

# The Economic Benefits of Reducing the Prevalence of Tobacco Smoking

*In Quebec and Ontario*

*August 6, 2020*



4554 48B Street, Delta, BC V4K 2R8

Tel: 604.946.5464 Email: [hans@krueger.ca](mailto:hans@krueger.ca)

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# The Economic Benefits of Reducing the Prevalence of Tobacco Smoking

## *In Quebec and Ontario*

### Executive Summary

In March of 2019 Canada's three largest tobacco companies asked for and received a court-ordered extension of the suspension on all tobacco litigation in Canada. The companies are facing at least \$500 billion in lawsuits, primarily from 10 Canadian provinces. This suspension was extended on February 20, 2020 until September 30, 2020 and we assume that legal teams for the provinces are actively attempting to reach an out-of-court settlement with the tobacco companies.

It is within this context that the *Coalition québécoise pour le contrôle du tabac* and *Physicians for a Smoke-Free Canada* are seeking information on the economic burden attributable to tobacco smoking, particularly in the provinces of Quebec and Ontario. More specifically, how might the healthcare costs avoided by reducing the prevalence of smoking in each province to 5% by 2035 compare with the proposed value of settlements negotiated with the tobacco companies? That is, is the economic value of an accelerated reduction in tobacco use (a phase out) negotiated with the tobacco companies of greater economic value than a proposed out-of-court settlement?

### Quebec

In 2000, in Quebec, an estimated 29.2% of the population ages 12 and older smoked (30.9% of males and 27.5% of females). This has decreased to an estimated 17.5% in 2018 (19.7% for males and 15.3% for females) or 1.3 million smokers (716,000 males and 563,000 females).

The total economic burden attributable to tobacco smoking in Quebec in 2018 is estimated at \$3.79 billion (ranging from \$3.27 to \$4.57 billion). Of this \$3.79 billion, \$1.20 billion (ranging from \$1.02 to \$1.48 billion) is for direct costs and \$2.59 billion (ranging from \$2.25 to \$3.09 billion) is for indirect costs.

Given current trends and estimated population growth, there would be an estimated 1,046,000 smokers in Quebec in 2035. This would decline to an estimated 405,000 smokers under the 5% scenario, or 641,000 fewer smokers. The reduction in the number of smokers under the 5% scenario consists of 426,000 (66% of the total) fewer light smokers, 172,000 (27%) fewer moderate smokers and 44,000 (7%) fewer heavy smokers.

This reduction in the number of smokers in the province, in turn, would lead to a reduction in the economic burden attributable to tobacco smoking of \$1.33 billion (ranging from \$1.12 to \$1.56 billion) in 2035, with \$424 million (ranging from \$359 to \$499 million) in direct costs and \$903 million (ranging from \$765 to \$1,062 million) in indirect costs. Cumulatively, costs avoided between 2020 and 2035 are estimated at \$12.7 billion, ranging from \$10.7 to \$14.9 billion (using constant 2018 dollars).

Between 2008 and 2017, Quebec saw an average annual increase of 4.69% in health care expenditures. If we assume a similar annual rate of increase through 2035, the 5% scenario in Quebec would lead to a reduction in the economic burden attributable to tobacco smoking of \$2.89 billion (ranging from \$2.45 to \$3.40 billion) in 2035 and cumulative costs avoided between 2020 and 2035 of \$22.2 billion (ranging from \$18.8 to \$26.1 billion) (see following table).

<b>Annual Direct and Indirect Costs Avoided, Quebec</b>													
Adjusted for Inflation, by Cost Category													
2019 - 2035, Ages 12+													
(\$,000,000)													
Year	Target	Annual Cost Avoided			Cost Avoided by Direct Cost Category					Cost Avoided by Indirect Cost Category			
	Prevalence	Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total
2019	17.1%	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
2020	15.4%	\$14.3	\$30.6	\$44.9	\$7.3	\$1.5	\$1.6	\$3.9	\$14.3	\$21.1	\$6.0	\$3.4	\$30.6
2021	13.7%	\$44.1	\$94.2	\$138.3	\$22.3	\$4.7	\$5.0	\$12.0	\$44.1	\$65.1	\$18.5	\$10.6	\$94.2
2022	12.2%	\$88.9	\$190.0	\$278.8	\$45.0	\$9.5	\$10.1	\$24.3	\$88.9	\$131.3	\$37.4	\$21.3	\$190.0
2023	10.8%	\$144.8	\$306.0	\$450.8	\$73.3	\$15.5	\$16.4	\$39.5	\$144.8	\$211.4	\$60.2	\$34.3	\$306.0
2024	9.7%	\$210.6	\$439.4	\$650.1	\$106.7	\$22.6	\$23.8	\$57.5	\$210.6	\$303.6	\$86.5	\$49.3	\$439.4
2025	8.8%	\$279.6	\$579.6	\$859.3	\$141.6	\$30.0	\$31.6	\$76.3	\$279.6	\$400.5	\$114.1	\$65.1	\$579.6
2026	8.0%	\$349.8	\$722.7	\$1,072.5	\$177.2	\$37.6	\$39.6	\$95.5	\$349.8	\$499.3	\$142.2	\$81.1	\$722.7
2027	7.4%	\$417.1	\$861.5	\$1,278.6	\$211.3	\$44.8	\$47.2	\$113.9	\$417.1	\$595.3	\$169.6	\$96.7	\$861.5
2028	6.9%	\$481.7	\$996.6	\$1,478.2	\$244.0	\$51.7	\$54.5	\$131.5	\$481.7	\$688.6	\$196.1	\$111.9	\$996.6
2029	6.4%	\$545.6	\$1,132.2	\$1,677.8	\$276.3	\$58.6	\$61.7	\$148.9	\$545.6	\$782.3	\$222.8	\$127.1	\$1,132.2
2030	6.0%	\$609.0	\$1,269.3	\$1,878.3	\$308.5	\$65.4	\$68.9	\$166.2	\$609.0	\$877.0	\$249.8	\$142.5	\$1,269.3
2031	5.7%	\$670.9	\$1,404.9	\$2,075.7	\$339.8	\$72.0	\$75.9	\$183.1	\$670.9	\$970.7	\$276.5	\$157.7	\$1,404.9
2032	5.5%	\$731.7	\$1,539.0	\$2,270.7	\$370.6	\$78.6	\$82.8	\$199.7	\$731.7	\$1,063.4	\$302.9	\$172.8	\$1,539.0
2033	5.3%	\$792.8	\$1,674.1	\$2,466.9	\$401.6	\$85.1	\$89.7	\$216.4	\$792.8	\$1,156.7	\$329.5	\$187.9	\$1,674.1
2034	5.2%	\$857.3	\$1,817.1	\$2,674.4	\$434.2	\$92.1	\$97.0	\$234.0	\$857.3	\$1,255.5	\$357.6	\$204.0	\$1,817.1
2035	5.0%	\$923.7	\$1,965.7	\$2,889.4	\$467.9	\$99.2	\$104.5	\$252.1	\$923.7	\$1,358.2	\$386.9	\$220.6	\$1,965.7
<b>Total</b>		<b>\$7,161.9</b>	<b>\$15,022.9</b>	<b>\$22,184.8</b>	<b>\$3,627.8</b>	<b>\$769.2</b>	<b>\$810.0</b>	<b>\$1,955.0</b>	<b>\$7,161.9</b>	<b>\$10,380.1</b>	<b>\$2,956.6</b>	<b>\$1,686.3</b>	<b>\$15,022.9</b>

