The Conference Board of Canada
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MOVING AHEAD

The Economic Impact of Reducing Physical Inactivity and Sedentary Behaviour.

At a Glance

- Only 15 per cent of Canadian adults get the recommended 150 minutes per week of moderate to vigorous physical activity. Further, the majority of Canadians lead a sedentary lifestyle, spending most of their waking hours sitting.
- Individuals, businesses, and governments all have a stake in helping Canadians become more physically active and minimize the time they spend sitting.
- Even a modest reduction in inactivity and sedentary behaviour would cause a substantial decline in disease prevalence and premature mortality, all while boosting economic activity and reducing health care spending.

BRIEFING OCTOBER 2014

Executive Summary

Canadian physical activity guidelines indicate that adults should get at least 150 minutes of moderate to vigorous physical activity per week. Yet, a national survey that measured physical activity found that only 15 per cent of Canadians meet these guidelines.

Even more troubling is the excessive amount of sitting; the same study found that Canadians spend about 10 waking hours every day sitting or being otherwise sedentary. A growing body of research indicates that it is not only necessary to be physically active for at least 150 minutes a week, but it is also important to limit the number of waking hours spent in a sedentary state.

Using the Physical Activity Module of Statistics Canada's Population Health Model (POHEM-PA), The Conference Board of Canada explored the potential benefits that would ensue if a small number of inactive and sedentary Canadians improved their activity levels and sedentary habits for the period 2015 to 2040. The results suggest that even a modest improvement can yield tangible benefits to individuals, employers, and government. By simply getting 10 per cent of Canadians with suboptimal levels of physical activity to exercise more and reduce their sedentary behaviour, the incidence rates for major chronic conditions would be reduced substantially. Moreover, with Canadians living longer and healthier lives, GDP would increase by a cumulative $7.5 billion by 2040. In addition, health care spending on hypertension, diabetes, heart disease, and cancer would potentially be reduced by a cumulative $2.6 billion over this time frame.

Moving Ahead

In The Conference Board of Canada's Canadian Alliance for Sustainable Health Care (CASHC) research series "Moving Ahead: Healthy Active Living in Canada," this and subsequent briefings aim to identify cost-effective, scalable,[1] and sustainable interventions that promote and improve healthy active living—minimizing physical inactivity and sedentary behaviour, promoting adequate nutrition and sleep, and highlighting the negative impacts of smoking and excessive alcohol consumption. A primer document preceding the series not only provided an overview of the linkages between modifiable healthy lifestyle risk factors and chronic conditions, but also laid the groundwork for the series.

In this first briefing, The Conference Board of Canada offers an economic perspective on the benefits of improving physical activity and reducing sedentary behaviour. Subsequent briefings will focus on cost-effective interventions that can be scaled up[2] and applied to varying population levels, including the workplace, communities, families, schools, and points of contact with the health care system.

The Dangers of Physical Inactivity and Sedentary Behaviour

Low levels of moderate to vigorous physical activity (MVPA) and prolonged sedentary behaviour, such as sitting during waking hours, have a negative impact on both our health and on our economy. Physical

1 Scalability refers to the ability for an intervention to be implemented on a more widespread basis. An intervention is "scaled up" when it is implemented on a larger population. Milat and others, "The Concept of Scalability."

2 Ibid.

Sitting is becoming the "new smoking"—making a compelling economic case for behavioural and lifestyle interventions.

inactivity can increase the risk of developing a number of chronic diseases[3,4] and is the fourth leading risk factor for mortality worldwide, contributing to an estimated 3.2 million deaths globally each year.[5]

Sedentary behaviour is characterized as expending very low energy during the day while in a sitting or reclined position. It is distinct from physical inactivity because of its different effects on the body and health, with recent research suggesting that less sitting and more standing, walking, fidgeting, and incidental movement can reduce the risk of overweight and obesity, cardiovascular problems, and premature death.[6]

While it is estimated that physical inactivity cost the Canadian economy $6.8 billion[7] in 2009,[8] to date there has been no published research on the cost of sedentary behaviour in Canada (see "Levels of Physical Inactivity and Sedentary Behaviour" for a definition of the two categories). There has also been no research on the potential benefits of incremental reductions in physical inactivity and sedentary behaviour in the Canadian population. Yet, sitting is becoming the "new smoking" (see "Butting Out: Sitting Is the New Smoking")—making a compelling economic case for behavioural and lifestyle interventions.

3 Chronic diseases include coronary heart disease, high blood pressure, stroke, type 2 diabetes, metabolic syndrome, colon and breast cancer, depression, bone fractures, respiratory conditions, muscular deterioration, and overweight and obesity.

4 World Health Organization (WHO), *Global Strategy on Diet*; and Canadian Society for Exercise Physiology, *Canadian Physical Activity Guidelines*.

5 WHO, *Global Strategy on Diet*.

6 Katzmarzyk, "Physical Activity, Sedentary Behavior, and Health."

7 Janssen, "Health Care Costs of Physical Inactivity in Canadian Adults."

8 This is the last year for which such an estimate is available.

Levels of Physical Inactivity and Sedentary Behaviour

Physical inactivity (PI) is defined as failing to achieve the recommended guideline of 150 minutes of MVPA per week, while sedentary behaviour (SB) is characterized by an excessive amount of sitting throughout the day.[9] The two are often conflated, but there is an important difference in both their nature and impact on health.[10]

Based on their PI/SB levels, individuals can be categorized as follows:

- **Physically active and non-sedentary**—at least 150 minutes of MVPA a week, with a limited number of waking hours spent in a sedentary state (e.g., sitting). It is estimated that only 21 per cent[11] of Canadian adults fall into this category.
- **Physically active and sedentary**—bouts of physical activity (e.g., an afternoon walk) but majority of time throughout the day spent in a sedentary state (referred to as physically active couch potatoes).[12] Almost one-third of adult Canadians fit this profile.[13] Independent of physical activity or exercise, it has been shown that every two-hour increase per day in sedentary behaviour increases the risk of developing type 2 diabetes by 20 per cent.[14]
- **Physically inactive and non-sedentary**—job or daily routine dictates that individuals are constantly moving or standing (e.g., nurses) but not getting the recommended 150 minutes per week of MVPA. About 16 per cent of Canadian adults fall into this category.

9 It is also defined as "waking behaviour characterized by an energy expenditure less than or equal to 1.5 METs while in a sitting or reclining posture." (See Sedentary Behaviour Research Network, "Letter to the Editor.")

10 Ibid.

11 The Canadian Community Health Survey (CCHS) 2011/2012 uses a threshold of 20 hours or more a week of sedentary behaviour during leisure time as the cut-off for sedentary versus non-sedentary behaviour. Note that this figure contradicts the 15 per cent cited earlier in this briefing; since the CCHS contains only self-reported data, it tends to overestimate physical activity levels, relative to data measured using an accelerometer.

