of Canada (Table 7). Trends in self-reported leisure-time physical activity observed from nationally representative surveys of adults (20 to 64 years) from 1981 to 1988 suggest high but decreasing levels of physical inactivity in Canada. Estimates from the 1998–1999 National Population Health Surveys (NPHS) indicate that the majority of Canadians (76.6% of women and 73.9% of men) are insufficiently active for health benefits (activity energy expenditure [AEE] < 3.0 kcal/kg/day). Using the same definition of inactivity, 2000–2001 CCHS data reports that 80% of Canadian adults aged 20+ (77% of men and 82% of women) are insufficiently active for health benefits.²⁵⁵ Fewer (59% of women and 53% of men) are sedentary (AEE < 1.5 kcal/kg/day).²⁵⁵ Physical inactivity has declined significantly since 1981.⁸⁰ It is important to note that there are limitations of comparing data from different surveys with varied data-collection strategies; these data, however, provide important indications of trends and are the only peer-reviewed Canadian data available.

<p>Table 7 Trends in Physical Inactivity Among Canadian Adults (20 to 64 Years)</p>		<p>Percentage Sedentary (AEE < 1.5 kcal/kg/day)</p>		<p>Percentage Insufficiently Active for Health Benefits (AEE < 3.0 kcal/kg/day)</p>	
	Year	1981	1998	1981	1998
	Men	72.7	54.8	86.9	73.9
	Women	71.4	58.9	86.7	76.6
<p>Source: M. J. Bruce, P. T. Katzmarzyk, "Canadian Population Trends in Leisure-time Physical Activity Levels, 1981–1998," <i>Canadian Journal of Applied Physiology</i> 27, 6 (2002): pp. 681–690.</p>					

Among children, U.S. surveys reveal that only ~50% of young people (12 to 21 years) exercise vigorously on a regular basis; approximately 25% report no vigorous physical activity.⁸¹ Participation in daily, school-based physical education is declining (42% of high school students in 1991 to 25% in 1995).^{76, 81} According to the 2000–2001 CCHS, a survey reliant upon self- or parental-reported levels of physical activity, 27.7% of Canadian youth aged 12 to 19 (34.6% of girls and 21.1% of boys) are physically inactive, 21.1% are moderately active, and only 38.4% (44.2% of boys and 32.3% of girls) are physically active.⁸² A recent study in several Nova Scotia schools using accelerometers to measure changes in movement has shown interesting results.²⁰ The accelerometers measure cumulative minutes of moderate and vigorous daily physical activity. Current recommendations for health benefit are > 60 minutes of measured physical activity (MPA)/day. Table 8 summarizes the results and clearly shows decreasing levels of physical activity from elementary to high school. These data also emphasize the tendency to overestimate physical activity from self-reports, particularly among high-school students. While accelerometers revealed that only 12.6% and 6.9% of Grade 11 boys and girls respectively were physically active for more than 60 minutes a day, data from the 2000–2001 CCHS estimated physical activity at much higher levels (36.7% of 15- to 19-year-olds).⁸² Despite weaknesses of using self-reported data, however, Canadian epidemiological evidence shows that physical activity among children aged 7 to 11 is negatively associated with overweight and obesity, while TV viewing and video game use increase risk of excess weight.⁸³

Table 8	Grade	Gender	< 30 MPA	30 to 60 MPA	> 60 MPA
Measured Physical Activity (MPA) Among Nova Scotia Schoolchildren	3	Male	10.0%	0	90.0%
		Female	7.7%	0	92.3%
	7	Male	36.7%	1.1%	62.2%
		Female	52.3%	3.2%	44.5%
	11	Male	82.6%	4.8%	12.6%
		Female	88.6%	4.5%	6.9%
Source: P. Campagna, G. Ness, R. Murphy, R. Rasmussen, A. Thompson, J. Porter, L. Rehman, <i>Physical Activity Levels in Children and Youth in the Province of Nova Scotia</i> , Revised December 2002 (Halifax: Sport and Recreation Commission, Government of Nova Scotia, 2002).					

There is little research providing direct evidence to support the hypothesis that improvements in technology, such as remote controls, garage door openers, and elevators, have had cumulative effects on reduced energy expenditure for daily living.⁶² Some suggest, however, that the cumulative effect of small savings of energy expenditure with multiple labour-saving devices can have a substantial impact on weight change over time.⁷⁹

Although the data are not definitive with respect to the relative contributions of energy intake and energy expenditure to the energy balance equation, one observation is self-evident—an increase in positive energy balance has led to an increase in obesity. People are eating too much for their level of activity.

Summary and Author’s Policy Options

The author’s interpretation of the literature reviewed herein is that limited food, nutrition, and physical activity surveillance data has posed a barrier to understanding the determinants of obesity in Canada.

- Although some data are available on adults, virtually no data are available on the food-consumption patterns and nutrient intake of children.
- Methods of surveillance to assess childhood physical activity are needed.
- As it has been previously established that obesity rates are increasing most rapidly among children (“Canadian Trends,” page 5), these data are essential.

In March 2003, the CCHS announced promising news that Cycle 2.2 will adopt a nutrition focus, and data collection is beginning in 2004. The CCHS will include physical measures and will provide a comprehensive picture of eating patterns and nutrient intake of Canadians.²⁵⁰ A policy option arising from apparent data gaps is that resources be committed to exploit opportunities for ongoing surveillance, data analysis, interpretation, and reporting, such as CCHS Cycle 2.2, so that the contribution of diet and physical activity to obesity can be understood and acted upon.

Environmental Determinants: The Context for Individual Behaviour

There is general agreement that the current epidemic of obesity is largely associated with an environment that, in multiple ways, promotes excessive food intake and discourages physical activity.^{84, 85, 86}

Unfortunately, most data available on environmental influences on food consumption and physical activity are American, with some data from other countries. It may be reasonable to assume that Canadian trends are parallel to global social trends in contributing to the obesity epidemic. However, since this paper is written with the assumption that policy levers can potentially influence the environment within which nutrition and physical activity choices are made, social differences between and within countries constitute evidence that may provide important insights into ways of influencing changes that can help stem the tide of the obesity epidemic. Therefore, caution should be exercised in generalizing data from different sociopolitical contexts. When possible, available Canadian data will be incorporated into the following sections so that judgements regarding the generalizability of global and American trends can be made. It is of note, however, that the lack of available Canadian data on environmental determinants of food consumption and physical activity patterns poses limitations to providing evidence-based policy options.

Food Intake

Shifting food consumption patterns: In the U.S., food-consumption data on subjects aged 2 years and up was measured from 1977 to 1996 in three nationally representative surveys of food intake by individuals. According to these surveys, the most significant trend in food consumption is a decline in energy intake from foods consumed at home (from 76.9% of energy to 64.5%), with a corollary increase in energy consumption from restaurant/fast-food sources (from 9.4% to 21.3%). Trends were remarkably similar, with slight variations, among all age groups.⁶⁸ Analyzing these same data specifically for adolescents (aged 12 to 18) and young adults (aged 19 to 29) reveals that for adolescents, energy consumption from restaurant/fast-food sources increased from 6.5% to 19.3% of energy. For young adults, energy consumption from restaurant/fast-food sources more than doubled, from 14.3% to 31.5% of energy. For adolescents, increased energy intake can be attributed primarily to snack consumption, while both meals and snacks account for the increase among young adults. For both age groups, trends in decreasing consumption of milk and increasing consumption of soft drinks were observed over

time.⁸⁷ As a recently published study of associations between eating patterns and obesity has found an increased prevalence of obesity among U.S. adults who frequently consume breakfast or dinner away from home,⁸⁸ changing food consumption patterns have implications for population obesity trends.

While Canadian data on food consumption patterns are less readily available, some inferences can be made from food purchasing patterns. In 1996, Canadians spent approximately 30% of their food dollars on food consumed away from home, 30% of which was spent at fast-food establishments.⁸⁹ Although the trend in spending food dollars in restaurants increased steadily in the 1980s, a drop in restaurant spending in 1991—attributed to the introduction of the GST—is now recovering.⁹⁰ Interestingly, per capita, Canadian consumers spend only 50% of what their American counterparts spend on food away from home.⁹⁰ From these data, it is not possible to infer the percentage of energy consumed from food purchased away from home, but it is reasonable to assume that the percentage of energy consumed at fast-food restaurants is on the rise. In addition, selected Canadian food consumption data (1992–2002) suggest trends towards decreasing consumption of milk (- ~10%) and increasing consumption of sugars and syrups (+~12%), soft drinks (+~13%), and fruit juices (+~23%).⁶⁷ U.S. soft drink availability in 2000 was 65% higher than Canadian availability (187 litres/person vs. 113 litres/person).⁶⁶

Food retail outlets: As the majority of Canadians' food dollars are spent on food to be consumed at home, access to food retail outlets is likely to influence intake. Availability of large supermarkets as opposed to small grocery stores in neighbourhoods may also have an influence on dietary intake. A local food environment with supermarkets was found to be positively associated for meeting dietary guidelines for fruits and vegetables, even when controlling for individuals' educational attainment and ability to afford healthy foods.⁹¹ One possible interpretation of these data is that smaller grocery stores may not carry an assortment of produce, thereby limiting shoppers' choices. Considering that small Canadian studies have observed decreased access to supermarkets in lower-income areas⁹² and in First Nations communities,⁹³ further analysis of the geographic distribution of food retail outlets may contribute to our understanding of the environmental determinants of eating behaviour.

Fast-food restaurants: The increase in consumption of foods away from home, particularly at fast-food restaurants, is not surprising, considering that in the U.S., the number of fast-food restaurants grew 147% from 1972 to 1995, and the percentage of meals and snacks consumed at fast-food restaurants doubled.⁸⁴ These trends have implications for dietary quality and quantity. Among students in Grades 7 to 12 in the urban U.S. who participated in Project EAT (Eating Among Teens), self-reports of frequency of fast-food restaurant use and recorded dietary intake revealed that frequency of fast-food restaurant use is associated with higher energy and fat intake. This is largely due to increases in high-fat, high-sugar food choices such as french fries and soft drinks, and decreases in consumption of fruits, vegetables, and milk. Despite higher energy intakes associated with frequency of fast-food restaurant use, no associations with overweight status were found in this study.⁹⁴ Similar findings were ascertained from the

national (U.S.) Continuing Survey of Food Intake among 6,212 children and adolescents 4 to 19 years old. Fast-food consumption in this sample was frequent (30.3% of the total sample consumed fast food on a typical day), and fast-food consumption was associated with more total energy and poorer dietary quality (higher fat, added sugars, sugar-sweetened beverages, less fibre, less milk, and fewer fruits and non-starch vegetables).⁹⁵ Analysis of the same survey with adults (37% reported fast-food consumption) revealed higher fat, saturated fat, sodium, and carbonated soft-drink consumption with fast food, and lower intake of vitamins A and C, milk, fruits, and vegetables.⁹⁶

Schools: Although data are not readily available in Canada, observation suggests that school fundraising efforts regularly sell candy, chips, and soft drinks to students. Food and beverage vending machines, the majority of which offer high-fat and high-sugar choices, are nearly universal in high schools and in many junior high schools. Recent media attention related to major soft-drink companies' voluntary withdrawal of carbonated soft drinks (but not branded juices, waters, and sports drinks) from elementary schools effective September 2004⁹⁷ has brought to the public's attention the proliferation of multi-year contracts into which individual schools have entered with major beverage companies, and the variability in policies regarding vending among school boards in Canada.⁹⁸ In the U.S., vending machines attract \$1 billion per year of student snack spending.⁹⁹ "Students in middle and high schools are faced with a huge array of high-fat and high-sugar food choices and given little, if any, guidance about these choices."⁹⁹ (p. S45) Although the U.S. has national, profit-driven school food programs (breakfast and lunch) while Canada does not, the school food environment in the U.S. may provide some insights and warnings for Canada, particularly in high schools. In the U.S., fast-food establishments have made contracts with 17% of middle and high schools and direct advertising in schools has expanded.⁹⁹ Although such arrangements are not yet the case in Canadian high schools, they are commonplace in post-secondary institutions.