LTD = Long Term Disability, STD = Short Term Disability

## Ontario

In 2000, in Ontario, an estimated 24.1% of the population ages 12 and older smoked (27.0% of males and 21.4% of females). This has decreased to an estimated 15.2% in 2018 (18.8% for males and 11.8% for females) or 1.91 million smokers (1,156,000 males and 752,000 females).

The total economic burden attributable to tobacco smoking in Ontario in 2018 is estimated at \$5.36 billion (ranging from \$4.45 to \$6.43 billion). Of this \$5.36 billion, \$1.79 billion (ranging from \$1.46 to \$2.18 billion) is for direct costs and \$3.57 billion (ranging from \$2.99 to \$4.25 billion) is for indirect costs.

Given current trends and estimated population growth, there would be an estimated 1,747,000 smokers in Ontario in 2035. This would decline to an estimated 758,000 smokers under the 5% scenario, or 990,000 fewer smokers. The reduction in the number of smokers under the 5% scenario consists of 632,000 (64% of the total) fewer light smokers, 244,000 (25%) fewer moderate smokers and 114,000 (12%) fewer heavy smokers.

This reduction in the number of smokers in the province, in turn, would lead to a reduction in the economic burden attributable to tobacco smoking of \$1.88 billion (ranging from \$1.56 to \$2.26 billion) in 2035, with \$634 million (ranging from \$526 to \$760 million) in direct costs and \$1,248 million (ranging from \$1,037 to \$1,497 million) in indirect costs. Cumulatively,

costs avoided between 2020 and 2035 are estimated at \$16.4 billion, ranging from \$13.7 to \$19.7 billion (using constant 2018 dollars).

Between 2008 and 2017, Ontario saw an average annual increase of 3.82% in health care expenditures. If we assume a similar annual rate of increase through 2035, the 5% scenario in Ontario would lead to a reduction in the economic burden attributable to tobacco smoking of \$3.56 billion (ranging from \$2.96 to \$4.27 billion) in 2035 and cumulative costs avoided between 2020 and 2035 of \$26.1 billion (ranging from \$21.7 to \$31.4 billion) (see following table).

### Annual Direct and Indirect Costs Avoided, Ontario

Adjusted for Inflation, by Cost Category

2019 - 2035, Ages 12+

(\$,000,000)

Year	Target	Annual Cost Avoided			Cost Avoided by Direct Cost Category					Cost Avoided by Indirect Cost Category			
	Prevalence	Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total
2019	15.2%	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
2020	13.8%	\$17.4	\$34.5	\$51.9	\$8.8	\$1.9	\$2.0	\$4.7	\$17.4	\$23.9	\$6.8	\$3.9	\$34.5
2021	12.6%	\$52.5	\$104.4	\$156.9	\$26.6	\$5.6	\$5.9	\$14.3	\$52.5	\$72.1	\$20.5	\$11.7	\$104.4
2022	11.5%	\$105.5	\$209.9	\$315.4	\$53.4	\$11.3	\$11.9	\$28.8	\$105.5	\$145.1	\$41.3	\$23.6	\$209.9
2023	10.5%	\$170.6	\$336.0	\$506.5	\$86.4	\$18.3	\$19.3	\$46.6	\$170.6	\$232.2	\$66.1	\$37.7	\$336.0
2024	9.6%	\$247.5	\$482.2	\$729.6	\$125.3	\$26.6	\$28.0	\$67.5	\$247.5	\$333.2	\$94.9	\$54.1	\$482.2
2025	8.9%	\$325.8	\$631.4	\$957.2	\$165.0	\$35.0	\$36.9	\$88.9	\$325.8	\$436.3	\$124.3	\$70.9	\$631.4
2026	8.2%	\$407.9	\$788.0	\$1,195.9	\$206.6	\$43.8	\$46.1	\$111.3	\$407.9	\$544.5	\$155.1	\$88.5	\$788.0
2027	7.6%	\$490.1	\$946.6	\$1,436.8	\$248.3	\$52.6	\$55.4	\$133.8	\$490.1	\$654.1	\$186.3	\$106.3	\$946.6
2028	7.1%	\$572.9	\$1,108.2	\$1,681.1	\$290.2	\$61.5	\$64.8	\$156.4	\$572.9	\$765.7	\$218.1	\$124.4	\$1,108.2
2029	6.7%	\$656.8	\$1,273.4	\$1,930.2	\$332.7	\$70.5	\$74.3	\$179.3	\$656.8	\$879.9	\$250.6	\$142.9	\$1,273.4
2030	6.3%	\$742.4	\$1,443.0	\$2,185.3	\$376.0	\$79.7	\$84.0	\$202.6	\$742.4	\$997.0	\$284.0	\$162.0	\$1,443.0
2031	5.9%	\$829.6	\$1,617.3	\$2,446.9	\$420.2	\$89.1	\$93.8	\$226.5	\$829.6	\$1,117.5	\$318.3	\$181.5	\$1,617.3
2032	5.6%	\$919.8	\$1,798.2	\$2,718.0	\$465.9	\$98.8	\$104.0	\$251.1	\$919.8	\$1,242.5	\$353.9	\$201.8	\$1,798.2
2033	5.4%	\$1,011.9	\$1,983.6	\$2,995.6	\$512.6	\$108.7	\$114.5	\$276.2	\$1,011.9	\$1,370.6	\$390.4	\$222.7	\$1,983.6
2034	5.2%	\$1,105.1	\$2,171.6	\$3,276.7	\$559.8	\$118.7	\$125.0	\$301.7	\$1,105.1	\$1,500.4	\$427.4	\$243.8	\$2,171.6
2035	5.0%	\$1,198.4	\$2,360.5	\$3,558.8	\$607.0	\$128.7	\$135.5	\$327.1	\$1,198.4	\$1,631.0	\$464.5	\$265.0	\$2,360.5
<b>Total</b>		<b>\$8,854.0</b>	<b>\$17,288.9</b>	<b>\$26,142.9</b>	<b>\$4,484.9</b>	<b>\$950.9</b>	<b>\$1,001.4</b>	<b>\$2,416.9</b>	<b>\$8,854.0</b>	<b>\$11,945.7</b>	<b>\$3,402.5</b>	<b>\$1,940.6</b>	<b>\$17,288.9</b>