12 Tremblay and others, "Physiological and Health Implications of a Sedentary Lifestyle."

13 Estimated using the Canadian Community Health Survey 2011/2012 threshold of 20 hours or more a week of sedentary behaviour.

14 Hu and others, "Physical Activity and Television Watching in Relation to Risk for Type 2 Diabetes Mellitus in Men."

- **Physically inactive and sedentary**—most of the day spent in front of a computer or at a desk, and leisure time spent watching TV, browsing the web, or reading; at greatest risk of ill health. Just under one-third of adult Canadians are considered to be inactive couch potatoes.[15]

The objective of this first briefing in the research series "Moving Ahead: Healthy Active Living in Canada" is to estimate the potential health and economic benefits of reducing physical inactivity and sedentary behaviour (PI/SB). Modest targets were established and their economic implications analyzed from the perspectives of the public, government, and employers over the next 25 years. Such a fact-based approach will contribute to articulating a healthy active living plan for Canada.

Butting Out: Sitting Is the New Smoking

One challenge is to identify and implement interventions that are not only effective but also scalable to different populations, acceptable to the public, sustainable, and cost-effective. To promote healthier lifestyles, all stakeholders such as policy-makers, city planners, school administrators, health care providers, community groups, and employers need to engage with one another and deliberate on how things should be done differently.

Sedentary behaviour now attracts a level of concern reminiscent of the days when smoking was most prevalent. In the early 1960s, smokers made up about half of the population.[16] It has taken over five decades to get to the point we are at today, where a little over 20 per cent of the population smokes. Just as smoking as a public health hazard was largely ignored or unknown back then, the dangers of sedentary behaviour are not currently a major concern for the general public. Smoking rates may have declined modestly in the past decade, but the average Canadian is moving less and sitting more. In contrast to past efforts aimed at reducing smoking in the population, recent policies, programs,

15 Estimated using the Canadian Community Health Survey 2011/2012 threshold of 20 hours or more a week of sedentary behaviour.

16 Bounajm and Stonebridge, *Smoking Cessation and the Workplace: Briefing 1*.

and social awareness campaigns seem to have had little success in improving the state of PI/SB in Canada. Due to the complexities of human behaviour and the impact of smoking on both individual and public health, the approaches used to reduce the prevalence of smoking may not be transferrable to those used to reduce physical inactivity and sedentary behaviour. In a subsequent briefing, the Conference Board discusses the challenges of getting people to move more and sit less, and offers insights into the interventions that could be adopted to achieve these results, while reducing costs to the health care system, the economy, and employers.

Canadians Not Meeting Recommended Guidelines

Most Canadians not only do not get enough physical activity but they also spend an excessive amount of time sitting. National physical activity guidelines indicate that adults (aged 18 and older) should get at least 150 minutes per week of MVPA in bouts of at least 10 minutes (see "Canadian Physical Activity and Canadian Sedentary Behaviour Guidelines).[17] Measuring physical activity objectively using accelerometers, the Canadian Health Measures Survey (CHMS) found that only 15 per cent of Canadian adults met these guidelines.[18] While the results varied slightly by age and sex, physical inactivity was a problem in every age and sex group.

17 Canadian Society for Exercise Physiology, *Canadian Physical Activity Guidelines*.

18 Statistics Canada, *Directly Measured Physical Activity of Canadian Adults*.

Canadian Physical Activity and Canadian Sedentary Behaviour Guidelines

The Canadian Society for Exercise Physiology (CSEP) and the Healthy Active Living and Obesity Research Group of the Children's Hospital of Eastern Ontario Research Institute (HALO-CHEO) recently developed evidence-based guidelines for physical activity. Endorsed by ParticipACTION, these guidelines are the official *Canadian Physical Activity Guidelines*. Recommendations include:

- Children ages 1 to 4 should accumulate at least 180 minutes of physical activity at any intensity throughout the day and minimize time being sedentary, with no screen time recommended for toddlers less than 2 and under 1 hour a day for preschoolers.
- Children ages 5 to 11 and youth ages 12 to 17 should accumulate at least 60 minutes of moderate- to vigorous-intensity physical activity every day and spend no more than 2 hours a day on recreational screen time, while minimizing their time spent in motorized transportation and extended sitting.
- Adults ages 18 years and older should engage in at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity a week, in bouts of 10 minutes or more, and should add muscle- and bone-strengthening activities at least 2 days a week.

While research shows that prolonged and frequent sedentary behaviour among adults is bad for their health, current CSEP guidelines do not include recommendations for sedentary behaviour for this age group. This is a current gap in knowledge for public and population health.

But even individuals who meet the recommended 150 minutes of moderate to vigorous physical activity a week may still be at higher risk of disease and premature mortality if they spend too much time being sedentary. Accelerometer data from the CHMS show that Canadian adults spend about 70 per cent of their waking hours being sedentary.[19] Another one-quarter of this time is spent doing light physical activity, including household chores and leisurely walking, and less than

19 As accelerometers are not able to distinguish between sitting and standing, some of this time would have been spent standing up.

3 per cent of the time is spent engaging in moderate to vigorous physical activities such as brisk walking and jogging. The results varied slightly by age and sex, with younger populations being slightly more active. (See Table 1 and Chart 1.)

Although there are currently no official guidelines concerning sedentary behaviour for adults, studies show that reducing the amount of such behaviour improves health outcomes and extends life in both children and adults[20] (e.g., sitting less than 3 hours a day could extend life by 2 years).[21]

In essence, the less time spent being sedentary, the better.

Table 1
Physical Activity During Waking Hours, Canadian Adults, 2007–2011
(average time, in hours)

Sex and Age in Years	Sedentary	Light activity	Moderate to vigorous activity
Males 18–39 years old	9.5	4.1	0.5
Males 40–59 years old	9.6	4.2	0.4
Males 60–79 years old	9.9	3.4	0.3
Females 18–39 years old	9.7	4.0	0.4
Females 40–59 years old	9.9	3.9	0.3
Females 60–79 years old	10.1	3.2	0.2

Source: Statistics Canada, *Directly Measured Physical Activity of Canadian Adults.*

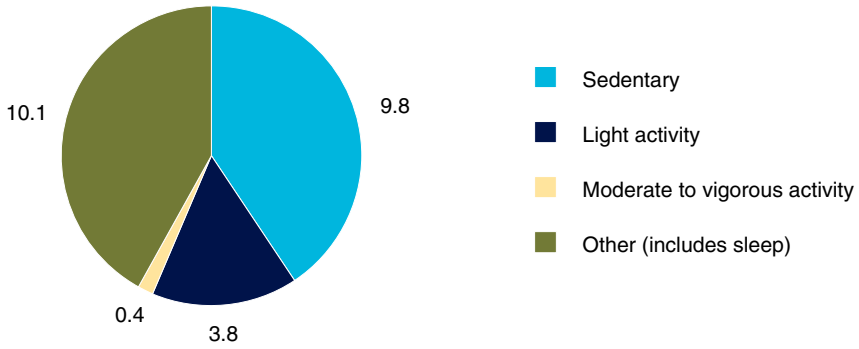
20 Tremblay and others, "Physiological and Health Implications of a Sedentary Lifestyle." This finding is also supported by POHEM-PA estimates using the National Population Health Survey.