Portion sizes: An increase in energy intake may be associated with rising portion sizes. Examination of trends in food portion sizes from nationally representative food consumption surveys in the U.S. from 1977 to 1998 revealed that portion sizes and energy intake increased for all key foods (except pizza) at all locations, with the largest portions consumed at fast-food restaurants.¹⁰⁰ "Super sizing" of portions can be observed. For example, the current McDonald's "child size" soft drink is 12 oz.; the same serving in the 1950s would have been marketed as "king size."⁸⁴

A systematic study of portion sizes (weighed samples) of foods sold for immediate consumption and compared to USDA standard portions for dietary guidance revealed that marketplace food portions have increased in size and now exceed federal standards as follows: soda, 35%; fast-food hamburger, 112%; bagel, 195%; steak, 224%; and cookie, 700%.¹⁰¹ Dates of introduction for large-size portions were obtained for 181 foods. Portion sizes began to grow in the 1970s, although fewer than 10 larger-sized portions were introduced in that decade. The number of larger sizes rose sharply in the 1980s, and has continued steadily. Between 1995 and 1999, 65 new large-size portions were introduced.¹⁰¹

Evidence suggests that the availability of larger portion sizes influences increased consumption among both normal-weight and overweight men and women.¹⁰² Analysis of two subsequent cycles, five years apart, of the U.S. Continuing Survey of Food Intakes by Individuals found that portions consumed increased by all persons over 2 years of age for approximately one-third of the foods assessed.¹⁰³ Although some of the portion-size increases were quite small (for example, soft drinks increased by 2 oz.), minor increases in portions sizes consumed regularly over time can contribute to significant changes in weight. In addition, when researchers and professionals assume that consumers are reporting “standard” portion sizes in the assessment of food intake, underreporting of intake lies not only with the respondent, but also with the analyst.

Marketing/advertising: Exposure to food advertising may influence choices towards foods of higher energy density and lower nutritional value. Foods that are heavily advertised are generally over-consumed relative to recommendations, while foods that are advertised less frequently are under-consumed.⁸⁴ In 1997, U.S. food manufacturers, retailers, and services spent \$11 billion in mass-media advertising. This amount included \$765 million on confectionaries and snacks, \$571 million on McDonald’s, \$549 million on soft drinks, and only \$105 million on fruits and vegetables. The entire nutrition education budget for the USDA that same year was only \$333 million (3% of food industry expenditures).⁸⁴ Although Canadian advertising expenditures are not readily available, most Canadians could be exposed to a significant volume of American advertising via cable/satellite television and print media.

Children may be particularly vulnerable to advertising. Direct advertising in schools includes advertising for fast foods in school buses, promotional textbook covers, student newspapers, yearbooks, and sports scoreboards.⁹⁹ In New Zealand, analysis of 269 food advertisements from 42 hours of children’s television programming revealed that 63% were for foods high in fat and sugar, and 14% were for fast foods.¹⁰⁴ By hypothetically constructing a diet of the advertised foods, researchers calculated that the advertised diet would exceed recommendations for fat, sugar, and sodium, and would fail to meet requirements for fibre and several micronutrients. The authors conclude that “food advertisements targeted at children generally reflect the dietary pattern associated with an increased risk of obesity and dental caries in childhood; and cardiovascular disease, diabetes and cancers in adulthood.”¹⁰⁴ (p. 647)

Marketing is not limited to advertising. An interesting case in point is soft-drink marketing in schools. Competition among soft-drink companies led to “pouring rights” contracts with universities and school districts in the 1990s. These contracts involve lump-sum payments to schools in return for exclusive rights to sell the company’s products in vending machines and at all school events. On the surface, this arrangement appears mutually beneficial. Schools benefit from funds that enable the purchase of supplies, such as computers, that might not be available otherwise, and soft-drink companies instill brand loyalty among children while increasing market share and profit. Such arrangements, however, place schools in the unusual position of “pushing” soft-drink consumption, which encourages dietary practices inconsistent with recommendations.¹⁰⁵ In U.S. schools, the number of such exclusive rights contracts doubled between 1997 and 1998.⁸⁴ As previously mentioned on page 25, such contracts are becoming commonplace in schools in Canada (although beverage companies are voluntarily withdrawing carbonated drinks in elementary schools),⁹⁷ and are nearly universal at post-secondary institutions.

Physical Activity

Leisure time: In 1998, 98% of U.S. households owned televisions.⁸⁴ Canadian estimates are similar: almost 99% of households owned televisions in 1998,¹⁰⁶ and 69.1% of Canadian households subscribed to cable service.¹⁰⁷ According to the 1998 General Social Survey (GSS), television viewing is the primary leisure-time activity among Canadian adults; high-income adults (aged 25 to 54) spent an average of 9.5 hours/week watching television, while low-income Canadians watched television for an average of 15.4 hours/week.¹⁰⁸ In 2002, average hours of television viewing per week for all Canadians over age 12 was 21.8¹⁰⁹; Americans over age 12 watched an average of 28 hours per week.⁸⁴ In the U.S., length of viewing time increased 44% between 1965 and 1985, to 15.1 hours per week for adults. By 1999, that number almost doubled again. Canadian viewing time has also increased over the past few decades. Little data is available on computer use and whether computer use replaces TV viewing or more active leisure-time pursuits. In the 2000 GSS, however, 82% of parents reported that their school-aged children used the Internet; 71% reported Internet access through school and 45% reported access at home.¹¹⁰

Sedentary behaviours, such as TV viewing, have been associated with increased risk of obesity and diabetes. A prospective cohort study, the Nurses’ Health Study, conducted in 11 U.S. states from 1992 to 1998, documented new cases of obesity and diabetes among subjects and correlated outcomes with sedentary behaviours. Each two-hour/day increment in TV watching was associated with a 23% increase in obesity and a 14% increase in diabetes risk. The authors also noted that each one-hour/day of brisk walking was associated with a 24% reduction in obesity and a 34% reduction in diabetes.¹¹¹ These data support the premise that decreasing sedentary behaviours and increasing active leisure time reduces obesity risk.

An examination of changing recreational spending patterns of Canadian families from the 1982 Family Expenditure Survey and the 1999 Survey of Household Spending reveals significant shifts. While spending (in constant dollars) on recreational fees increased by only 8% over the 17-year period, spending on cable television increased by 253%. Of home recreational equipment spending, the 73% increase in spending could be accounted for entirely by a five-fold increase in spending on computers. Athletic equipment spending increased by only 8%. Closer examination of these data reveal that although overall average spending on athletic equipment and recreational fees increased slightly, the increase was accounted for by increases in spending among the fewer households that purchased in these categories.¹¹² These data are consistent with the observation from the 1998 GSS that only 54% of children aged 5 to 14 in Canada participate in organized sport activity.¹¹³

Occupational activity: Although few data are available on temporal trends in the physical demands of work, observation suggests that work-related activity has decreased over the past several decades. For example, work in more physically demanding agricultural and manufacturing sectors is decreasing, while work in finance has increased.⁸⁴ Although data are not readily available, even within traditionally physically demanding jobs, technology and automation could contribute to decreased energy expenditure associated with work.⁸⁴ In the Nurses' Health Study, described above, each two-hour/day increment of sitting at work was associated with a 5% increase in obesity and a 7% increase in diabetes,¹¹¹ adding credence to the notion that occupational inactivity is associated with obesity.

Schools: In Canada, physical education is becoming an option; only Quebec requires physical education in its curriculum until graduation. In all other provinces, physical education becomes optional as early as Grade 8.¹¹⁴ In the U.S. in 1997, only 27.4% of students attended physical-education classes. Increasing pressure for academic time may also lead to decreases in time for unstructured physical activity during recess and lunch breaks.¹¹⁵ In Canada, the average amount of time in a school week devoted to physical education is less than one hour; this is among the lowest in the world and is less than 40% of the 150 minutes recommended to meet standards for Quality Daily Physical Education (QDPE). Fewer than 5% of schools in Canada meet standards of QDPE.¹¹⁶ Participation in school physical education declines as students get older, particularly for girls.¹¹⁷ The association between the decline in physical activity levels of children at approximately the same age at which school physical education is no longer required provides some insight into the importance of mandatory physical education.¹¹⁶

Beyond the school curriculum and opportunities for activity during the school day is the opportunity for active methods of transportation (walking or cycling) to and from school. In Canada, only 37% of 5- to 13-year-olds and 33% of 14- to 18-year-olds walk to school. Only 2% and 4% of students in those respective age groups cycle, despite accessibility to

a bicycle. Decreased accessibility (for example, longer distance) to neighbourhood schools is cited by 53% of parents as a barrier to walking. Concern for children's safety also contributes to children being more frequently driven or bused to school.¹¹⁸

Transportation: In 1996, 79% of Canadian households owned a vehicle.¹⁰⁷ Passenger vehicle registrations grew 21% from 1985 to 1997.¹¹⁹ According to the 1998 GSS, on a typical weekday, 75% of the adult population travelled by car, compared to 70% in 1986. In 1998, 77% of commuters travelled alone, compared to 69% in 1986. Over the 12-year comparison period, average Canadian commuting time to work by car rose from 56 to 58 minutes per day. Of total car travel time, Canadians spent six more minutes travelling each day in 1998 than in 1986.¹¹⁹ Automobiles are readily available and highly advertised, and urban design encourages their use. Only automobile advertising expenditures exceed those of the food industry.⁸⁴