LTD = Long Term Disability, STD = Short Term Disability

## Introduction

In March of 2019 Canada's three largest tobacco companies asked for and received a court-ordered extension of the suspension on all tobacco litigation in Canada. The companies are facing at least \$500 billion in lawsuits, primarily from 10 Canadian provinces. This suspension was extended on February 20, 2020 until September 30, 2020 and we assume that legal teams for the provinces are actively attempting to reach an out-of-court settlement with the tobacco companies.

It is within this context that the *Coalition québécoise pour le contrôle du tabac* and *Physicians for a Smoke-Free Canada* are seeking information on the economic burden attributable to tobacco smoking, particularly in the provinces of Quebec and Ontario. More specifically, how might the healthcare costs avoided by reducing the prevalence of smoking in each province to 5% by 2035 compare with the proposed value of settlements negotiated with the tobacco companies? That is, is the economic value of an accelerated reduction in tobacco use (a phase out) negotiated with the tobacco companies of greater economic value than a proposed out-of-court settlement?

H. Krueger & Associates Inc. has developed a model which assesses the economic burden attributable to the risk factors of tobacco smoking, physical inactivity, excess weight, alcohol consumption and low fruit and vegetable consumption.<sup>1,2,3</sup> Data on the economic burden is available for both direct (hospital, physician, drugs, etc.) and indirect costs (premature mortality, short- and long-term disability) for Canada and by province.

The model uses a detailed approach based on the calculation of population attributable fractions using risk factor prevalence by sex and age and the most recent data on the relationship (relative risk) between the risk factor and specific disease categories.

The variable risks and economic burden associated with tobacco smoking intensity (light, moderate and heavy smokers<sup>4</sup>) are taken into account using an extension of the basic population attributable fraction formula to address complications that can arise when a polytomous risk factor is involved (that is, a risk factor that is made up of more than one level of exposure).

In addition to calculating the economic burden associated with this risk factor in any province, the model can be used to estimate the economic benefits of risk factor reduction over time.<sup>5</sup>

At its simplest, the following information and steps are required for modelling purposes:

- The proportion of the population exposed (E) to smoking (by sex and intensity).
- The diseases found to be partially or wholly attributable to tobacco smoking.

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<sup>1</sup> Krueger H, Williams D, Ready A et al. Improved estimation of the health and economic burden of chronic disease risk factors in Manitoba, Canada. *Chronic Diseases and Injuries in Canada*. 2013; 33(4): 236-246.

<sup>2</sup> Krueger H, Krueger J, Koot J. Variation across Canada in the economic burden attributable to excess weight, tobacco smoking and physical inactivity. *Canadian Journal of Public Health*. 2015; 106(4): e171-77.

<sup>3</sup> Krueger H, Koot J, Andres E. The economic benefits of fruit and vegetable consumption in Canada. *Canadian Journal of Public Health*. 2017; 108(2): e152-61.

<sup>4</sup> Light tobacco smoking includes all occasional smokers and those who smoke fewer than 10 cigarettes on a daily basis, moderate tobacco smoking includes those who smoke 10-19 cigarettes on a daily basis, and heavy smoking includes those who smoke 20 or more cigarettes on a daily basis.

<sup>5</sup> Krueger H, Turner D, Krueger J et al. The economic benefits of risk factor reduction in Canada: tobacco smoking, excess weight and physical inactivity. *Canadian Journal of Public Health*. 2014; 105(1): e69-78.

- The relative risk (RR) associated with the presence of each of the risk factors and the identified diseases.
- Calculation of the population attributable fraction (PAF) based on E and the disease-specific RR. The PAF is the proportion of disease that will be removed if exposure to the risk factor is eliminated.
- Calculation of the direct health care costs and indirect costs (premature mortality, short and long-term disability) associated with the respective diseases.
- The hazard ratios for the time lag between when an individual ceases smoking and when their risk of an attributable disease is eliminated.

In the following sections of the report, each of these steps will be detailed, including results for the provinces of Quebec and Ontario.



## Estimating the Population Exposed to the Risk Factor

In order to calculate PAF, we require data on both the relative risk (RR) of a given disease for those exposed to a risk factor, and the level of risk factor exposure in a population (E). In this model, we consider “exposure” to a given risk factor to be equal to the prevalence of that risk factor in a population.

While a given RR value may remain relatively constant among different populations (especially if it is derived through multiple studies in diverse populations; see following section), risk factor exposure does vary considerably between regions and socioeconomic groups, as well as over time. As a result, exposure to various risk factors are often a focus of ongoing public health monitoring.

Thus, when PAF values are formed based on population-specific exposure rates, the resulting PAF is also population-specific. These PAFs may vary considerably from population to population and over time. We therefore cannot assume that PAF values calculated for one population (e.g., a province) or time period are also relevant for another population or time.

This model calculates unique PAFs for varying intensities of exposure tobacco smoking (referred to a polytomous exposure), using both intensity-specific exposure rates and intensity-specific relative risk values.

### Source of Risk Factor Exposure Data

The Canadian Community Health Survey (CCHS) is a cross-sectional survey that collects information related to health status, health care utilization and health determinants for the Canadian population. Prior to 2007, data collection occurred on a two-year cycle. For this time period, data are available for the 2000/01, 2003 and 2005 cycles. In 2007, major changes were made to the survey design, resulting in yearly data collection.

The target population of the CCHS is Canadians aged 12 years and older who live in private occupied dwellings in health regions covering all provinces and territories. Excluded from the survey are individuals living on reserves or other aboriginal settlements, on Crown Lands, institutional residents, full-time members of the Canadian Forces and residents of certain remote regions. The CCHS is the primary data source for risk factor prevalence data, which we use as “exposure” to a given risk factor in this model.