21 Katzmarzyk and Lee, "Sedentary Behaviour and Life Expectancy in the USA."

Chart 1

Physical Activity and Sedentary Behaviour Over 24 Hours, Canadian Adults, 2007–2011

(average time, in hours)



Source: Statistics Canada, *Directly Measured Physical Activity of Canadian Adults.*

The Intervention: Reducing Physical Inactivity and Sedentary Behaviour

This analysis relied on the physical activity module of Statistics Canada's Population Health Model (POHEM-PA).[22] Because it is based on Canadian data and was developed in consultation with Canada's leading experts in this research area, POHEM-PA is considered the best available tool for this type of analysis. A quantitative model, it provides a projection for physical activity and various health outcomes in Canada, thereby making it possible to provide alternative assumptions for past and future levels of physical activity. By modifying these assumptions and by observing the impact of these modifications on various health outcomes, the model can be used to simulate and estimate the impact of increasing physical activity in Canada. As a starting base, data from the Canadian Community Health Survey (CCHS) (Cycle 1.1) were used. All the equations were estimated using longitudinal data from the

22 Nadeau and others, "Development of a Population-Based Microsimulation Model."

Experts in the field were consulted to establish an intervention scenario that is both significant and yet achievable within a reasonable time frame.

National Population Health Survey (NPHS) with the exception of the Health Utilities Index, which was estimated using the CCHS (Cycle 1.1). (See Appendix A for more details on data sources and methodology.)

The following section describes the changes to the status quo used in the analysis. Throughout this briefing, the set of assumptions is referred to as the "intervention" because, together, these assumptions represent the outcomes of a hypothetical intervention policy that leads to an incremental reduction in physical inactivity and/or sedentary behaviour.

Several of Canada's leading experts in the field were consulted in order to establish an intervention scenario that is both significant and yet achievable within a reasonable time frame. Based on current knowledge on interventions, it was established that a 10 per cent improvement in physical activity and sedentary behaviour would be a reasonable target.

Physical activity is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure,"[23] while sedentary behaviour is "any waking behaviour characterized by an energy expenditure less than or equal to 1.5 METs while in a sitting or reclining posture."[24] These broad definitions encompass a wide range of activities. Three levers or modifiable variables of physical activity and sedentary behaviour in POHEM-PA were used in this analysis.[25] Each variable represents a different type, time, and place in which these activities take place. The variables include: leisure time physical activity; walking for errands and commutes; and a person's usual activity during the day.

The following section provides a brief description of each of these three activities and how they were modified under the intervention scenario. For all three variables, the intervention is assumed to begin in the year 2015 and end in 2040.

23 World Health Organization, *Health Topics: Physical Activity*.

24 Sedentary Behaviour Research Network, "Letter to the Editor."

25 These definitions are based on Canadian Community Health Survey questions.

Leisure Time Physical Activity

Leisure time physical activity (LTPA) is the amount of time spent on physical activity during discretionary time. This consists of exercise, sports, and active leisure pursuits, and can be viewed as a good proxy for MVPA. It includes a large number of activities such as brisk walking, jogging, biking, playing soccer, exercising, weight training, dancing, and yard work. According to POHEM-PA,[26] approximately half of the Canadian population reports engaging in less than 30 minutes a day of LTPA.

POHEM-PA divides the Canadian population into four groups:

1. no LTPA
2. 0 to 30 minutes per day of LTPA
3. 30 to 60 minutes per day of LTPA
4. 60 or more minutes per day of LTPA

In this analysis, 10 per cent of people who are currently or forecast to be in categories 1, 2, and 3 are moved to the next highest category. In other words, the intervention scenario assumes that, as of the year 2015:

1. 10 per cent of people who usually get no LTPA move to the next best group, as it is assumed they now get 0 to 30 minutes per day of LTPA.
2. 10 per cent of people who usually get 0 to 30 minutes per day of LTPA move to the next best group, where they now get 30 to 60 minutes of LTPA.
3. 10 per cent of people who usually get 30 to 60 minutes per day of LTPA move to the next best group, where they get 60 or more minutes of LTPA.
4. People who already get 60 or more minutes per day continue to do so.[27]

26 POHEM-PA is a simulation model. The primary sources of its data are the CCHS and NPHS.

27 Though their status cannot be changed in POHEM-PA, there may still be important health benefits from having them engage in even more physical activity.

Usual Daily Activity (Sitting)

Usual daily activity is a variable in POHEM that encompasses a person's reported typical behaviour throughout the day. For the purposes of this analysis, the focus of the intervention was on Canadians who typically sit most of the day without standing or walking around much. This is fairly common among Canadians who sit at their desks for much of their work day, drive to and from work, and watch television, use the computer, and/or read when they get home. This variable can, therefore, be considered a good proxy for sedentary behaviour. POHEM-PA estimates that about one-quarter of the Canadian population leads a sedentary lifestyle.[28]

In the analysis, beginning with the year 2015, the number of Canadians who usually sit during the day is reduced by 10 per cent. Instead of sitting, it is assumed they stand or walk around quite often.

Walking for Errands and Commutes

This variable is measured as the amount of time spent walking for errands and commuting to work or school. In POHEM-PA, about one-quarter of Canadians almost never walk for errands or commutes.

POHEM-PA places Canadians into four categories:

1. never walk
2. walk 5 hours or less per week
3. walk 6 to 10 hours per week
4. walk 11 or more hours per week

For this type of physical activity, a similar approach was used to that adopted for leisure time physical activity—with 10 per cent of the population moving from its current (or forecast) category of physical activity to the next best (more active) category. Beginning in 2015:

28 POHEM-PA is a simulation model. The primary sources of its data are the CCHS and NPHS.

1. 10 per cent of people who usually do not walk for errands and commutes are moved to the next best group, and now walk 5 hours or less per week for errands and commutes.
2. 10 per cent of people who usually walk 5 hours or less per week for errands and commutes are moved to the next best group, and now walk 6 to 10 hours per week for errands and commutes.
3. 10 per cent of people who usually walk 6 to 10 hours per week for errands and commutes are moved to the next best group, and now walk 11 hours or more per week for errands and commutes.
4. People who already walk 11 hours or more per week for errands and commutes continue to do so.

Population Health and Economic Impact of Reduced Physical Inactivity and Sedentary Behaviour

The results of this analysis are presented by describing the impact of reducing physical inactivity and sedentary behaviour (PI/SB) on population health, including its impact on mortality and the incidence of four chronic conditions: hypertension, diabetes (types 1 and 2), heart disease, and all types of cancer.[29] The impact on the economy was also measured, including changes to labour force participation, absenteeism, and health care expenditures.