Active commuting (walking or cycling) is much less common than vehicle travel among Canadians. Only 14% of Canadians report living within walking distance (2.5 km) of work. Of those who do live within walking distance, 51% walk at least some of the time (38% walk most of the time and 49% never walk). A minority (28%) of Canadians living within 2.5 km of any destination never choose walking as a mode of transportation.¹¹⁸ A larger percentage (33%) of Canadians report living within cycling distance (8 km) to work. However, 87% never cycle to work. Overall, 72% of Canadians living within 8 km of any destination never choose cycling as a mode of transportation. A majority of Canadians indicate an interest in increasing walking (82%) and cycling (66%) as modes of transportation. However, perceived barriers to active commuting include convenience and safety: 53% of Canadians think cycling is dangerous because of traffic, and 70% indicate that they would cycle 30 minutes or more to work if cycling lanes were available.¹¹⁸ American studies report similar barriers to bicycle commuting, including lack of bike-trail access, safety concerns (crime, lighting, traffic), and lack of changing or bicycle-storage facilities at work.⁸⁴

The built environment—land use and “urban sprawl”: There is a close relationship between increases in car travel, decreases in active commuting, and “urban sprawl.” As suburban areas of low-density population develop, it is customary—sometimes legislated by zoning—that different land uses (housing, retail, office, recreation) are kept separate from one another. As land uses become separate, distances between them increase, roads are more available than cycling paths or sidewalks, and vehicle travel becomes preferable.^{120, 121} Suburban street networks typically minimize connectivity through cul-de-sacs and T-intersections, thereby increasing distance between destinations and discouraging active transport. In a unique study associating “sprawl indices” of U.S. counties and metropolitan areas with health data from the 1998–2000 Behavioural Risk Factor Surveillance System, living in a sprawling county was associated with less walking, higher BMI, and more hypertension; metropolitan sprawl was associated only with less walking.¹²² These results add to the evidence base relating the design of communities to health behaviours and outcomes.

Summary: A Framework for Analyzing Environmental Determinants of Food Intake and Physical Activity

The preceding sections provide evidence to support the assertion that the current epidemic of obesity is related to an environment that, in multiple ways, encourages excessive food intake and discourages physical activity. However, since the environmental determinants interact in complex ways to influence behaviour, and data on the various environmental determinants are from diverse sources often unrelated to the health field, establishing the strength of relationships in an analysis of environmental contributions to obesity presents a challenge. Without a thorough analysis of environmental contributions to the obesity problem, setting priorities for interventions also becomes difficult. Using a framework to organize and analyze the environment is a potentially useful option for decision-making.

The ANGELO framework (Analysis Grid for Environments Linked to Obesity) is a conceptual model for dissecting “the rather nebulous concept of environment into concrete elements which are amenable to measurement and intervention.”¹²³ (p. 564) The framework is a 2 x 4 grid that dissects the environment into size (micro and macro) by type (physical, economic, political, and sociocultural). Micro-environments are relatively small and potentially influenced by individuals. Some examples of micro-environments are homes/families, workplaces, schools, food retailers, food service outlets, and recreation facilities. Macro-environments influence micro-environments and include media, technology, food marketing, urban planning, and transportation systems. Both micro- and macro-environments can be further typed into physical environment (availability of healthy foods, opportunities for physical activity), economic (costs and income), political (rules governing behaviour, such as family rules for food consumption or national food policies), and sociocultural (community or societal beliefs and values related to food and physical activity).¹²³ The ANGELO framework can help analyze the environmental elements that influence food intake, physical activity, and their interaction. Those promoting over-consumption and inactivity are characterized as obesogenic (promoting obesity). The framework may be helpful in prioritizing environmental interventions.

Social Determinants: Socioeconomic Status/Poverty

The previous sections describe current levels of understanding of behavioural determinants of obesity and growing evidence to support the assertion that excessive food intake and physical inactivity are promoted within environmental contexts. However, the social context of obesity is less well understood. Previous sections describe an increased risk of obesity among low social status groups. The social determinants of obesity among low-income and Aboriginal populations will be explored in more detail in the following sections.

Epidemiology

Most studies of the effects of social status on health refer to socioeconomic status (SES). SES can refer to one or more of the following indicators: income, education, and employment/occupational status. Varying results may be associated with varying definitions of SES among studies.

An extensive review of 140 studies of the relationship between SES and obesity concluded that prevalence of obesity increases as SES decreases among women in industrialized nations, while the relationships for men and children are inconsistent. In developing countries, however, obesity prevalence increases as SES increases among all age-sex groups.¹²⁴ More recent studies in several industrialized nations revealed consistent observations, but also shed more light on the interactions among the various indicators of SES.

Data from 26 random population samples surveyed by the WHO MONICA (Monitoring Trends and Determinants in Cardiovascular Disease) project in 1979–1989 (initial survey) and 1989–1996 (final survey) revealed that lower education was associated with higher BMI in about half of the male and in almost all of the female populations. Geographical differences were noted: for men, positive associations of BMI with education were observed in central and eastern European countries. Differences in relative body weight between educational levels increased between the two surveys for two-thirds of the populations.¹²⁵

In Britain, data from the 1996 Health Survey for England revealed that higher educational attainment and higher SES were associated with a lower risk of obesity in both men and women, although higher occupational status protected only women.¹²⁶ Data from London civil servants enrolled in the Whitehall II study used employment grade as a measure of SES in examining health outcomes.¹²⁷ Employment grade among civil servants is hierarchical and closely tied to education, income, and status. Three grades were identified: “administrative” (Grade I—high), “professional and executive” (Grade II), and “clerical and office support” (Grade III—low).¹²⁷ (p. 720) Employment grade was strongly and negatively associated with obesity (lower grade = higher obesity) for both men and women [Grade III men were 1.4 times more likely to be obese (> 80th percentile BMI) than Grade I men; Grade III women were 1.7 times more likely to be obese than Grade I women]. It is important to note that none of these occupational grades included manual labour, which could protect against obesity through increased energy expenditure. After approximately 25 years, a larger gain in BMI was observed with lower employment grades among both men and women. Adjustment for behaviour differences (smoking, alcohol, diet, activity) reduced the grade differences in BMI by only ~20%.

In Australia, data from a representative sample of adults participating in the 1995 Australian National Health and Nutrition Survey revealed that employment status was associated with obesity. For women, low employment status was associated with a 1.4-fold increase in risk for obesity, while for men, lower-status employment decreased the risk of obesity.¹²⁸

In an urban population of employed people in Switzerland, education and occupation were used as indicators of SES. In men, both level of education and occupation were inversely related to BMI; a higher prevalence of obesity, however, was associated with education, not occupation. In this study, lower occupational levels were representative of manual labourers, so the increased expenditure of energy associated with these physically demanding jobs may account for this observation. Among women, a higher prevalence of obesity was associated with lower levels of both education and occupation, and the two indicators had a synergistic effect.¹²⁹

In Scandinavia, nationally representative surveys in Finland and Sweden in the 1990s found an inverse relation between social class and overweight among both men and women in both countries.¹³⁰ Using the same nationwide representative survey of adult Finns and analyzing multiple components of SES, researchers found that for both sexes, low education level was positively associated with body weight. Unemployment was highest among overweight and obese women and thin men. Highest income levels were found for normal-weight men and women.¹³¹ Among middle-aged, healthy Swedish women, low SES was a strong determinant of overweight and obesity. Reproductive history (higher parity and earlier age at menarche), unhealthy dietary habits, and psychosocial factors explained 53% of the association between low SES and obesity.¹³²

In all of these studies of adults in economically developed countries, low education level was significantly associated with prevalence of obesity for both men and women. In all cases, low-status occupation and unemployment were associated with increasing overweight for women, although results were variable for men. This variation may be explained in part by the fact that men in low-status, manual-labour positions with high physical demands may have increased energy expenditures that help offset obesity. Income levels were rarely explored independently of SES, but those data that are available support the observation that low-income levels are associated with higher levels of overweight. Of demographic variables examined in Canadian Heart Health Surveys (1986–1992) for adults aged 18 to 74 years,⁹ income, occupation, and employment status were unrelated to obesity, while education was negatively associated with the prevalence of obesity. According to Canadian Population Health Initiative analysis of the 2000–2001 CCHS, with increasing income level, rates of overweight and obesity increased for men. Women in the higher income groups, on the other hand, were less likely to be overweight and obese.²⁵⁴

A recent cross-national comparison of childhood obesity and its relation to SES (as defined by family income data), using large nationwide surveys from the early 1990s and standard cut-offs of BMI for overweight and obesity, found that the relation between childhood obesity and SES varied across countries. National socioeconomic development levels were associated with higher prevalence of obesity; highest rates were observed in the U.S. and lower rates in China, while Russian rates were in the middle. Higher SES children were more likely to be obese in developing (China) and recovering (Russia) economies, while lower SES groups were at higher risk in the U.S. Although ethnicity was also associated with obesity in the U.S., when adjustments were made for household income, ethnicity was no longer significant.¹³³ Supporting these findings, a prospective cohort study of 2,913 American children revealed that children with low family incomes had significantly elevated risks of developing obesity over the six-year study period.¹³⁴ Among Canadian children, the National Longitudinal Survey of Children and Youth 1998–1999 found that among children aged 2 to 11, those who lived in families with incomes below the low-income cut-offs (LICO) were more likely to be obese (25% prevalence) than those living in families with incomes above the LICO (16% prevalence).²³ Smaller, locality-specific studies, previously described, reveal high rates of childhood obesity among low-income, multi-ethnic,²² and Aboriginal^{26, 27} communities.

The potential mechanisms underlying the SES/obesity relationships will be explored further in the following sections.

Potential Mechanisms: Behavioural Differences

The underlying assumption to explain the observations of increasing rates of obesity with lower SES is that dietary and physical activity patterns of the poor are more consistent with the development of obesity than those patterns for people in higher SES groups. Although data support this assumption, behavioural differences account for only a portion of the problem.