While the content of the survey has varied from year to year, we have made every effort to make the results between cycles broadly comparable over time.

### Calculation of Risk Factor Prevalence

Sex-specific prevalence rates were calculated for age groups 12-19 and for ten-year age groups past age 20 to 80+. Prevalence rates were calculated separately for each province.

The weighted responses provided in the CCHS Public Use Microdata File (PUMF)<sup>6</sup> were used to calculate prevalence rates. The weighted number of individuals with a stated response, plus those for whom the question was “not applicable”, were used as the denominator (i.e., excluding those who were coded as “don’t know”, “not stated”, or “refusal”). It was assumed

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<sup>6</sup> This analysis is based on the Statistics Canada’s Canadian Community Health Survey Public Use Microdata Files from 2000/01 to 2017/18. All computations, use and interpretation of these data are entirely that of H. Krueger & Associates Inc.

that those who did not respond to a question would be distributed proportionally to those who did respond.

These region-, age- and sex-specific prevalence rates were then, in turn, applied to population estimates<sup>7</sup> for the given survey year to estimate the number of individuals with each risk factor, and the overall prevalence for the population. For years in which no CCHS survey was conducted, the age- and sex-specific prevalence rates from the preceding and following CCHS cycles were averaged.

### Prevalence of Tobacco Smoking – 2000 to 2018

The prevalence of tobacco smoking was calculated based only on those who currently smoke occasionally or daily, and does not include former smokers. For this study, we have classified smokers into three categories of risk factor exposure: light (<10 cigarettes per day or occasional smoking), moderate (10-19 cigarettes per day) and heavy ( $\geq 20$  cigarettes per day).

The number of total tobacco smokers was determined based on the CCHS question, “At the present time do you smoke cigarettes every day, occasionally, or not at all?” (variable SMK\_202 through 2014, variable SMK\_005 beginning in 2015). Those who smoke daily were further asked, “How many cigarettes do you smoke each day now?” (variable SMK\_204 through 2014, variable SMK\_045 beginning in 2015). Based on the weighted responses to this question, smokers were grouped into the three categories of risk factor exposure. Those who were classified by SMK\_202/SMK\_005 as “occasional” smokers were also grouped into the light smoking category.

Prevalence rates were calculated using the weighted number of individuals who were classified in variable SMK\_202/SMK\_005 as “daily,” “occasional,” or “not at all” as the denominator. The calculated prevalence rates by sex and age were then adjusted simultaneously so that the overall calculated prevalence by sex, province and year was identical to that calculated by Statistics Canada.<sup>8</sup>

We assumed that no children under the age of 12 smoked.

### Prevalence of Tobacco Smoking - Quebec

#### Trends

In 2000, an estimated 29.2% of the Quebec population ages 12 and older smoked. This has decreased to an estimated 17.5% in 2018. The most important reduction is in the prevalence of heavy smoking which has declined from 11.6% in 2000 to 3.8% in 2018 (see Figure 1).

In 2000, an estimated 30.9% of Quebec **males** ages 12 and older smoked. This has decreased to an estimated 19.7% in 2018. The most important reduction is in the prevalence of heavy smoking which has declined from 14.1% in 2000 to 5.1% in 2018 (see Figure 2).

In 2000, an estimated 27.5% of Quebec **females** ages 12 and older smoked. This has decreased to an estimated 15.3% in 2018. As with males, the most important reduction is in the

<sup>7</sup> Statistics Canada. *Table 17-10-0005-01 Population estimates on July 1st, by age and sex*. 2020. Available at <https://www150.statcan.gc.ca/t1/tb11/en/tv.action?pid=1710000501>. Accessed May 2020.

<sup>8</sup> Statistics Canada. *Table 13-10-0451-01* for the prevalence between 2003 and 2014 and *Table 13-10-0096-01* for the prevalence between 2015 and 2018. Available online at <https://www150.statcan.gc.ca/t1/tb11/en/tv.action?pid=1310045101> and <https://www150.statcan.gc.ca/t1/tb11/en/tv.action?pid=1310009601>. Accessed July 2020.

prevalence of heavy smoking which has declined from 9.2% in 2000 to 2.6% in 2018 (see Figure 3).

See Appendix A for detailed rates by sex, age group and year from 2000 to 2018.