29 Given that some chronic conditions associated with PI/SB (such as stroke and osteoporosis) are not included due to their absence from POHEM-PA, it is important to note that the overall impact on population health would be even greater.

People who stand or walk often during the day have a 30 per cent lower risk of mortality than people who usually sit all day.

Impact on Population Health

Mortality and Quality of Life

While all three activity types in POHEM-PA were correlated with the risk of mortality, sedentary behaviour was found to have the most significant impact. Data analysis by Statistics Canada[30] shows that people who stand or walk often during the day have a 30 per cent lower risk of mortality than people who usually sit all day.

The analysis showed that reducing PI/SB extends the life of many Canadians and minimizes the number of deaths until at least 2040—which means a larger population throughout the forecast period. The number of Canadians would increase by 0.1 per cent in 2020, and this increase would intensify to 0.5 per cent by 2040. Moreover, the greatest proportion of the population increase would be among older age groups. For instance, by 2040, while the change in the adult population under 40 would be negligible (less than 0.01 per cent), the model showed a projected 2 per cent increase in the population aged 80 to 89 and a 5.5 per cent increase in the population over 90 years old.

Furthermore, the number of health-adjusted life-years increases significantly, compared with the status quo—by 0.4 per cent in 2020 and 1.2 per cent in the year 2040. (See Table 2.) While most of the increase is concentrated among the older age groups, the increase in the number of health-adjusted life-years among the younger population is not negligible. For instance, by 2040, the number of health-adjusted life-years among those aged 30 to 39 is projected to increase by 0.4 per cent, compared with the status quo.

30 The POHEM-PA model and all of its input parameters were provided by Statistics Canada through personal communication. Input parameters were estimated by Statistics Canada using longitudinal data from the National Population Health Survey (NPHS) from 1994 to 2006.

Table 2
Potential Impact of Increasing Physical Activity and Reducing Sedentary Behaviour, Canadian Adults

	2013	2020	2030	2040
Number of deaths				
Status quo	235,006	275,688	349,741	429,049
Intervention	235,006	269,039	340,903	420,683
difference (per cent)		-2.4	-2.5	-1.9
Canadian population				
Status quo	27,490,076	29,850,289	32,300,441	34,009,384
Intervention	27,490,076	29,876,033	32,399,389	34,191,867
difference (per cent)		0.1	0.3	0.5
Health-adjusted life-years				
Status quo	24,295,128	26,385,781	28,396,123	29,607,296
Intervention	24,295,128	26,502,204	28,638,867	29,964,515
difference (per cent)		0.4	0.9	1.2

Sources: POHEM-PA; The Conference Board of Canada.

A health-adjusted life-year is a measure of a year of life that is adjusted for health status using the Health Utilities Index, a quantitative index that estimates the quality of life of a living person based on a wide range of attributes.[31] It is noteworthy that the increase in health-adjusted life-years due to intervention is greater than the increase in the population, which suggests that Canadians would live longer *and* live a healthier life.

31 See Roberge, Berthelot, and Wolfson, "The Health Utility Index."

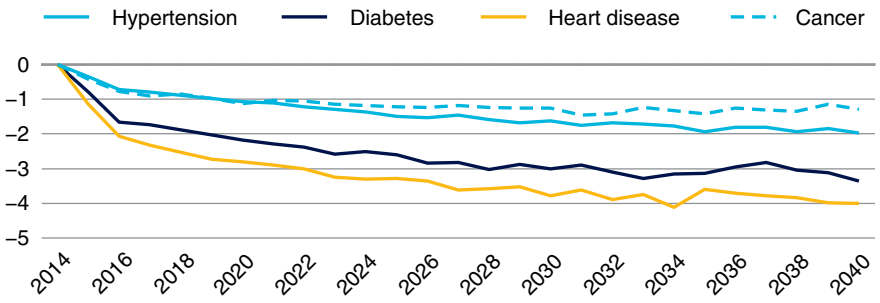
Incidence of Chronic Conditions

Reducing PI/SB can increase longevity in various ways, one of which is by reducing the incidence of chronic conditions. “Incidence” is the number of new cases in a given time period; “incidence rate” is the proportion (in per cent) of the disease-free population that develops a disease in a given year. POHEM-PA provides the incidence rate of four chronic conditions: hypertension, diabetes, heart disease, and cancer. (See Chart 2.)

Chart 2

Impact of Physical Activity on the Incidence Rate of Four Chronic Conditions

(per cent change in incidence rate, compared to status quo)



Sources: POHEM-PA; The Conference Board of Canada.

Hypertension

Reducing PI/SB was found to lower the hypertension incidence rate throughout the forecast period—by 1.6 per cent in 2030 and 2 per cent in 2040. (See Chart 2.) Over the entire forecast period (2015 to 2040), the total number of new cases of hypertension was reduced by nearly 220,000.

While this may seem modest, the full impact is mitigated due to the competing risk nature of POHEM-PA. In this model, as Canadians live longer, they are also more likely to develop chronic conditions as they age. As a result, some of the reduction in hypertension thanks to

the intervention is offset by an increase in hypertension attributable to an older population, which in itself is attributable to the reduction in premature mortality. Furthermore, the benefits of lower blood pressure among those with pre-hypertension are not accounted for and are known to reduce the risk of disease.

Diabetes

The intervention was found to reduce the diabetes incidence rate by 2.2 per cent in 2020, 3 per cent in 2030, and 3.4 per cent in 2040. (See Chart 2.) Over the entire forecast period (2015 to 2040), the number of new cases of diabetes was reduced by over 120,000.

This finding is consistent with the scientific literature, which has established a strong link between physical inactivity and type 2 diabetes. In 2009, nearly 40 per cent of cases in Canada were attributable to physical inactivity.[32]

Heart Disease

POHEM-PA results show that a modest reduction in PI/SB can produce significant reductions in the incidence rate of heart disease—by 2.8 per cent in 2020 and an average of 3.6 per cent per year until 2040. (See Chart 2.) Over the entire forecast period, the number of new cases of heart disease was reduced by over 170,000.

Again, the scientific literature supports these findings. For example, in 2009, physical inactivity was responsible for an estimated 26 per cent of heart disease cases among men and 27 per cent of cases among women in Canada.[33]

32 Janssen, “Health Care Costs of Physical Inactivity.”

33 Ibid.

Cancer

The POHEM-PA simulation results show that reducing inactivity and sedentary behaviour in turn will lower the incidence rate of cancer by 1.1 per cent in 2020 and thereafter by an annual average of 1.3 per cent. (See Chart 2.) Over the entire forecast period, the number of new cases of cancer was reduced by about 31,000 in total—or 1,200 cases per year.

It is important to emphasize that the reduction in cancer incidence—as with the other chronic conditions—may appear lower than it actually is because the intervention increases longevity and leads to an older population that is more likely to get cancer.[34] In addition, the impact on cancer is further complicated by the fact that physical inactivity had a significant impact only on breast cancer and colon cancer incidence rates. Research indicates that physical inactivity was responsible for approximately 15 per cent of all breast cancers and 24 per cent of all colon cancers in Canada in 2009.[35] A breakdown of cancer by type, which is not supported by POHEM-PA, may have shown a more discernible impact of physical activity on breast and colon cancers.