Diet and physical inactivity: Poor diet and physical inactivity appear to be clustered in lower socioeconomic groups. The diet of lower socioeconomic groups provides cheap energy from foods such as meat products, high-fat dairy products, fats, sugars, preserves, potatoes, and cereals, but has little intake of vegetables, fruit, and whole-wheat bread.¹³⁵ Canadian data from the NPHS show that levels of physical inactivity decrease as education levels increase (64% among those with less than high school graduation vs. 51% among university and college graduates). Moreover, as income level increases, the proportion of Canadians who are physically inactive decreases (62% versus 44%).¹³⁶ Women in low-income groups have been reported to consume more total energy and a higher proportion of energy from fat, and to have fewer specific behaviours associated with the consumption of a low-fat diet than women in higher-income groups; in this study, however, diet and exercise behaviour accounted for less than 10% of the variance in obesity among income groups.¹³⁷ Members of higher SES groups are more likely to monitor their weight, define themselves as overweight at a lower threshold, and make deliberate attempts at weight control through diet and physical activity.¹³⁸ Canadian data

support the idea of a higher perceptual threshold for obesity among low-income groups; overweight Canadian women living in affluent neighbourhoods have an 89% likelihood of body dissatisfaction as compared with overweight women living in poor neighbourhoods (71% likelihood).¹³⁹

The concept of food insecurity may be useful to examine the paradox of high levels of obesity in low-income populations where food supplies are presumably limited. If food security is defined as having “enough of the kinds of food we want to eat,” mild food insecurity as having “enough but not always the kinds of food we want to eat,” moderate food insecurity as having “sometimes not enough to eat,” and severe food insecurity as having “often not enough to eat,” food insecurity can differentiate between voluntary food choices/restriction and involuntary food choices/restriction. Within a nationally representative U.S. sample, there is a demonstrated relationship between overweight status and food insecurity among women, but not men.¹⁴⁰ Except among a small subgroup of older, white girls, food insecurity was not positively associated with overweight among American children.¹⁴¹ Among women, prevalence of overweight was lower for the two extremes of food insecurity (food secure and severely food insecure), extremes where food restriction is likely, although for different reasons (voluntary vs. involuntary). Higher rates of obesity among the mild and moderately food insecure may be more associated with dietary quality than quantity; prevalence of overweight was highest for those with a diet where more than 38% of energy came from fat.¹⁴⁰ Canadian nutrition survey data would support the high-fat/poor nutritional quality hypothesis.⁶⁹ In Nova Scotia, the cost of lower-fat dietary choices was found to be higher than a nutritionally adequate but higher-fat basket of foods.¹⁴² Among individual foods, those that are the most energy dense are often those that are the least costly.¹⁴³ Food banks, upon which the most disadvantaged families depend, offer foods of sub-optimal nutritional quality.⁹²

Overweight may also be related to temporary involuntary food restriction. The intermittent food-acquisition cycle—feasting when food is available immediately after receiving income followed by food insufficiency and involuntary fasting—may function to promote gradual weight gain over time similar to that noted with binge eating.¹⁴⁰ Canadian data have shown significant variations in energy intake among low-income women, reflecting cycles of income availability.¹⁴⁴

The observation that women, not men and children, are more likely to be overweight as food insecurity status increases suggests that family food provisioning strategies may place women at higher risk, as Canadian studies have reported that low-income women sacrifice their own nutritional intake for their children.¹⁴⁴

Potential Mechanisms: Environment

Family environment: Family environment, in particular residence in a single-parent family, has also been found to be a strong influence on activity patterns among children. Compared to children from two-parent homes, children with single parents watch more television, exercise less in school-based physical-education classes, but engage in vigorous physical exercise more frequently. In this case, television viewing does not compete with physical activity for children's time, but is an independent observation.¹⁴⁵ Canadian data reveals increased television viewing among low-income adults in comparison to their higher-income counterparts,¹⁰⁸ and the logical extension might be that lower-income family environments would support increased television viewing among children as well. Lower-income families in Canada are also less likely to participate in sports for recreation.¹¹³ As adolescent overweight is positively associated with higher levels of inactivity (TV/video viewing) and lower levels of physical activity,^{146, 147} attention to the mediating role of the family environment in physical inactivity/activity patterns deserves further exploration.

The influence of the familial environment and varying socioeconomic conditions on the development of obesity in children goes beyond influence on dietary or physical activity behaviour. One prospective cohort study of 2,913 children aged 0 to 8 years at baseline, followed over a six-year period, found that children raised in environments with lower levels of cognitive stimulation in the home environment had more than double the risk of becoming obese than those who received the highest levels of cognitive stimulation. Although the mechanisms by which cognitive stimulation works to protect against obesity are unknown, increased risk of childhood obesity associated with lower cognitive stimulation was demonstrated consistently among single mothers, minorities, and the lowest income and education groups.¹³⁴ The possibility exists that simply increased television viewing, a sedentary activity, may be associated with decreased cognitive stimulation.

Physical environment: The possibility exists that the physical environment in low-SES areas is structurally different than that of high-SES areas. If that structure is more obesogenic in low-SES areas, encouraging increased caloric intake and/or decreased physical activity, a link between environmental and social determinants of obesity is plausible.

A study in Australia analyzed the density of fast-food outlets associated with area measures of SES. Fast-food outlets were 2.5 times more likely to be located in areas where people from the poorest SES category lived as compared to where people in the wealthiest category lived. Increased exposure to energy-dense foods in these low-SES areas supports the link between social and economic determinants of obesity.¹⁴⁸ Canadian studies have reported that food costs are higher in lower-income neighbourhoods.⁹² Small Canadian studies have observed decreased access to supermarkets in lower-income areas; transportation to inexpensive food markets is challenging for low-income families.⁹² Access to affordable, nutritious market food in First Nations communities is

limited by geographic isolation.⁹³ All of these factors create a potentially obesogenic environment. Further analysis of the geographic distribution of retail- and fast-food outlets may help explain the environmental determinants of eating behaviour.

Although there are few studies of the effects of local environment on physical activity, one might expect that physical activity would be hampered by lack of access to inexpensive exercise facilities and inability to afford sports and exercise equipment. In one American study, lower-income adults were more likely to report living in a neighbourhood with fewer places to exercise, less enjoyable scenery, more heavy traffic, unattended dogs, and foul air from cars/factories.¹⁴⁹ Neighbourhoods with crime rates that create barriers to safe and affordable activities such as walking may encourage indoor pursuits associated with inactivity, such as TV viewing.⁸⁴ Canadian data support the idea that safety concerns may discourage outdoor activities for children, as only 54% of Canadians surveyed in the 1999 GSS were “not at all worried” about crime in their neighbourhoods, and higher-income Canadians were more likely to report feelings of safety.¹⁵⁰

The contributions of urban sprawl to obesity have been discussed previously in the context of environmental determinants of physical inactivity.^{120, 121, 122} Yet, the contribution of urban sprawl to the aggravation of poverty deserves some consideration. As resources and services (such as low-cost food markets, recreational facilities, and modern schools) migrate outward from the core of the city (following higher-income residents), poverty is left behind, concentrated in the inner city. The built environment may, therefore, have an impact on obesity beyond its influence on activity patterns. The “ghettoization” of inner cities may intensify income inequality across metropolitan areas, decrease social cohesion, and increase stress.¹²⁰ The interactions among various aspects of the social and physical environment and health, particularly obesity, deserve further exploration.

Potential Mechanisms: Bio-Psychological Pathways

Although data are limited, bio-psychological processes may contribute to the SES-obesity gradient. Epidemiological observations that inequality—not only absolute levels of SES—is an important predictor of poor health suggest that socioenvironmental stress associated with perceived relative social standing may contribute to health inequalities. The role of stress in promoting obesity may play a role in bio-psychological pathways leading to major chronic diseases related to SES.^{151, 152}

Effects of SES on health may be linked to obesity through distribution of fat abdominally, as measured by waist-hip ratio (WHR) or waist circumference (WC). Abdominal fat is more sensitive to cortisol, a hormone secreted in response to stress. As stress levels increase, cortisol is released and abdominal body fat is deposited. Thus, WC and WHR may be more predictive than BMI when studying the relationship between obesity and low SES.¹⁵¹

Since stress is subjective, a person's perceived social status may be more strongly linked to health than objective measures of SES. In a study of healthy women, higher subjective SES was associated with better self-rated health, smaller WHR, and cortisol habituation indicating healthy adaptation to novel stress.¹⁵¹ All of these observations support the hypothesis that low perceived social status is associated with abdominal obesity via cortisol action.

A study of ecologically defined socioenvironmental stress, as measured by a household income inequality index in 21 U.S. states, revealed that men's likelihood of abdominal weight gain was positively associated with higher levels of inequality, while women demonstrated non-significant trends in the same direction.¹⁵² There is, therefore, preliminary evidence of a role for socioenvironmental stress and perceived SES as indicators of social inequity in promoting abdominal obesity, a risk factor for several chronic diseases, including cardiovascular diseases and Type 2 diabetes.

Potential Mechanisms: Cultural Differences

When evaluating plausible mechanisms for social determinants of obesity, it is difficult to separate out ethnicity from income, education, and occupation as indicators of SES. The high rates of obesity among Canadian Aboriginal populations, described earlier,^{12, 25, 26, 27} and high burden of obesity among U.S. minority populations,¹⁵³ can often be largely accounted for by the lower SES of these populations. There does, however, appear to be a more generous cultural acceptance of a broader range of acceptable body sizes among certain non-dominant cultural groups. For example, one study revealed that Ojibwa-Cree tend to prefer relatively larger body shapes than those reported for Anglo populations, although the obese still perceive themselves as less healthy and would prefer a smaller body size for themselves.¹⁵⁴ Cultural values relating to obesity in minority populations may offer protection from fear of stigmatization prevalent in the larger society.¹⁵³

Culture, however, is not limited to ethnicity. Although the association of obesity with poor health has been common knowledge for some time, "sociocultural conceptions of what weight is appropriate predominate in the general population, and these conceptions may be minimally influenced by health criteria."⁸⁶ (p. 296) Eating and physical activity patterns are also rooted in culture. The "cultural embeddedness" (p. 295) of obesity in industrialized nations, where excess weight carries moral connotations of gluttony or slothfulness, acts as a filter, whereas obesity is viewed as a public health problem only when rates rise so rapidly that it constitutes a "crisis."⁸⁶ In addition, "obesity, eating disorders, and unhealthy weight loss practices are cultivated in the same cultural context—an increasingly "toxic" environment regarding food and weight."¹⁵⁵ (p. 299) Thus, the role of culture in defining and addressing body image should be considered in designing interventions. There is much to be learned with respect to the role of culture in social determinants of obesity.

Summary and Author's Policy Options: Socioeconomic Status as a Determinant of Obesity

The sociocultural context of obesity is less well understood than behavioural and environmental contexts. Canadian data demonstrate increased risk of obesity among low social status groups. For adults, education is a strong determinant; for children, household income plays a major role. The mechanisms by which low SES promotes obesity are complex. There is evidence to suggest that behaviour patterns of people living in poverty are more likely to promote obesity than those of their higher-income counterparts. However, those behaviours are embedded within environmental and social contexts that are well beyond individual control. Availability of low-cost, nutritious food and safe, inexpensive places to be active are limited for low-income people. Increasing social inequities and associated stress may have biological impacts.

The author identified gaps in research methodologies that would enable a better understanding of the social determinants of obesity and provide guidance for social policy development. Specifically,

- the development of a variety of methods and analytical techniques to assess the impact of SES-environment interactions on obesity is a potential area for further research development, and
- social policies linked to poverty and income inequity may have effects on health, including obesity, and deserve exploration.