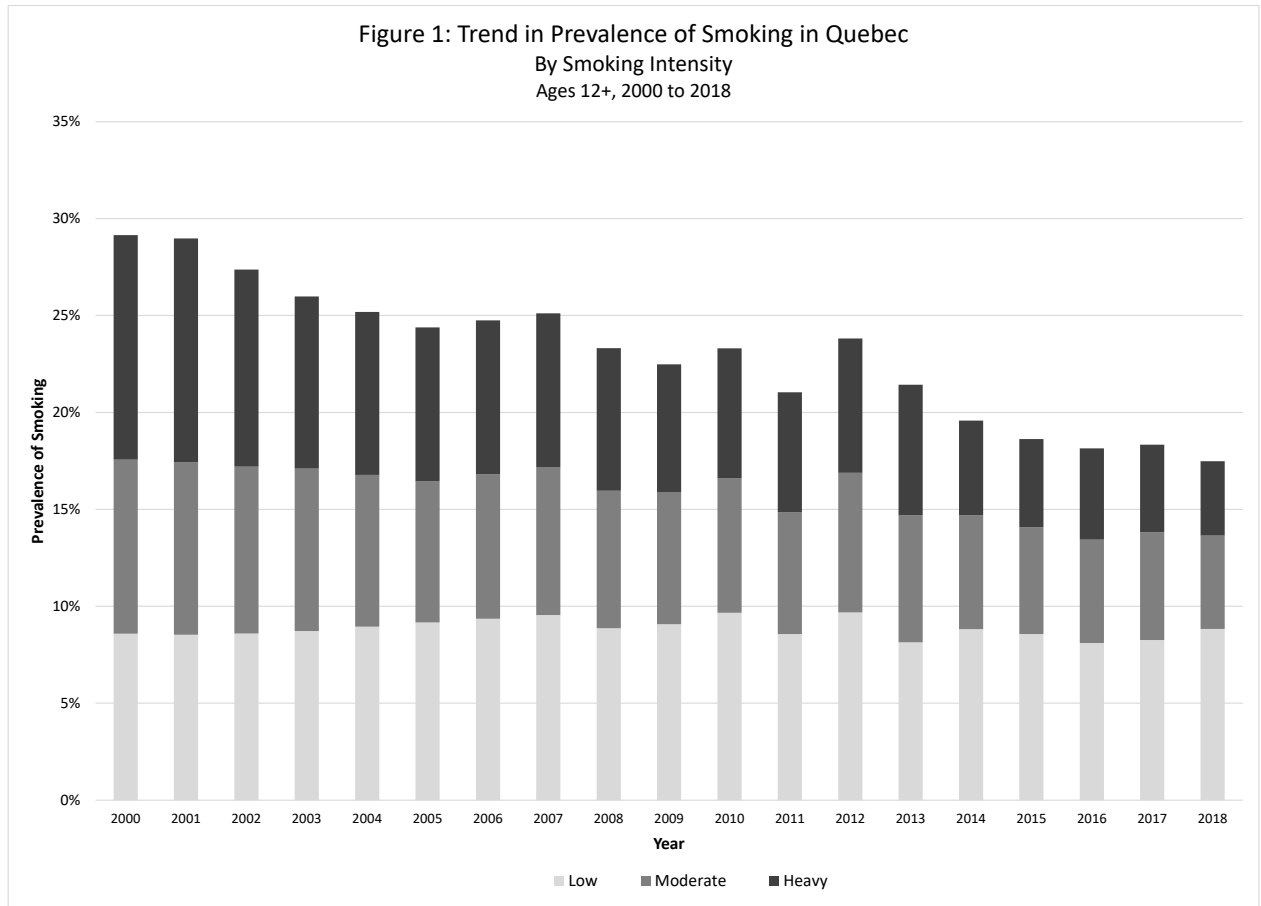


Figure 2: Trend in Prevalence of Smoking in Quebec  
**Males** by Smoking Intensity  
 Ages 12+, 2000 to 2018

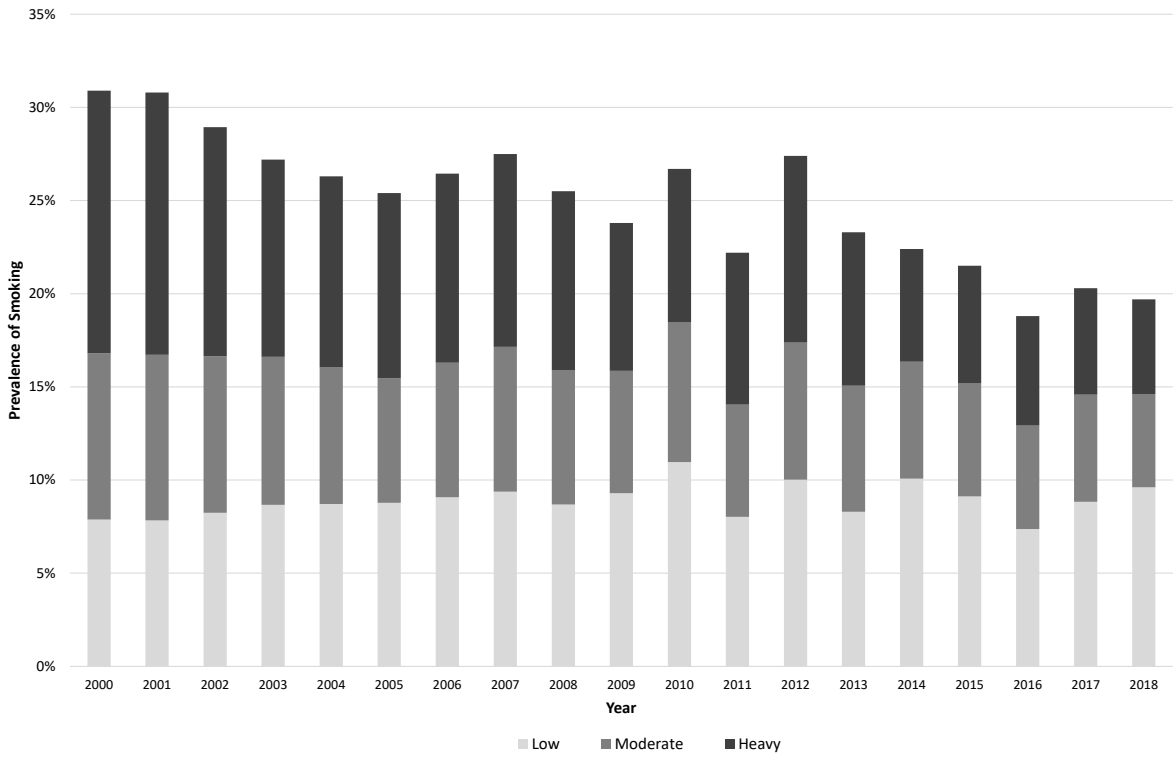
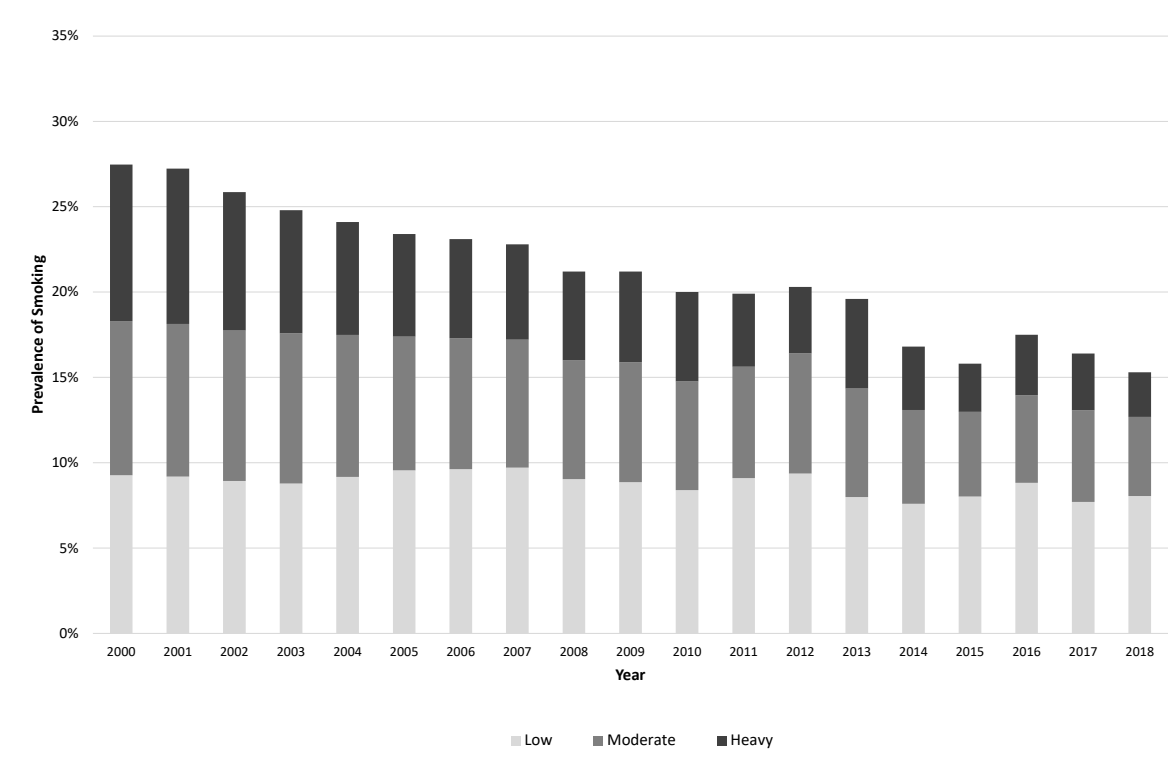