Economic Impact

Impact on GDP

A healthy population is key to a healthy economy. Reducing physical inactivity and sedentary behaviour fosters longer and healthier lives, which in turn helps to boost the economy, raise our standard of living, and improve overall quality of life.

The reduction in premature mortality demonstrated by the analytical model had a large impact on the country's gross domestic product (GDP), with an increase in population effectively increasing the total number

34 Since cancer generally affects more people who are older, an older population means an increase in the overall incidence rate of cancer in the entire population (all other things being equal).

35 Janssen, "Health Care Costs of Physical Inactivity."

Compared to the status quo, GDP was projected to be $230 million higher in 2020, $931 million higher in 2030, and nearly $1.6 billion higher by 2040.

of Canadians available and willing to work. For example, in 2020, there would be 4,100 more people in the labour force; by 2030, this number increased rapidly to 14,700; and by 2040, to over 22,000.

Similarly, a reduction in the prevalence of the four chronic conditions mentioned has an effect on the length of time that employees are away from work, on short- and long-term disability. By 2020, the size of the labour force would increase by 800 workers, due to reductions in disability alone. It is estimated the labour force would increase by 2,400 by 2030 and 3,600 by 2040.

As well, reduced PI/SB can lower the total number of days of work missed (absenteeism) by nearly 90,000 by 2040 (Table 3). This also helps to boost productivity and expand the Canadian economy.

Table 3
Absenteeism Reduced Due to PI/SB Intervention, by Year and Condition, Canadian Adults

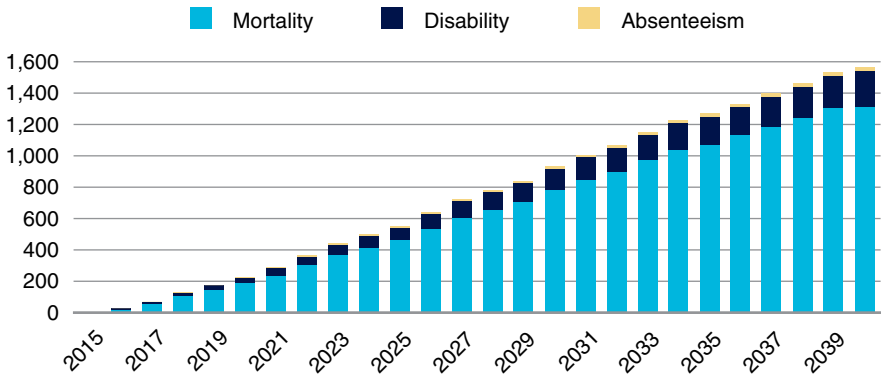
	Diabetes	Heart disease	Cancer	Total
2015	176	946	146	1,267
2020	3,313	16,899	2,875	23,087
2025	7,118	32,085	4,325	43,529
2030	10,698	44,833	5,314	60,844
2035	13,844	56,361	5,944	76,149
2040	15,971	64,801	7,883	88,655

Note: Hypertension was not included due to the lack of appropriate data.
Sources: POHEM-PA; The Conference Board of Canada.

Thanks to a reduction in premature mortality, disability, and absenteeism, economic activity (as measured by GDP) would receive a sizable boost. Compared to the status quo, GDP was projected to be $230 million higher in 2020, $931 million higher in 2030, and nearly $1.6 billion higher by 2040. The majority (84 per cent) of the boost would come from a

reduction in premature mortality, followed by disability (14 per cent), while absenteeism represents a small fraction. (See Chart 3.) Over the entire forecast period (2015 to 2040), there would be a cumulative $7.5-billion boost to GDP.[36]

Chart 3
Economic Impact of Reducing Physical Inactivity and Sedentary Behaviour
(change in GDP; 2013 $ millions)



Sources: POHEM-PA; The Conference Board of Canada.

Impact on Health Care Spending

Given the increasing pressure that health care spending exerts on public finances, it is important to assess the impact of any intervention, including policies and programs, on health care spending. Since the scope of the analysis is limited to the four chronic conditions in POHEM-PA, it was not possible to estimate the full impact of PI/SB on fiscal balances. As a result, the assessment was limited to the health care costs (related to hospitalization, physician care, and pharmaceuticals) associated with only hypertension, diabetes, heart disease, and cancer.

36 Discounted at 3.5 per cent.

The analysis showed that reducing PI/SB would reduce health care spending by $45 million in 2020, $126 million in 2030, and $167 million in 2040—$2.6 billion (in today's dollars) over the entire forecast period. Nearly 60 per cent of these savings were attributable to a reduction in heart disease ($1.52 billion). Meanwhile, savings of $842 million would result from a reduction in diabetes costs and $202 million from a reduction in costs related to hypertension. On the other hand, the overall change in spending on cancer is not expected to be significant. (See Table 4.)

Table 4

Cost Savings of Interventions to Health Care System, by Chronic Condition

(2013 $ millions; negative numbers indicate cost increases)

	Hypertension	Diabetes	Heart disease	Cancer	Total
2015	0.6	0.8	1.6	0.8	3.7
2016	1.5	2.5	5.1	2.2	11.3
2017	2.5	4.6	9.0	3.0	19.2
2018	3.1	6.5	13.2	3.9	26.6
2019	3.7	8.9	17.7	4.2	34.6
2020	5.0	11.6	23.7	5.2	45.4
2021	5.8	14.4	28.2	5.7	54.1
2022	6.4	16.9	32.8	4.5	60.6
2023	6.6	19.7	37.8	3.9	68.1
2024	7.3	22.4	43.2	3.0	76.0
2025	8.4	25.3	48.6	3.1	85.5
2026	9.2	28.0	53.0	2.1	92.2
2027	10.3	31.7	58.0	2.7	102.7
2028	10.8	34.9	62.7	0.9	109.3
2029	12.2	38.3	68.4	0.7	119.6
2030	12.3	41.3	73.1	-1.1	125.8
2031	12.2	43.4	77.4	0.0	132.9

(continued ...)

Table 4 (cont'd)

Cost Savings of Interventions to Health Care System, by Chronic Condition

(2013 $ millions; negative numbers indicate cost increases)

	Hypertension	Diabetes	Heart disease	Cancer	Total
2032	12.3	46.1	81.7	1.2	141.3
2033	11.8	49.1	87.3	-1.9	146.3
2034	11.1	52.5	91.2	-4.0	150.9
2035	11.1	54.8	94.8	-3.2	157.6
2036	9.9	55.8	97.6	-5.8	157.6
2037	8.1	56.5	98.4	-6.5	156.6
2038	7.5	56.9	100.6	-7.4	157.6
2039	7.0	58.4	104.7	-6.4	163.7
2040	5.2	60.3	109.1	-7.4	167.1
Cumulative savings, 2015–2040	201.9	841.6	1,518.9	3.7	2,566.0

Sources: POHEM-PA; The Conference Board of Canada.