Global Determinants of Obesity

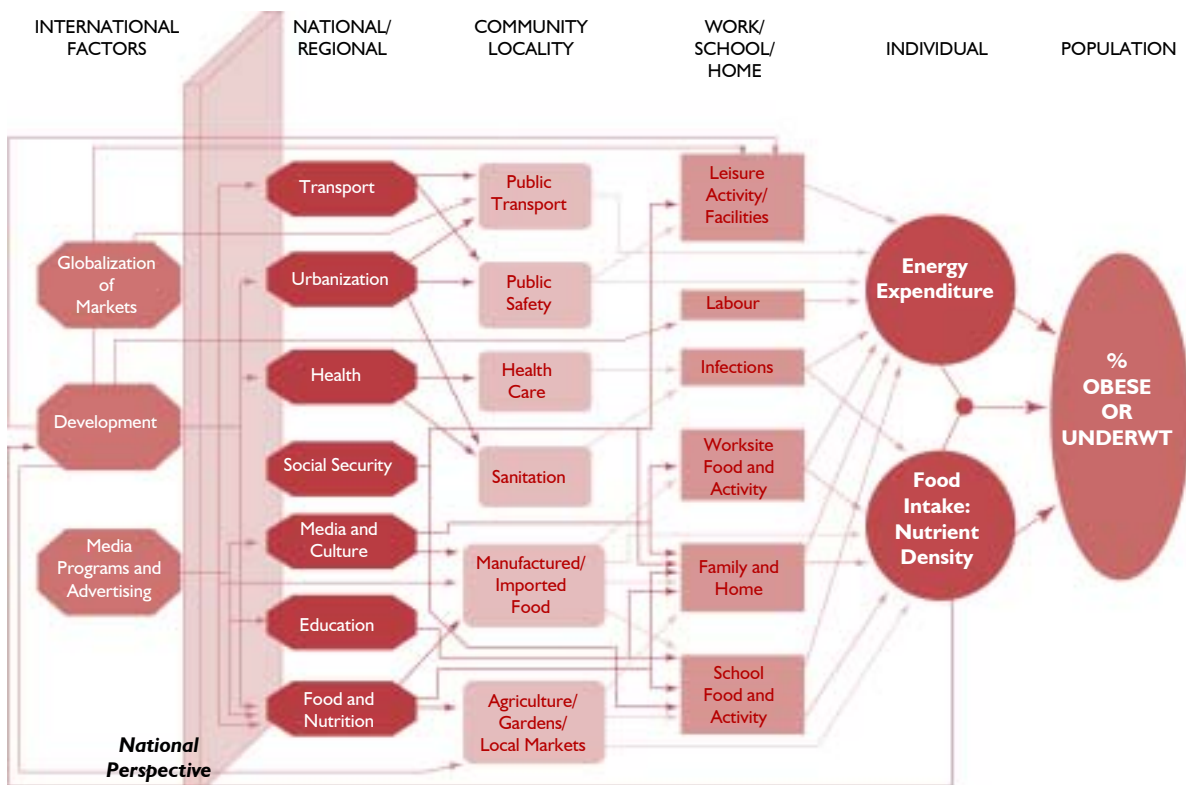
The individual, environmental, and social determinants of obesity are all embedded within a global environment. One commentary that explicitly examines globalization was found, and is considered here. Sobal defines globalization as “the process of worldwide integration and unification of previously local, national and regional phenomenon into global units.”¹⁵⁶ (p. 1137) He argues that the worldwide epidemic of obesity is more than a set of independent national occurrences. The penetration of Western food systems, labour-saving technological advances (including transportation), and consumer culture into societies worldwide has led to an obesogenic global environment:

Global corporations are establishing industrialized agro-food systems in almost all nations that will provide 24 hours a day/7 days a week/365 days a year consumer access to virtually unlimited volumes of relatively inexpensive calorically dense foods to all people in all places at all times through supermarket, catering, vending, takeout, home delivered, drive through, and fast/snack foods.¹⁵⁶ (p. 1137)

While some areas, such as the U.S. and southern Canada, are almost completely globalized, food and activity patterns vary little between social strata, except that more affluent citizens are able to access resources to assist them in battling obesity. In other nations, the more affluent are exposed to global systems and develop obesity, while rural areas are less drawn into global systems, rely on traditional local systems for food, and may experience under-nutrition. Children tend to be drawn into global systems more rapidly than their parents, a phenomenon that may relate to the faster rising rates of worldwide childhood obesity. Global measures should, therefore, be included in a comprehensive public health response to the obesity epidemic.¹⁵⁶

Summary of Obesity Determinants

The International Obesity Task Force has developed the following causal web for obesity that schematically organizes the determinants.⁴⁶ The schematic is a useful organizational tool for understanding how determinants of obesity are interrelated and the need for intervention at multiple levels.



Source: S. Kumanyika, R.W. Jeffery, A. Morabia, C. Ritenbaugh, V.J. Antipatis, Public Health Approaches to the Prevention of Obesity (PHAPO) Working Group of the International Obesity Task Force (IOTF), "Obesity Prevention: The Case for Action," *International Journal of Obesity and Related Metabolic Disorders* 26, 3 (2002): pp. 425–36.

Addressing Obesity and Its Determinants: An Ecological Approach

Examined from a population health perspective, the previous section characterizes the ways in which the development of obesity involves a complex set of factors from multiple contexts that interact with one another to increase risk. A variety of authors have advocated for an ecological approach to address this multifaceted system. Ecological approaches suggest multilevel public health strategies to promote healthy lifestyles and reduce obesity.^{115, 157, 158, 159, 160, 161} Ecological approaches are consistent with health promotion in that they can help to organize strategies that work both to support healthy lifestyles among individuals and influence policy that will create opportunities for social and cultural change. Strategies can be categorized by their predominant focus at the following ecological levels: individual or intrapersonal (individual knowledge, attitudes, and behaviour), interpersonal (family and peers), institutional (schools and worksites), community (interagency and intersectoral), and public policy.¹⁶² Ecological levels are not discrete but interconnected. For ease of presentation and consistency with the organization of the previous section on determinants of obesity, strategies will be grouped as follows: 1) individual (intrapersonal and family), 2) environmental (institutional and community), and 3) population. There are implications for policy at all levels of the ecological model.

The emphasis here will be on environmental and population strategies, not in opposition to individual strategies, but in support of them. The rationale for this choice is that most strategies for promoting changes in dietary and physical activity behaviour to date have focused on individual and group levels. The review of determinants of obesity, however, calls for a broader change in social environments. Other health issues—namely tobacco, seatbelts, breastfeeding, and recycling—have succeeded in generating social change at levels similar to those necessary to address the current obesity epidemic. These successful models have predominantly targeted environment and population policy.¹⁶³ Lessons learned from these social-change models provide hope for a social-change approach to obesity. All of these models began with a crisis; worked from a basis of evidence; were grounded in problems with high economic costs; were propelled forward by projections of savings from change; created coalitions that brought people, sectors, and organizations together for a common goal; were supported by media advocacy that created a public will for change; and involved governments with respect to environmental and policy change.¹⁶³ As the evidence of the increasing prevalence of obesity increases along with accompanying impacts on health and the economy, and as coalitions, including government, are beginning to form, there appears to be support for a movement toward social-change models to address the obesity epidemic in Canada.

Individual Strategies to Address Behavioural Risk

Table 9 summarizes individual strategies. For overweight individuals, reducing health risk can be achieved with as little as a 10% reduction in weight,⁴⁹ regardless of whether an “ideal” BMI has been achieved. Unfortunately, the effectiveness of programs for weight loss via lifestyle change (controlled energy intake, increased physical activity) is highly variable. There are little available data on the effectiveness of commercial, private, or ambulatory-care weight-management programs. In fact, the proliferation of commercial weight-loss options has been accompanied by false and misleading claims in advertising that may undermine individual efforts and compromise financial status.¹⁶⁴ Long-term multidisciplinary programs, although more expensive to run, seem to be more effective than short-term programs. For example, long-term (10-year) success has been reported by Epstein and colleagues for multidisciplinary behavioral weight-management programs for children.^{165, 166} Available data, however, suggest that most lifestyle weight-loss programs are not so comprehensive and infrequently result in sustained weight loss.

Barriers to implementing maximally effective weight-management programs include lack of resources to support such programs within the current environment of cost containment, lack of knowledge and counselling skills for health professionals, and lack of widespread third-party reimbursement for weight management.¹⁶⁷ In Canada, counselling services offered by dietitians and physical-activity specialists are not considered “medically necessary” and so are not covered as part of provincial health plans. However, some relatively inexpensive and readily applied strategies are promising. For example, intensive and repeated counselling by primary health care professionals can help patients become more physically active.^{168, 169}

Resistance to support for weight-management programs is to be expected. The growing size-acceptance movement¹⁷⁰ has paralleled a “health at any size” movement among health professionals that advocates a new paradigm of supporting overweight people in improving their health regardless of weight change. Arguments for non-weight-based strategies are grounded in both concern for the psychological and social well-being of overweight people in a weight-obsessed society with growing rates of body-image disturbance and disordered eating¹⁷¹ as well as evidence of physiological and psychological health risks of chronic restrictive dieting and weight cycling.^{172, 173} Although the health at any size movement provides valuable insights into non-stigmatizing counselling strategies for health professionals and the importance of fitness in reducing health risk, even among overweight individuals,¹⁷⁴ it fails to take into account the fact that weight loss can significantly reduce comorbidities for obese patients. As even those who work with eating-disordered populations see space for integrating the prevention of eating disorders and obesity through environmental and policy approaches,^{155, 175} the health at any size movement is likely to be supportive of research-based treatment that promotes healthy, normal eating;¹⁷⁶ primary prevention; and the creation of supportive environments for healthy lifestyles.

Prevention of obesity can also begin at the individual and interpersonal levels. Family interventions for obesity prevention among children are particularly noteworthy.¹⁷⁷ Although evaluation data are not readily available, Health Canada’s VITALITY program is a Canadian strategy philosophically consistent with an integrated approach to obesity prevention at the individual level.¹⁷⁸ “VITALITY is an integrated approach that promotes healthy eating, active living and positive self and body image.”¹⁷⁸ This integrated approach emphasizes health-enhancing behaviours to achieve and maintain a healthy weight rather than focusing on weight itself. “VITALITY provides nutrition, fitness and other health professionals and leaders in schools, workplaces and communities with opportunities to take a more holistic approach by moving beyond weight control, calorie-restricted diets and prescriptive exercise regimes.”¹⁷⁸ The VITALITY approach could therefore also be used as a model for the promotion of healthy weights at environmental levels of the ecological framework.