Figure 3: Trend in Prevalence of Smoking in Quebec  
**Females** by Smoking Intensity  
 Ages 12+, 2000 to 2018



## Prevalence of Tobacco Smoking - Ontario

### Trends

In 2000, an estimated 24.1% of the Ontario population ages 12 and older smoked. This has decreased to an estimated 15.2% in 2018. The most important reduction is in the prevalence of heavy smoking which has declined from 8.0% in 2000 to 3.3% in 2018 (see Figure 4).

In 2000, an estimated 27.0% of Ontario **males** ages 12 and older smoked. This has decreased to an estimated 18.8% in 2018. The most important reduction is in the prevalence of heavy smoking which has declined from 10.5% in 2000 to 4.6% in 2018 (see Figure 5).

In 2000, an estimated 21.4% of Ontario **females** ages 12 and older smoked. This has decreased to an estimated 11.8% in 2018. As with males, the most important reduction is in the prevalence of heavy smoking which has declined from 5.5% in 2000 to 2.1% in 2018 (see Figure 6).

See Appendix A for detailed rates by sex, age group and year from 2000 to 2018.

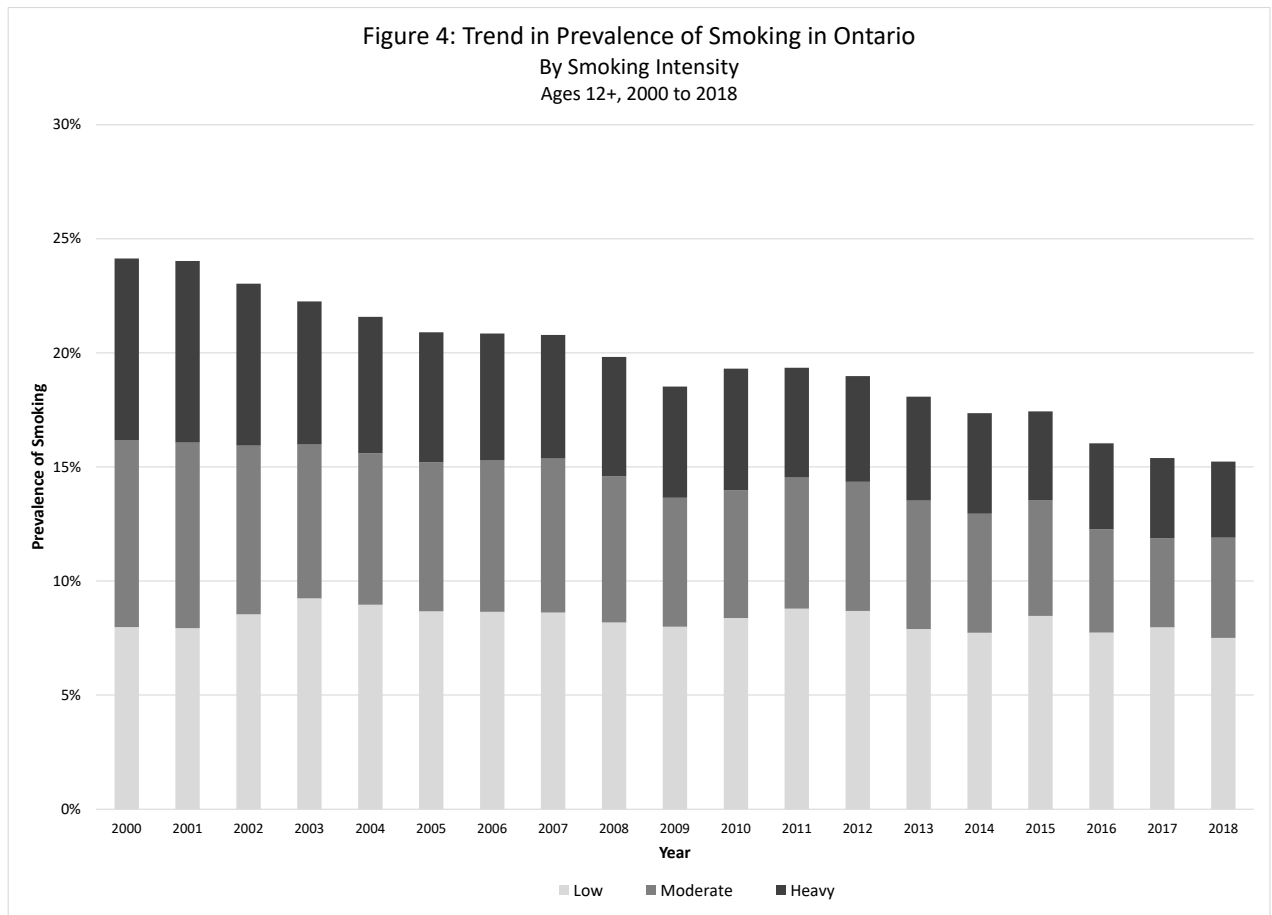


Figure 5: Trend in Prevalence of Smoking in Ontario  
**Males** by Smoking Intensity  
 Ages 12+, 2000 to 2018