Despite a reduction in the cancer incidence rate (Chart 2), a similar reduction was not observed in its prevalence. This can be explained by the fact that Canadians would be living longer—while the probability of developing cancer is reduced, more people are also alive in any given year, which can increase the number of people living with cancer. Further, reducing PI/SB would increase the longevity of people who are diagnosed with cancer. While these offsetting factors are applicable to the other three conditions, they were only large enough to offset the reduction in cancer costs. (See "Methodological Limitations" for a detailed explanation of how and what benefits were included in the analysis.)

Methodological Limitations

While every effort was made to estimate the full benefits of reducing PI/SB, some factors were not included due to the absence of data. The most important limitation is the incomplete list of chronic conditions estimated by POHEM-PA. The model leaves out several key conditions such as stroke, osteoporosis, and mental illness. Further, the model uses LTPA instead of total physical activity or MVPA, thus potentially underestimating the full impact of physical activity on these conditions.

In addition, the model does not include impacts on children. Given that the mortality rates among children are very low—as are the incidence rates of chronic conditions that can be attributed to PI/SB—for the purposes of this briefing, this is not likely an important omission. Consequently, the impact on direct costs and the economy is likely to be minimal. However, from a policy perspective, reducing PI/SB among children is important as it will influence behaviour and affect health well into adulthood. As a result, future briefings in this series will place significant emphasis on identifying cost-effective and scalable interventions to reduce PI/SB in children.

When it comes to estimating the benefits to GDP, certain potential factors were not included due to a lack of hard evidence on the magnitude of the impact. Arguably, the most important omitted factor is the possibility that the labour force participation rate by age (the proportion of the population that is willing to work) could increase above and beyond what is already captured in the disability rate. Other omitted potential benefits include the possible boost to productivity during work (e.g., exercise improves the ability to do difficult mental work) and lower staff turnover.

There were also some limitations in computing direct costs to the health care system. The cost of treating all chronic conditions was assumed to be equal among both active and inactive populations. In other words, it was assumed that the cost to treat a physically active person with heart disease would be the same as the cost to treat an inactive person with heart disease. If the true treatment costs of the latter are in fact higher—as the research suggests—then the benefits of physical activity may be underestimated. Finally, no attempt was made to include the potential costs of injuries that may occur due to increased physical activity or increases in pension liabilities from extended longevity.

Decreasing PI/SB among the entire population will not only reduce the incidence of disease, but subclinical benefits are likely for those below disease detection thresholds. Given that these benefits, along with the resulting cost-savings, were not captured in the analysis, it is likely that they have been underestimated. As well, the potential benefits to the environment (from increased active transportation) and to the social capital of communities (from more people being active) were not captured.

What Does This All Mean?

What do these findings mean for individuals, government, and employers? The answer sets the stage for future briefings in this research series, which will identify interventions such as policies and programs that can be used to reduce PI/SB in the population groups that were targeted.

Individuals

When looking at the impact of reducing PI/SB on the entire population, the benefits that accrue to a single individual may be unclear. It is therefore useful to focus on the benefits for people who make positive lifestyle changes.

According to research by Janssen,[37] being physically active reduces a person's lifetime probability of developing type 2 diabetes by 43 per cent, hypertension by 26 per cent, and osteoporosis by 36 per cent. This can mean the difference between an arduous, drug-dependent life and a healthy one. Physical activity also reduces the risk of developing potentially deadly conditions such as colon cancer (27 per cent), breast cancer (17 per cent), heart disease (30 per cent), and stroke (29 per cent).

Avoiding a sedentary lifestyle is also critically important, particularly when it comes to the reduction of mortality risk. According to POHEM-PA, people who usually sit all day have a 30 per cent higher chance of

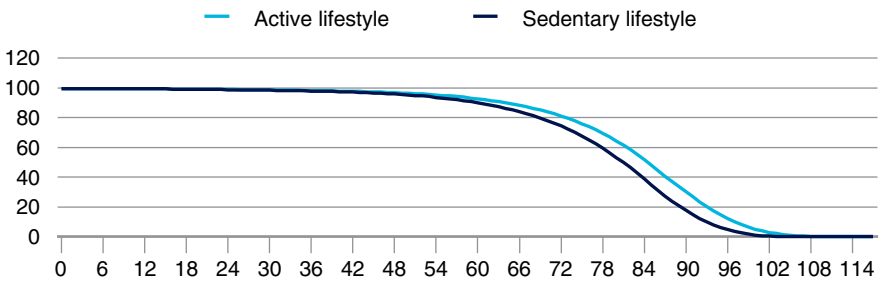
37 Janssen, "Health Care Costs of Physical Inactivity."

mortality compared to the rest of the population. As a result, people who avoid a sedentary lifestyle can extend their lives by about 3.8 years.[38] Moreover, their chance of living until the age of 80 (64 per cent) is over 20 per cent higher, compared with those who lead a sedentary lifestyle. (See Chart 4.) Further, those who reduce PI/SB enjoy a higher quality of life as well as an increased array of recreational opportunities.

Chart 4

Chance of Being Alive by a Certain Age, Active Versus Sedentary Lifestyle

(per cent; age in years)



Sources: POHEM-PA; The Conference Board of Canada.

In summary, making the effort to be more physically active and less sedentary in our busy lives can be challenging, but it pays real dividends. Devoting time for 150 minutes of physical activity and minimizing the number of waking hours spent sitting during the day will have tangible health benefits.

38 This estimate was achieved by computing life expectancy in Canada using two different sets of mortality rates by age: one for the sedentary population; the other for the non-sedentary population (30 per cent lower mortality). The weighted average of the mortality rates was set to match actual mortality rates in Canada; see Statistics Canada, *CANSIM Table 102-0504*.

Modest physical activity could reduce health care spending on hypertension, diabetes, heart disease, and cancer by $2.6 billion from 2015 to 2040.

Government

Over the next two decades, the demographic shifts in the Canadian population are expected to exert significant pressure on public finances. The aging of the population is expected to slow economic growth, thereby also slowing growth in government tax revenues. Moreover, an aging population increases the demand for health and social services, and for pharmaceuticals. Furthermore, the declining physical activity and fitness of our children, along with an increase in their sedentary behaviour and obesity, predict an earlier and more intensive demand on the health care system for a variety of lifestyle-related health conditions.

In the face of these challenges, improving the health status of Canadians through increased physical activity and reduced sedentary behaviour may play an instrumental role in helping to reduce the demand for health and social services. For example, if disability rates can be reduced, seniors may be able to live longer and rely on long-term care for a shorter period of time at the end of life. Similarly, fewer young Canadians may die of breast cancer, which would boost economic activity and generate more tax revenues. This analysis showed that even modest physical activity could reduce health care spending on hypertension, diabetes, heart disease, and cancer by $2.6 billion from 2015 to 2040.