Table 9 Individual Strategies to Promote Healthy Weights*	Strategy	Target Group	Target Outcome	Evidence of Effectiveness (Health and Cost)	Barriers to Implementation	Canadian Initiatives
	Counselling by primary care professionals ¹⁶⁸	<ul style="list-style-type: none"> • Overweight/obese • Overweight/sedentary adults 	<ul style="list-style-type: none"> • Weight loss • ↑ Physical activity 	<ul style="list-style-type: none"> • Unclear¹⁷⁹ • Cost-effectiveness unknown • One year effectiveness of behavioral counselling¹⁶⁹ 	<ul style="list-style-type: none"> • Clinician time • Fee schedules • Inadequate knowledge of effective counselling 	<ul style="list-style-type: none"> • Clinical Practice Guidelines • Healthy Heart Kit (adults)¹³⁹ • Primary Health Centres
	Telephone-based intervention ¹⁸⁰	<ul style="list-style-type: none"> • Overweight adults 	<ul style="list-style-type: none"> • Weight loss 	<ul style="list-style-type: none"> • No advantage to telephone support • Minimal cost 	<ul style="list-style-type: none"> • Minimal 	<ul style="list-style-type: none"> • Telephone-based health information
	Healthy living programs ¹⁷⁸	<ul style="list-style-type: none"> • All 	<ul style="list-style-type: none"> • Healthy eating and active living 	<ul style="list-style-type: none"> • Minimal data 	<ul style="list-style-type: none"> • Minimal 	<ul style="list-style-type: none"> • VITALITY
	Family-based behavioural treatment ¹⁶⁶	<ul style="list-style-type: none"> • Overweight children and adolescents 	<ul style="list-style-type: none"> • Weight management 	<ul style="list-style-type: none"> • Long-term success for children in research settings¹⁶⁵ 	<ul style="list-style-type: none"> • Practicality in primary care settings 	
	Family-based prevention ^{177, 179}	<ul style="list-style-type: none"> • Children and adolescents 	<ul style="list-style-type: none"> • Prevention 	<ul style="list-style-type: none"> • Encouraging 		
* Please note that this chart does not represent a systematic review and, therefore, comparable indicators have not been provided.						

Environmental Strategies to Promote Healthy Living

Environmental strategies involve institution- and community-based interventions to promote healthy living. That is, their focus of outcome is not necessarily on weight/obesity per se, but on encouraging healthy eating, increased physical activity, and decreased sedentary living. Implementation of environment-based strategies needed to encourage and support behaviour change will probably require the involvement of people from relevant sectors outside the obesity field.¹⁸¹ Schools, worksites, and local municipalities/neighbourhoods are likely settings for change. Table 10 summarizes environmental strategies to promote healthy living.

School Initiatives

As children spend a great percentage of their time at school, schools present an environmental opportunity for prevention and management of childhood and adolescent obesity. School personnel generally support the concept of promoting health through schools, although lack of time, knowledge, and resources have been reported as barriers to program implementation.¹⁸² Although few well-controlled studies of school-based interventions with a specific obesity-prevention focus have been reported, a variety of initiatives focusing on increasing physical activity and healthy eating have shown promising results.^{183, 184} Efforts to decrease sedentary activity through school-based curriculum have also been shown to be effective in decreasing BMI, television viewing, and meals eaten in front of the TV.¹⁸⁵ The emphasis of this discussion will be on the prevention of obesity through the promotion of healthy living; it is recognized, however, that a health-promoting school environment will likely be supportive of efforts to manage weight among those children who are already overweight.

A comprehensive school health program model has been proposed to address obesity. Evidence suggests that such a program would include eight interacting components: health instruction, health services, school environment, food service, school-site health promotion for faculty and staff, social-support services, physical-education classes, and integrated and linked family and community health promotion efforts.¹⁸⁴ The Kiel (Germany) Obesity Prevention Study (KOPS) is one such rigorously evaluated comprehensive intervention. KOPS encourages consumption of fruits and vegetables and lower-fat food choices, increased physical activity, and decreased TV viewing through instruction of children and parents, as well as daily opportunities for physical activity and individualized counselling for obese children through partnership with a sports-based agency. KOPS is currently part way through an eight-year follow-up and shows promising results.¹⁸⁶

Although not specific to obesity prevention, the Canadian Association for Health, Physical Education, Recreation and Dance has developed a position on quality school health that takes a similar comprehensive, integrated approach.¹¹⁶ A comprehensive school health program, based upon the Calgary Comprehensive Schools Heart Health model, is currently being adopted by Alberta Learning and school boards throughout the province of Alberta.¹⁸⁷ The curriculum and school environments specifically promote “heart healthy” eating, physical activity, and tobacco reduction. The Kahnawake Schools Diabetes Prevention Project is another promising comprehensive Canadian initiative that focuses specifically on enhancing health curriculum, school-based physical activity, and healthy food policies for Aboriginal (Mohawk) students.¹⁸⁸

School initiatives specific to healthy eating: Evidence suggests that nutrition education at school is likely to be more effective in an environment that limits exposure to non-nutritive foods and increases availability of healthy food choices on site. Improving the nutritional quality of food available at school is a strategic policy option that works with school food services to support nutrition instruction.⁴⁶ Adopting school policies that promote healthy food choices at school, including approved menus for school meals and student stores, guidelines for bag lunches, and healthier choices for fundraising, would be expected to have moderate to high impact with easy-to-moderate changeability.¹⁸⁹ In Canada, some efforts to move toward school food policies have been embraced by students, staff, and parents,¹⁹⁰ while others have met with resistance due to revenue-generation pressures.¹⁹¹

Of particular note is the “growing political movement against soft drinks in schools”¹⁹² (p. 2181) in the U.S. The American Academy of Pediatrics has issued a policy statement on restriction of sales of soft drinks in schools.¹⁹³ School districts in the U.S. are beginning to refuse to enter into exclusive contracts with soft-drink companies, a phenomenon that the author suggests Canada may wish to follow. In February 2002, Oakland school district banned all soda and candy from schools,¹⁹² and in August, the Los Angeles (L.A.) school district voted to ban all soft drinks beginning in 2004.¹⁹⁴ With \$4.5 million in soda sales per year in the L.A. district’s 677 schools, this move is significant, and support from the state department of education in the form of grants is assisting schools with the transition.¹⁹² Sale of bottled water, sports drinks, and juices are still permitted. As discussed earlier, in Canada, large beverage manufacturers will voluntarily withdraw carbonated beverages from vending machines in elementary schools effective September 2004.⁹⁷

School initiatives specific to physical activity: Improving opportunities for physical activity by increasing the range of enjoyable, non-competitive activities offered at school as well as promoting “safe routes to school” programs are part of school-based environmental interventions for childhood obesity prevention.⁴⁶ Available evidence also suggests adopting school policies that promote mandatory physical education at school as a viable policy option.¹⁹⁵ Providing adequate free playtime at recess and lunch breaks, after-school physical-activity opportunities, and support for commuting to school via active means could have moderate to high impact with easy-to-moderate changeability.¹⁸⁹

Curriculum changes within the context of a supportive school environment have also been shown to be effective in promoting physical activity.¹¹⁷ Promising Canadian strategies include the Ontario Physical and Health Education Association's programs, which include curriculum support for teachers and a variety of active-schools programs targeted to age- and gender-specific groups to generate opportunities for enhancing the physical health and well-being of children and youth.¹⁹⁶ Advocacy for quality daily physical education to a minimum standard of 150 minutes per week is ongoing.¹¹⁶ Alberta's Ever Active Schools program, an inter-ministerial initiative of Alberta Community Development, Health and Wellness and Learning, as well as non-governmental partners, is an ongoing comprehensive initiative to promote active living in more than 120 Alberta schools.¹⁹⁷ Canada's Go for Green active living and environment program includes an Active & Safe Routes to School component, which includes parent-supervised Walking and Cycling School Buses that gather groups of children together to walk or cycle to school.¹⁹⁸

Workplace Initiatives

While children spend a great percentage of their time at school, adults spend a significant amount of time at work. Worksites present an environmental opportunity for the promotion of increased physical activity and healthy eating. The emphasis of this discussion will be on prevention of obesity through promotion of healthy living; it is recognized, however, that a health-promoting work environment will likely be supportive of efforts to manage weight among those who are already overweight. In addition, occupational health and safety departments may provide counselling, referral, or resources for weight management of employees; most published reports of worksite obesity programs have emphasized a clinical perspective.¹⁹⁹

Very little literature explicitly addresses the promotion of healthy weights through worksite policies. Limited data are available on benefits of worksite fitness programs, however, while less data is available for nutrition policies. Comprehensive programs that include physical activity and, in some cases, smoking cessation, weight reduction, and substance-abuse control, have been shown to provide a net financial benefit to the corporation as high as 5:1. That is, a \$100-per-employee investment in health promotion programs can save up to \$500 per employee through increased productivity, decreased absenteeism and turnover, decreased medical costs, decreased occupational injuries, and decreased premature deaths.²⁰⁰ It is important to recognize, however, that in spite of economic impact, there are very few well-designed studies that enable attribution of effect to improvements in fitness or weight control; the impact on obesity prevention or management, therefore, is unclear. A summary of recent data on worksite wellness programs is available through Health Canada's "The Business Case for Active Living."²¹⁷

A variety of moderately feasible environmental interventions with estimated moderate impact at worksites include the introduction of fitness facilities, bicycle racks, shower facilities, flexible hours to accommodate time for exercise, kitchen facilities, point-of-purchase nutrition information in cafeterias and on vending machines, and availability of healthy food choices at a reasonable price through subsidization.^{46, 189} In Canada, Go for Green offers a guide to active transportation to, from, and at the workplace to motivate people to become active commuters and to provide workplace supports.²⁰¹ A unique and relatively low-cost intervention that has been evaluated for effectiveness is making stairwells more easily accessible via prominent signage, combined with artwork and music to increase the attractiveness of use.²⁰² Although tested at a worksite, stairwell interventions have broader community applications.

Community Initiatives

Community initiatives to promote healthy eating: Community initiatives to promote healthy eating provide ready access to a variety of nutritious, affordable foods and disincentives for less healthy alternatives. Targeted settings for intervention include food retailers, food service operations, and community food producers.