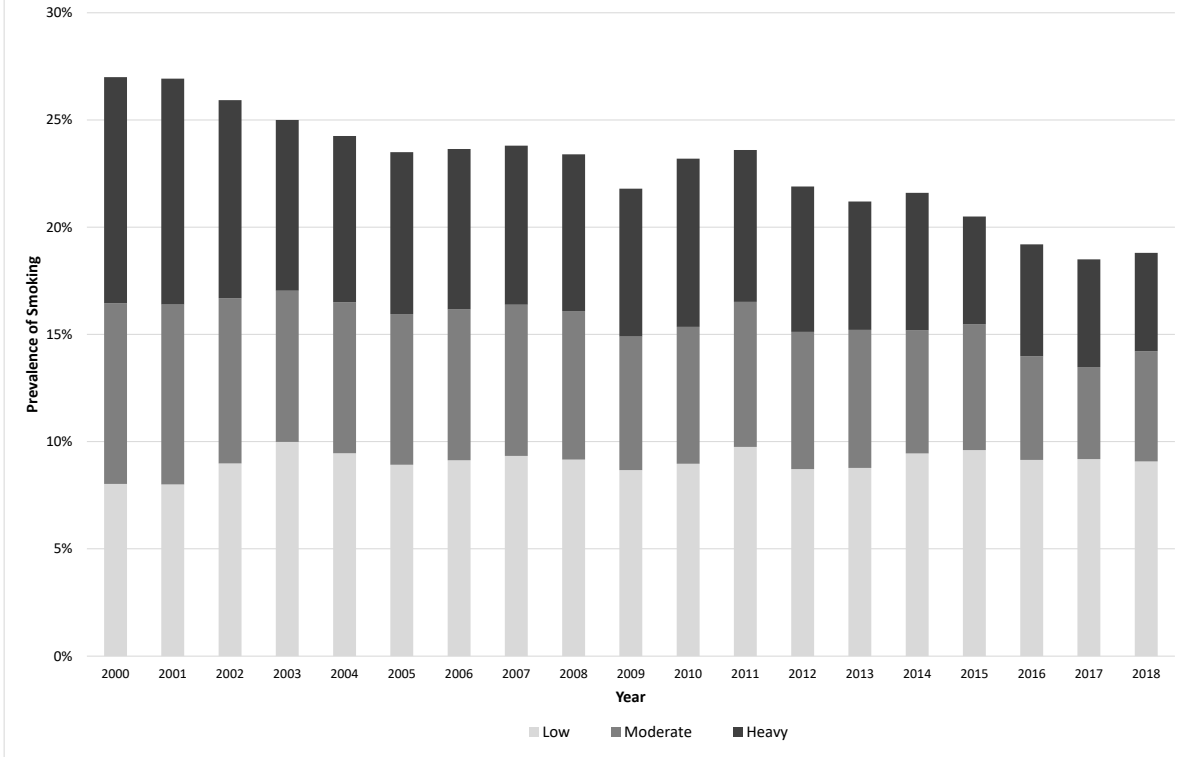
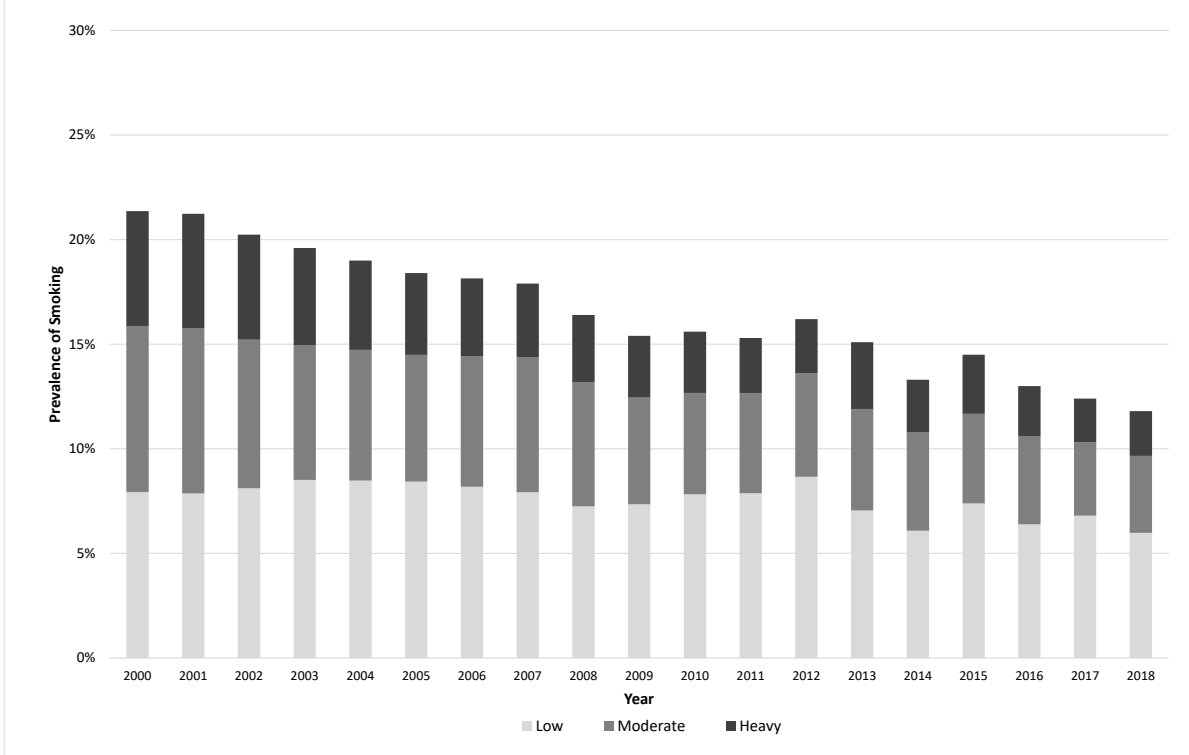


Figure 6: Trend in Prevalence of Smoking in Ontario  
**Females** by Smoking Intensity  
 Ages 12+, 2000 to 2018



## Estimating the Relative Risk

### Risk Factors and Relative Risk

A common approach used in epidemiologic research involves comparing groups of individuals against each other to determine if belonging to a particular group increases or decreases the risk of developing a disease of interest. Other areas of medicine also use this concept when, for example, comparing the effect of treatment A and treatment B on ameliorating disease symptoms. For the present model, the groups of interest are those with exposure to a potentially modifiable chronic disease risk factor, specifically, tobacco smoking. The critical concern is how much a risk factor influences the incidence of disease—in short, the degree to which it is associated with the disease (most importantly, in a *causal* manner).