It is important to note that this analysis falls short of measuring the full fiscal impact of physical activity. The lack of information on conditions other than the four included in POHEM-PA, combined with physical activity's link to a wide range of health effects whose benefits are difficult to quantify (e.g., reduced depression, better sleep, and stress relief),[39] means that reduced inactivity and sedentary behaviour would have implications that extend well beyond the scope of this briefing. A more comprehensive analysis is required to assess its full fiscal impact.

39 Fox, "The Influence of Physical Activity on Mental Well-Being."

Employers

Increasing physical activity and reducing sedentary behaviour can significantly reduce absenteeism and disability, which in turn helps to reduce staff turnover. The benefits to employers also likely go beyond the scope measured in this briefing. One Swedish study suggests that workplace interventions to promote physical activity can make employees more productive on the job. The study reports that when employers exchanged 2.5 hours of work a week with mandatory exercise, they were still able to maintain their production level. Researchers attributed these results to an increase in employee stamina and reduced employee absenteeism.[40]

The share of jobs that require little to no physical activity during the day (e.g., desk jobs) has more than doubled since 1970—a trend that is expected to continue.[41] Employers would be wise to find ways to help their employees compensate for this increase in sedentary behaviour.

Key Messages

Canadians are not getting enough physical activity. Only 15 per cent of Canadian adults get the recommended 150 minutes per week of MVPA. Moreover, the majority of Canadians lead a sedentary lifestyle, spending most of their waking hours sitting at their desks, televisions, or other devices and computers. A sedentary lifestyle has physiological effects that are distinct from insufficient physical activity. Therefore, in order to minimize health risks, improve quality of life, and maximize longevity, Canadians need to be more physically active *and* reduce their time spent sitting.

40 ScienceDaily, *Exercise at Work Boosts Productivity*.

41 Owen and others, “Sedentary Behavior.”

By meeting the official physical activity and sedentary guidelines, Canadians can reduce their risk of developing diabetes, heart disease, hypertension, stroke, depression, osteoporosis, and cancers of the colon and breast. They can also improve their productivity at work and increase their concentration levels.

All of these factors will result in a longer and healthier life, which has positive implications for the economy, government finances, and labour force productivity.

Reduced mortality and disability supplies the economy with a larger and more productive pool of labour, which in turn boosts productivity, increases GDP, and ultimately enhances living standards. This analysis has shown that even small enhancements to physical activity can lead to tangible benefits. By simply getting 10 per cent of Canadians with suboptimal levels of physical activity to be more active and reduce sedentary behaviour—starting in 2015—GDP will increase by nearly $1.6 billion by 2040. Along with this boost will be a cumulative $2.6-billion reduction in health care spending on hypertension, diabetes, heart disease, and cancer from 2015 to 2040. Additionally, employers will benefit from reduced staff turnover, short-term disability costs, and absenteeism rates.

These findings build a strong case for action on the part of the public, government, and employers. Future briefings in this series will delve deeper into what can and must be done, with a focus on proven programs and policies that can successfully change these behaviours among different populations and in different settings.

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APPENDIX A

Data Sources and Methodology

POHEM-PA

The projections for disease incidence and prevalence, population growth, mortality, and health-adjusted life-years were conducted using the physical activity module of Statistics Canada's Population Health Model (POHEM-PA). This micro-simulation model simulates the entire adult Canadian population, tracking each simulated individual and his or her health status over their lifetime. The model's population characteristics were derived from the Canadian Community Health Survey, while the relationships between physical activity and health outcomes were estimated using longitudinal data (1994 to 2006) from the National Population Health Survey (NPHS).[1]

The "status quo" results can be reproduced using the following settings:

- intervention start year: 2015; end year: 9999
- intervention start age: 0; end age: 999
- 40 million simulated cases with population scaling enabled
- open population with future births and new immigrants enabled
- calendar time cap for all diseases and mortality, and for both disease onset and cure, set at the year 2010
- starting seed: 16,807
- identity matrices for all four physical activity intervention parameters

1 Nadeau and others, "Development of a Population-Based Microsimulation Model."

The intervention scenario may be reproduced by keeping all the above settings except the intervention parameters, three of which are altered as described in the section "The Intervention: Reducing Physical Inactivity and Sedentary Behaviour."

Health Care Costs

Data on the health care costs (hospital, physician, and drug) for each chronic condition were derived from the Public Health Agency of Canada's Economic Burden of Illness in Canada (EBIC). Where available, data from EBIC 2008 (unpublished) were used to estimate the costs per case. For the diseases where such data were not available, EBIC 2000 data were used instead. In both instances, health care costs per case were projected to the year 2013 by adjusting for estimated health care inflation.

Economic Impact Estimates

Projections for the economic impact of reducing inactivity and sedentary behaviour were estimated using The Conference Board of Canada's model of the economy. The first step involved estimating the impact of the intervention on the size of the labour force. In the second step, the increase in the size of the labour force was introduced as a shock in the Conference Board model, which allowed for the estimation of this shock's impact on potential output and consequently on GDP.

The impact on the size of the labour force was estimated as follows:

- **Mortality**: POHEM-PA provides estimates on the population size by age and sex under each of two scenarios: the status quo and the intervention. The impact on the size of the labour force for each age–sex group was estimated by multiplying the difference in the number of people (intervention minus status quo) in each group by the group's respective labour force participation rate.

- **Disability and absenteeism**: Disability rates and absenteeism days for diabetes, heart disease, and cancer were estimated using data from CCHS. Wherever the intervention eliminates one person's chronic condition (by preventing or curing it), it is also assumed to eliminate this person's disability (provided the disability was caused by the condition itself).

APPENDIX B
Bibliography

Bounajm, Fares, and Carole Stonebridge. *Smoking Cessation and the Workplace: Briefing 1—Profile of Tobacco Smokers in Canada*. Ottawa: The Conference Board of Canada, 2013. www.conferenceboard.ca/temp/c36265d5-875e-4daa-abd0-892866e4ec07/13-267_smokingcessation-brief1_cashc.pdf (accessed August 4, 2014).

Canadian Society for Exercise Physiology. *Canadian Physical Activity Guidelines*. www.csep.ca/CMFiles/Guidelines/CSEP_PAGuidelines_adults_en.pdf (accessed March 18, 2014).

Fox, Kenneth. "The Influence of Physical Activity on Mental Well-Being," *Public Health Nutrition* 2, no. 3a (1999): 411–8. http://journals.cambridge.org/download.php?file=%2FPHN%2FPHN2_3a%2FS1368980099000567a.pdf&code=3c9a225f7609e31750aadfcbedad50cd (accessed August 4, 2014).

Hu, F.B., M.F. Leitzmann, M.J. Stampfer, G.A. Colditz, W.C. Willett, and E.B. Rimm. "Physical Activity and Television Watching in Relation to Risk for Type 2 Diabetes Mellitus in Men." *Archives of Internal Medicine* 161, no. 12 (2001): 1542–8. www.researchgate.net/publication/11913797_Physical_activity_and_television_watching_in_relation_to_risk_for_type_2_diabetes_mellitus_in_men (accessed August 4, 2014).