Point-of-choice nutrition education in food retail and service operations have been used extensively with variable success rates in motivating consumer choices.²⁰³ The Heart and Stroke Foundation of Canada's Health Check program is an example of such a strategy.²⁵⁰ Pricing strategies have also been used to promote healthy food choices. For example, reducing relative prices on low-fat snacks has been shown to be effective in promoting lower-fat snack purchases from vending machines in both adult and adolescent populations.²⁰⁴ Evaluation of combined nutrition message/price reduction strategies suggests that price decreases may be a more powerful means than health messages of increasing consumption of healthy foods.²⁰⁵

Beyond nutrition messaging and price, the organization of supermarkets and other retailers may also be a target for change. Encouraging stores to offer adequate shelf space for healthy foods and to discourage junk food placement targeting children (for example, candy-free checkouts) is potentially useful, but may be difficult considering profit motives.¹⁸⁹

Taking into account the previously described connection between obesity and low-income populations, environmental interventions that consider the needs of low-income people may include community programs such as collective kitchens (with a focus on healthy food choices) and access to public green space for community gardens (to support production of low-cost nutritious food as well as active living). Originally developed in response to the needs of low-income city-dwellers, the Toronto Food Policy Council (TFPC) of the Toronto Board of Health was developed in 1990.²⁰⁶ The TFPC is a unique organization with membership from large food corporations, conventional and organic farms, co-operatives, unions, social justice and faith groups, and City Council. The Council supports programs such as Field to Table, which connect low-income inner-

city residents with farmers in need of a market for their produce, as well as rooftop and community gardens. The TFPC's local action is "balanced by longer-term efforts to develop policies at the municipal and provincial level that will support Ontario farmers and provide quality, environmentally-sound, nutritious food to the people of Toronto."²⁰⁶

Community initiatives to promote active living: There have been few well-evaluated and comprehensive community-wide programs promoting increases in physical activity, although recently there have been more efforts in this area. Community-wide active living strategies combine media, newsletters, special events, promotional materials, information lines, health fairs, and partnerships with worksites and schools. A recent phenomenon is the use of pedometers to encourage walking among residents of entire communities.²⁰⁷ Preliminary effectiveness data in the Canadian context is promising,²⁰⁸ and Prince Edward Island has developed a community-wide program, *PEI Stepping Out*.²⁰⁹ In January 2004, *Canada on the Move*, a partnership between industry and a health-research organization was launched. More than 800,000 pedometers were distributed free of charge in cereal boxes, and recipients were urged to donate their steps on-line.²⁵¹ The on-line database is being used to evaluate the effectiveness of pedometers in increasing physical activity in the population by researchers associated with the Institute of Nutrition, Metabolism and Diabetes of the Canadian Institutes of Health Research.²¹⁰ In Australia, a nationwide social marketing campaign "Exercise—make it a part of your day" significantly increased the level of walking across all social classes and age groups in a sample community.²¹¹ Long-term impact on weight is not yet available.

Based upon demonstrated effectiveness of community interventions in increasing physical activity and improving fitness, the Task Force on Community Preventive Services strongly recommends such campaigns.¹⁹⁵ Canadian examples include Saskatoon's *In Motion*,²¹² and *Healthy Active Kids*, Nova Scotia's provincial physical activity strategy for children and youth.²¹³

Community-based campaigns to increase neighbourhood safety, provide adequate lighting, and advocate for park space are also plausible means of making communities safer places to be physically active.²¹¹ In rural communities, construction of walking trails has been found effective in promoting physical activity, particularly among lower-SES groups.²¹⁴ Such strategies require buy-in from multiple sectors, and are thus frequently an entry point to broader, structural change.

Table 10
Environmental
Strategies to
Promote
Healthy Living*

Environmental Setting	Strategy	Description	Strength of Evidence	Barriers to Implementation	Canadian Initiatives
Schools	<ul style="list-style-type: none"> Comprehensive school health 	<ul style="list-style-type: none"> Health instruction Health services School environment Food service School-site health promotion for faculty and staff Social support services Physical-education classes Integrated and linked family and community health promotion efforts¹⁸⁴ 	<ul style="list-style-type: none"> Promising¹⁸⁶ 	<ul style="list-style-type: none"> Resources 	<ul style="list-style-type: none"> Quality school health²¹⁵ Calgary Comprehensive Schools Heart Health model¹⁸⁷ Kahnawake Schools Diabetes Prevention Project for Aboriginal (Mohawk) students¹⁸⁸
Schools	<ul style="list-style-type: none"> School food policies 	<ul style="list-style-type: none"> Approved menus for school meals and student stores Guidelines for bag lunches Healthier choices for fundraising¹⁸⁹ Soft-drink ban¹⁹² 	<ul style="list-style-type: none"> Moderate to high impact¹⁸⁹ 	<ul style="list-style-type: none"> Minimal Potential for corporate resistance 	<ul style="list-style-type: none"> Voluntary withdrawal
Schools	<ul style="list-style-type: none"> School physical-education policies Active schools programs Active routes to school 	<ul style="list-style-type: none"> Mandatory physical education Adequate free play time at recess and lunch breaks, after-school physical activity opportunities Parent-supervised Walking and Cycling School Buses 	<ul style="list-style-type: none"> High impact^{195, 216} Moderate to high impact¹⁸⁹ 	<ul style="list-style-type: none"> Resources Political will at school system level²¹⁶ Minimal 	<ul style="list-style-type: none"> Quality Daily Physical Education¹¹⁶ Ontario Physical and Health Education Association programs¹⁹⁶ Alberta's Ever Active Schools¹⁹⁷ Active and Safe Routes to School¹⁹⁸
Worksites	<ul style="list-style-type: none"> Comprehensive worksite health promotion 	<ul style="list-style-type: none"> Physical activity Smoking cessation Weight reduction Substance abuse counselling 	<ul style="list-style-type: none"> Return on employer investment²⁰⁰ 	<ul style="list-style-type: none"> Resources Staffing Implementation costs²¹⁷ 	<ul style="list-style-type: none"> Business Case for Active Living at Work²¹⁷
Worksites	<ul style="list-style-type: none"> Supportive facilities 	<ul style="list-style-type: none"> Fitness facilities Bicycle racks Shower facilities Flexible hours Kitchen facilities Point-of-purchase nutrition information in cafeterias and on vending machines Healthy food choices subsidization^{46, 189} 	<ul style="list-style-type: none"> Moderate impact¹⁸⁹ 	<ul style="list-style-type: none"> Resources 	<ul style="list-style-type: none"> Go for Green's Walk and Roll²⁰¹

(table continued on next page)

Table 10 (cont'd)

Environmental Setting	Strategy	Description	Strength of Evidence	Barriers to Implementation	Canadian Initiatives
Community	<ul style="list-style-type: none"> Point-of-choice nutrition education 	<ul style="list-style-type: none"> “Signposts” or logos indicating healthier alternatives 	<ul style="list-style-type: none"> Simplify consumer choice Motivate food reformulation 	<ul style="list-style-type: none"> Standards and policies require development 	<ul style="list-style-type: none"> Heart and Stroke Foundation of Canada’s Health Check
Community	<ul style="list-style-type: none"> Pricing strategies 	<ul style="list-style-type: none"> Decreased pricing for healthy food choices 	<ul style="list-style-type: none"> Effective in promoting lower-fat snack purchases from vending machines²⁰⁴ 	<ul style="list-style-type: none"> Resources 	
Community	<ul style="list-style-type: none"> Re-organization of retail food outlets 	<ul style="list-style-type: none"> Inconspicuous placement of less healthy foods Candy-free checkout aisles 	<ul style="list-style-type: none"> Little evidence 	<ul style="list-style-type: none"> Potential for corporate resistance¹⁸⁹ 	
Community	<ul style="list-style-type: none"> Food security programs and policies 	<ul style="list-style-type: none"> Collective kitchens Community gardens 	<ul style="list-style-type: none"> Effective primarily in low-income populations²⁰⁶ 	<ul style="list-style-type: none"> Resources Political will 	<ul style="list-style-type: none"> Toronto Food Policy Council²⁰⁶
Community	<ul style="list-style-type: none"> Point-of-decision prompts for physical activity 	<ul style="list-style-type: none"> Stairwells more easily accessible via prominent signage²⁰² 	<ul style="list-style-type: none"> Effective¹⁹⁵ 	<ul style="list-style-type: none"> Minimal 	
Community	<ul style="list-style-type: none"> Community-wide campaigns to increase physical activity 	<ul style="list-style-type: none"> Media Support and self-help groups Community health fairs Risk screening School and worksite programs 	<ul style="list-style-type: none"> Very effective¹⁹⁵ 	<ul style="list-style-type: none"> Significant financial investment 	<ul style="list-style-type: none"> Saskatoon’s In Motion²¹² Healthy Active Kids²¹³
Community	<ul style="list-style-type: none"> Pedometer programs 	<ul style="list-style-type: none"> Use of pedometers to motivate walking 	<ul style="list-style-type: none"> Preliminary effectiveness data²⁰⁸ 	<ul style="list-style-type: none"> Cost of pedometers Staffing of programs 	<ul style="list-style-type: none"> PEI Stepping Out²⁰⁹

* Please note that this chart does not represent a systematic review and, therefore, comparable indicators have not been provided.

Author's Summary of Strategies for Population-Wide Structural Change

There is a very strong relationship between the average BMI of a population and the prevalence of obesity in that population. At lower levels of average BMI (< 23), the prevalence of obesity (BMI > 30) is quite low. However, for every unit of increase above 23 of average BMI in a population, there is an almost 5% increase in obesity prevalence.²¹⁸ These epidemiological observations suggest that the most effective prevention strategies for obesity will be those that concentrate on preventing a rise in the mean population BMI. Although population-based interventions may be criticized for encouraging changes in people who may not be directly affected by obesity, the relationship between mean population BMI and obesity prevalence addresses this criticism. In addition, as the majority of the adult population in industrialized nations, including Canada, is affected by excess weight, the importance of population-level interventions is clear.¹

Population-Wide Public Health Programs

Evidence suggests that most effective interventions to change diet and physical-activity patterns at the population level 1) adopt an integrated, multidisciplinary, and comprehensive approach; 2) involve a complementary range of actions; and 3) work at individual, community, environmental, and policy levels.²¹⁹ Therefore, population-based change strategies are usually most effective when they include, but are not limited to, strategies previously described under other ecological levels. A review of population-based change strategies reveals that their success requires political support to ensure that programs are well resourced and integrated into existing programs and structures.⁴⁶ 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 prepared to capture local opportunities.⁴⁶

According to the WHO (World Health Organization), “[t]o date, there have not been any well-evaluated and properly organized public health programmes aimed at the population-level management or prevention of obesity.”¹ (p. 183) One exception would be Singapore, whose Trim and Fit coordinated, targeted, healthy lifestyle program has shown promising reductions in obesity rates (approximately 4%) among school-aged children between 1992 and 1995.^{252, 253}

Results from several long-term, large-scale coronary heart disease (CHD) prevention or “heart health” programs may also be instructive, as many of these programs included obesity as a focus and BMI as a measurable outcome. Although effective with respect to reduction in cardiovascular risk factors, these programs did not affect mean BMI of the target populations.²²⁰ The disappointing results in terms of obesity reduction may be due to 1) the primary emphasis on reducing CHD risk, with weight reduction as a means to

achieve risk reduction and not an explicit goal; 2) insufficient reach or “dose” of prevention strategies; 3) attempts to reduce too many risk factors at once (for example, obesity, hypertension, blood lipids, smoking); and 4) rapidly rising secular trends in obesity that may have counteracted interventions.⁴⁵

The longest running and most successful CHD prevention project is the North Karelia Project in Finland. This program included mass media, workplace, and school-based programs as well as legislation, with an emphasis on creating a community infrastructure supportive of “heart healthy” behaviours. The primary emphasis was diet, and over a 20-year period, Finland was able to reduce national fat consumption from 42% to 34% of energy.²²¹ The program led to dramatic reductions in CHD risk factors and mortality.²²² The impact on obesity was one of stabilization. From 1972 to 1982, the mean BMI among women declined, and has since stabilized. Among men, mean BMI continued to increase until 1987, but declined slightly from 1987 to 1992.²²¹ These results are promising, considering that stabilization occurred at a time when global prevalence of obesity was rising rapidly and despite simultaneous decreases in levels of physical activity, a risk factor not addressed in programming.²²¹

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.¹⁶¹ Evaluation of large-scale interventions, including economic-impact evaluations and long-term surveillance of program impacts, are suggested to increase the evidence base.¹⁶¹ In addition, researchers and professionals may feel overwhelmed in the light of perceived inadequate experience and training in practical aspects of large-scale intervention.^{181, 223}

Population-Wide Policy Interventions

The capacity to make large-scale, macrosystem changes in the social environment that promotes obesity depends, in part, upon political will. To that end, there has been a call for policy interventions.^{46, 175, 224, 225, 226, 227, 228, 229, 230, 231} 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.”²³² (p. 510) 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).