Janssen, Ian. "Health Care Costs of Physical Inactivity in Canadian Adults." *Applied Physiology, Nutrition, and Metabolism* 37, no. 4 (2012): 803–6. www.nrcresearchpress.com/doi/pdf/10.1139/h2012-061 (accessed August 3, 2014).

Jetté, M., K. Sidney, and G. Blümchen. "Metabolic Equivalents (Mets) in Exercise Testing, Exercise Prescription, and Evaluation of Functional Capacity." *Clinical Cardiology* 13, no. 8 (1990): 555–65. http://onlinelibrary.wiley.com/doi/10.1002/clc.4960130809/pdf (accessed August 3, 2014).

Katzmarzyk, Peter T. "Physical Activity, Sedentary Behavior, and Health: Paradigm Paralysis or Paradigm Shift?" *Diabetes* 59, no. 11 (2010): 2717–25. http://diabetes.diabetesjournals.org/content/59/11/2717.full.pdf+html (accessed August 3, 2014).

Katzmarzyk, Peter T., and I-Min Lee. "Sedentary Behaviour and Life Expectancy in the USA: A Cause-Deleted Life Table Analysis." *BMJ Open* 2 (2012). http://bmjopen.bmj.com/content/2/4/e000828.full.pdf+html (accessed August 4, 2014).

Milat, A.J., L. King, A.E. Bauman, and S. Redman. "The Concept of Scalability: Increasing the Scale and Potential Adoption of Health Promotion Interventions Into Policy and Practice." *Health Promotion International* 28, no. 3 (September 2013): 285–98.

Milat, Andrew J., Lesley King, Robyn Newson, Luke Wolfenden, Chris Rissel, Adrian Bauman and Sally Redman. "Increasing the Scale and Adoption of Population Health Interventions: Experiences and Perspectives of Policy Makers, Practitioners, and Researchers." *Health Research Policy and Systems* 12, no. 18 (April 2014). www.health-policy-systems.com/content/pdf/1478-4505-12-18.pdf (accessed August 3, 2014).

Nadeau, Claude, Suzy Wong, William Flanagan, Jillian Oderkirk, Doug Manuel, Ronald Wall, and Mark Tremblay. "Development of a Population-Based Microsimulation Model of Physical Activity in Canada." *Health Reports* 24, no. 10 (2013): 11–9. www.statcan.gc.ca/pub/82-003-x/2013010/article/11873-eng.pdf (accessed August 4, 2014).

Owen, Neville, Phillip Sparling, Geneviève Healy, David Dunstan, and Charles Matthews. "Sedentary Behavior: Emerging Evidence for a New Health Risk." *Mayo Clinic Proceedings* 85, no. 12 (2010): 1138–41. www.ncbi.nlm.nih.gov/pmc/articles/PMC2996155/ (accessed August 4, 2014).

Roberge, Roger, Jean-Marie Berthelot, and Michael Wolfson. "The Health Utility Index: Measuring Health Differences in Ontario by Socioeconomic Status." *Health Reports* 7, no. 2 (1995): 25-32.

ScienceDaily. *Exercise at Work Boosts Productivity, Swedish Researchers Find*. News release, September 8, 2011. www.sciencedaily.com/releases/2011/09/110906121011.htm (accessed April 4, 2014).

Sedentary Behaviour Research Network. "Letter to the Editor: Standardized Use of the Terms 'Sedentary' and 'Sedentary Behaviours.'" *Applied Physiology, Nutrition, and Metabolism* 37, no. 3 (2012): 540–42. www.nrcresearchpress.com/doi/abs/10.1139/h2012-024#.U96ST_ldXNk (accessed August 3, 2014).

Statistics Canada. *Directly Measured Physical Activity of Canadian Adults, 2007 to 2011*. Ottawa: Statistics Canada, 2013. www.statcan.gc.ca/pub/82-625-x/2013001/article/11807-eng.htm (accessed March 18, 2014).

—. *Canadian Community Health Survey 2011/2012*. Ottawa: Statistics Canada, 2013.

—. *CANSIM Table 102-0504, Deaths and Mortality Rates, by Age Group and Sex, Canada, Provinces and Territories*. Ottawa: Statistics Canada, 2013. www5.statcan.gc.ca/cansim/a05?lang=eng&id=1020504&paSer=&pattern=102-0504&stByVal=1&csid= (accessed August 4, 2014).

—. "Population Health Model – Physical Activity." Ottawa: Statistics Canada, 2010. www.statcan.gc.ca/microsimulation/health-sante/health-sante-eng.htm (accessed August 4, 2014).

—. *Canadian Community Health Survey (Cycle 1.1)*. Ottawa: Statistics Canada, 2007. www23.statcan.gc.ca/imdb/p2SV.pl?Function=getSurvey&SurvId=1630&InstaId=3359&SDDS=3226 (accessed August 4, 2014).

Tremblay, Mark Stephen, Rachel Christine Colley, Travis John Saunders, Genevieve Nissa Healy, and Neville Owen. "Physiological and Health Implications of a Sedentary Lifestyle." *Applied Physiology, Nutrition, and Metabolism* 35, no. 6 (2010): 725–40. www.sfu.ca/~leyland/Kin343%20Files/sedentary%20review%20paper.pdf (accessed August 4, 2014).

World Health Organization. *Global Strategy on Diet, Physical Activity and Health*. www.who.int/dietphysicalactivity/factsheet_adults/en/ (accessed March 18, 2014).

—. *Health Topics: Physical Activity*. www.who.int/topics/physical_activity/en/ (accessed March 20, 2014).

Acknowledgements

We would like to acknowledge the contributions of the advisory committee, including: Dr. Mark Tremblay, Director of Healthy Active Living and Obesity Research, Children's Hospital of Eastern Ontario; Dr. John C. Spence, Professor and Associate Dean (Research), Faculty of Physical Education & Recreation, University of Alberta; and Dr. Ian Janssen, CRC Chair in Physical Activity and Obesity, Queen's University.

We thank Claude Nadeau and William Flanagan for their advice on the use of POHEM and for their review of this briefing. We also thank the external reviewers: Mark Tremblay, John Spence, and Ian Janssen; and Matthew Stewart of The Conference Board of Canada, the internal reviewer.

The analyses in this briefing were based on Statistics Canada's POHEM micro-simulation model. The assumptions and calculations underlying the simulation results were prepared by The Conference Board of Canada, and the responsibility for the use and interpretation of these data is entirely that of the authors. The findings and conclusions of this briefing do not necessarily reflect the views of the CASHC investors, advisory committee members, or the external reviewers. Any errors or omissions in fact or interpretation remain the sole responsibility of The Conference Board of Canada.

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PUBLICATION 6436
PRICE: Complimentary