Policy: dietary and physical activity guidance: 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*,²³³ *Canada's Physical Activity Guide to Healthy Active Living*,²³⁴ *Canada's Guidelines for Healthy Eating*,²³⁵ *Promoting Healthy Weights: A Discussion Paper*,²³⁶ and *Canadian Guidelines for Body Weight Classification in Adults*.² 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. The national plan of action on nutrition, *Nutrition for Health: An Agenda for Action*,²³⁷ builds on the population health model and sets out strategic directions to encourage policy and program development that is coordinated and intersectoral, that supports new and existing partnerships, that promotes the efficient use of limited resources, and that 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.²³⁸

Although a strong foundation exists, the need to move beyond this is clear. The U.S. *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).²³⁹ 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.²⁴⁰

Taxation: In 1991, California enacted an 8.25% "Twinkie Tax" on non-essential foods. Although the tax generated \$200 million in revenue and decreased snack sales by 10%, 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.²²⁵ 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.²⁴¹

In Canada, the GST/HST have been in place for more than a decade. The GST is a 7% national goods and services tax, while the HST is a 15% regional harmonized sales tax that integrates the federal GST with provincial taxes in the Atlantic region (except P.E.I.). The GST/HST functions as a "sin tax" for food, as basic groceries are exempt (zero-rated),

while foods prepared by eating establishments, those for catering and vending machines, and specific foodstuffs such as alcoholic beverages, soft drinks, and snack foods are taxed.²⁴² Although initially the GST/HST may have acted as disincentives to purchasing foods promoting obesity, over the long run there does not seem to be an impact on purchasing. However, 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 U.S. states.

Advertising restrictions/media regulation: Given the previously documented extent of exposure to food advertising, the majority of which is for foods of lower nutritional quality, restrictions on advertising may be a viable policy option. However, potential opposition to restrictive advertising by corporations and civil libertarians is to be anticipated; public support for such policy initiatives is essential.²²⁵

It is of interest to note that increasing threat of litigation for fast-food companies may have had an impact on fast-food marketing.²⁴⁵ McDonald's France has started an advertising campaign that suggests to consumers that "once a week is enough."²⁴⁶

Policy approaches to land development and transportation planning: The section entitled "Determinants of Obesity: A Population Health Perspective" examined the relationship between increases in car travel and decreases in active commuting and "urban sprawl." As land uses become separate, distances increase, roads are more available than cycling paths or sidewalks, and vehicle travel becomes preferable.^{120, 121} Applying a public health lens to urban planning would promote mixed land use and planning for active transportation. Eighty-two percent (82%) of Canadians believe that the government should support spending on bike lanes.¹¹⁸

Population-Wide Policy Interventions: Summary and Author's Policy Options

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.²³⁰ The effect would be a changed price structure for food that favours purchase of more nutritious choices.²⁴³
- 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.²³⁰
- 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,²⁴⁴ the following policy options are directed at children's media:
 - restrictions on advertising of “junk” foods during peak TV viewing times for children, and²³⁰
 - regulating advertising time to ensure promotion of healthy foods receives equal time.²³⁰
- 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).^{121, 247, 248}

Author's Conclusions, Knowledge Gaps, and Policy Options*

This paper presents evidence that the dramatic increases in overweight and obesity among Canadians over the past 20 years constitutes an epidemic. Epidemiological evidence suggests that the increased prevalence of obesity is accompanying a rise in the mean BMI of the population. According to the WHO (World Health Organization),¹ the impact of the obesity epidemic on non-communicable diseases such as cardiovascular disease, Type 2 diabetes, and cancer threatens to overwhelm health systems; public health and economic implications of obesity deserve attention, and prevention and control is needed. The author identified gaps in existing surveillance of obesity, associated non-communicable diseases, and economic impacts of obesity, gaps that limit understanding of the problem based on accurate, accessible, and appropriate data. Addressing these gaps could facilitate adequate understanding of this problem for targeting appropriate, efficacious, and cost-effective public health interventions.

Policy Option No. 1: Develop a comprehensive, coordinated surveillance system to monitor ongoing rates of obesity, the costs of obesity, and impacts of interventions.

Data available on the energy and nutrient content of the Canadian diet is limited. Although ecological food disappearance data suggests that Canadians are consuming more food than they did 20 years ago, nutrition surveys suggest the opposite. The author identified gaps in food and nutrition surveillance data as a barrier to understanding the determinants of obesity in Canada. While limited data are available on adults, virtually no data are available on the food-consumption patterns and nutrient intake of children. As it has been previously established that obesity rates are increasing most rapidly among children, these data are essential.

Policy Option No. 2: Build upon current commitments to food and nutrition surveillance, including eating patterns and nutrient intake physical measures, through the Canadian Community Health Survey, Cycle 2.2, planned to begin in 2004. Commit further resources to exploit opportunities for ongoing surveillance, data analysis, interpretation, and reporting so that the contributions of food intake and physical activity to obesity can be understood and acted upon.

Available data suggests that physical inactivity is decreasing, although the majority of the population continues to be sedentary. The author identified the following gaps in surveillance of physical activity in Canada:

* Please note that the analyses and conclusions in the report do not necessarily reflect those of the individual members of the Expert Advisory Group, their affiliated organizations, the Canadian Population Health Initiative, or the Canadian Institute for Health Information.

- Current surveillance is limited to self-report. Limitations of self-report have become increasingly apparent. At the same time, new technologies for monitoring physical movement have been successfully tested.
- There is currently no valid, ongoing source of physical activity data on children in Canada.

Limitations of physical activity surveillance pose a barrier to understanding the contribution of physical inactivity and sedentary lifestyle to obesity.

Policy Option No. 3: Develop a comprehensive, coordinated surveillance system to monitor physical activity among Canadians.

There is general agreement that the current epidemic of obesity is largely related to an environment that, in multiple ways, promotes excessive food intake and discourages physical activity. Social differences between and within countries constitute evidence that may provide important insights into ways of influencing changes that could alter the obesity trend. The author identified gaps in available Canadian data on environmental determinants of food-consumption and physical-activity patterns, that pose limitations to developing evidence-based policy and practice.

Policy Option No. 4: 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.

The sociocultural context of obesity is less well understood than behavioural and environmental contexts. Canadian data demonstrate increased risk of obesity among groups with low social status. For adults, education is a strong determinant; for children, household income plays a major role. The mechanisms by which low socioeconomic status is associated with obesity are complex. There is evidence to suggest that behaviour patterns of people living in poverty are more likely to promote obesity than those of their higher-income counterparts. However, those behaviours are embedded within environmental and social contexts that are well beyond individual control. Availability of low-cost, nutritious food and safe, inexpensive places to be active may be limited for low-income people. Increasing social inequities and associated stress may have biological impacts. The author noted that social policies linked to poverty and income inequity may have impacts on health, including obesity.

Policy Option No. 5: Conduct health impact analyses of social policies influencing income equity/financial security to assist in developing an understanding of socioeconomic determinants of obesity.

The problem of obesity is complex. Ecological approaches to the promotion of healthy weights acknowledge this complexity and recommend action on many levels. Most strategies for promoting changes in dietary and physical-activity behaviour to date have focused on individuals and groups. The review of determinants of obesity, however, calls for a broader change in social environments.

Policy Option No. 6: Develop policies supportive of weight management for individuals at risk for health problems due to obesity.

Policies that could be considered include:

- Consider effective strategies for weight management as an appropriate insured service for Canada's health system and/or for supplementary health-insurance plans.
- Develop and implement clinical practice guidelines for health professionals to assist in promoting best practices in weight management.
- Build on existing federal programs and resources that promote obesity prevention, such as the VITALITY program.

Environmental strategies involve institution- and community-based interventions to promote healthy living. That is, their focus of outcome is not necessarily on weight/obesity per se, but on encouraging healthy eating, increased physical activity, and decreased sedentary living. Implementation of environment-based strategies needed to encourage and support behaviour change will probably require the involvement of people from relevant sectors outside the obesity field. Schools, worksites, and local municipalities/neighbourhoods are likely settings for change.

Policy Option No. 7: 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.

Policy Option No. 8: Work with private- and public-sector employers to develop a workplace environment that promotes healthy weights.

Policies that could be considered include:

- Develop comprehensive worksite 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.

Policy Option No. 9: 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 worksites, 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 cost of low-energy, nutritious food and to fund health promotion initiatives.
- Support tax policy that promotes social equity to address low SES 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.

Policy Option No. 10: Evaluate and measure outcomes of programs and interventions using common indicators of success to increase the evidence base for future public-health initiatives.

Evidence suggests that most effective interventions to change diet and physical activity patterns at the population level 1) adopt an integrated, multidisciplinary, and comprehensive approach; 2) involve a complementary range of actions; and 3) work at individual, community, environmental, and policy levels. A review of population-based change strategies reveals that their success requires political support 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 prepared to capture local opportunities. 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 suggested to increase the evidence base. Capacity to make large-scale, macrosystem changes in the social environment that promotes obesity depends, in part, upon political will. To that end, there has been a recent call for policy interventions.

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This publication is part of CPHI's ongoing inquiry into the patterns of health across this country. Consistent with our broader findings, it reflects the extent to which the health of Canadians is socially determined, interconnected, complex and changing. CPHI is committed to deepening our understanding of these patterns.