Relative risk (RR) is a measurement of risk (or factor-disease association) that is used widely in epidemiological studies. It may be defined as the proportion of individuals experiencing an outcome (such as incident disease) in an exposed group divided by the proportion experiencing the outcome in the control (or unexposed) group. Specifically, RR of incidence is a fraction where the numerator and the denominator are the same metric, namely, the risk of incident disease as measured by proportion. Thus, RR by definition has no unit; it is simply a number representing a ratio or comparison of two risks—hence, the name “relative risk.”

Relative risk is commonly expressed as a decimal, such as 1.2, which means the exposed group has a 0.2 times higher risk than in the unexposed group. This measure of risk can also be expressed as a percentage increase, for example, a 20% increase in risk in the exposed group. Likewise, if the relative risk happens to be a whole number such as 3.0, it may be expressed as a “three-fold increase” in risk.

### Sources of RR Data

The RR metric is central to the calculation of the risk of disease in a population that is attributable to a risk factor, which in turn can be used to estimate the attributable costs.

Meta-analyses of multiple studies are often available to identify RRs, which typically results in a more reliable “summary” or “pooled” RR figure. Alternatively, studies with very large sample sizes can also be utilized. In selecting sources for RR values used in this model, we investigated the existing literature and selected meta-analyses or large studies that we determined to have the most reliable evidence.

### RR of Tobacco Smoking

The 2013 study by Pirie and colleagues was used as the source for RR data associated with tobacco smoking.<sup>9</sup> Their study is based on 1.3 million women from the United Kingdom who were recruited between 1996 and 2001 and followed until January 1, 2011. RRs were adjusted for geographic region, age, body mass index, socio-economic status, current alcohol intake, weekly strenuous physical activity, height, oral contraceptive use, menopausal status and menopausal hormone therapy use. RRs are also presented by three levels of smoking intensity based on the number of cigarettes smoked per day at the time of study recruitment, namely <10, 10-19 or  $\geq 20$ . Trend information from the United States suggests a convergence of relative and absolute risk of death from smoking in men and women, resulting from the convergence of

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<sup>9</sup> Pirie K, Peto R, Reeves GK et al. The 21st century hazards of smoking and benefits of stopping: a prospective study of one million women in the UK. *Lancet*. 2013; 381(9861): 133-41.

smoking patterns between the sexes since the 1960s.<sup>10</sup> However, there appears to be a higher risk in female smokers compared with male smokers even after adjusting for smoking intensity<sup>11</sup>, with the possible exception of lung<sup>12</sup> and colo-rectal<sup>13</sup> cancers. We therefore adjusted the relative risk for males downward (with the exception of the RR for lung and colo-rectal cancers) to reflect the overall sex-specific difference observed in the meta-analysis by Mucha and co-authors.<sup>14</sup>

Table 1 provides the resulting smoking-related RR values.

<b>Table 1: Relative Risks Associated with Tobacco Smoking</b>								
<b>Stratified by Disease Category, Smoking Intensity and Sex</b>								
<b>Disease category</b>	<b>ICD-10 Codes</b>	<b>Tobacco Smoking</b>						
		<b>&lt;10 Cigarettes</b>		<b>10-19 Cigarettes</b>		<b>≥20 Cigarettes</b>		
		<b>Males</b>	<b>Females</b>	<b>Males</b>	<b>Females</b>	<b>Males</b>	<b>Females</b>	
		<b>RR</b>	<b>RR</b>	<b>RR</b>	<b>RR</b>	<b>RR</b>	<b>RR</b>	<b>RR</b>
<b>Neoplasm</b>								
Lip, oral cavity, pharynx, larynx	C00-14, 30-32	2.29	2.85	3.94	4.91	5.11	7.20	
Esophagus	C15	1.74	2.17	2.40	2.99	3.28	4.62	
Stomach	C16	1.40	1.75	1.64	2.04	1.56	2.20	
Colo-rectal	C18-20	1.20	1.20	1.22	1.22	1.39	1.39	
Liver	C22	1.14	1.42	1.25	1.56	1.09	1.54	
Pancreas	C25	1.52	1.89	1.90	2.37	1.89	2.66	
Trachea, bronchus, lung	C33-34	10.83	10.83	22.03	22.03	36.00	36.00	
Breast	C50				1.15		1.25	
Kidney	C64	1.14	1.42	1.83	2.28	1.82	2.56	
Urinary bladder	C67	2.15	2.68	2.94	3.66	2.30	3.24	
<b>Endocrine, nutritional and metabolic diseases</b>								
Type 2 diabetes	E11-14			1.49	1.86	1.54	2.17	
<b>Diseases of the circulatory system</b>								
Ischaemic heart diseases	I20-25	2.56	3.19	3.65	4.55	4.20	5.92	
Pulmonary embolism	I26	1.08	1.34	1.12	1.39	1.26	1.77	
Venous thromboembolism	I80-82	1.08	1.34	1.12	1.39	1.26	1.77	
Cerebrovascular disease	I60-69	1.84	2.29	2.57	3.20	2.70	3.81	
Aortic aneurysm	I71	3.10	3.87	5.76	7.18	5.74	8.09	
<b>Diseases of the respiratory system</b>								
Pneumonia	J12-18	1.65	2.06	2.45	3.06	3.13	4.42	
Chronic lung disease	J40-44	18.22	22.71	26.37	32.87	42.89	60.49	
<b>Diseases of the digestive system</b>								
Intestinal ischemia	K55	3.15	3.93	4.27	5.32	5.97	8.42	
Cirrhosis of liver	K70,74	2.19	2.73	2.68	3.34	2.82	3.97	
<b>External causes of morbidity and mortality</b>								
	V01-Y98	<b>1.18</b>	<b>1.47</b>	<b>1.32</b>	<b>1.65</b>	<b>1.66</b>	<b>2.34</b>	

<sup>10</sup> Thun MJ, Carter BD, Feskanich D et al. 50-year trends in smoking-related mortality in the United States. *New England Journal of Medicine*. 2013; 368(4): 351-64.

<sup>11</sup> Mucha L, Stephenson J, Morandi N et al. Meta-analysis of disease risk associated with smoking, by gender and intensity of smoking. *Gender Medicine*. 2006; 3(4): 279-91.

<sup>12</sup> Yang J, Yu D, Wen W et al. Tobacco smoking and mortality in Asia: A pooled meta-analysis. *JAMA Network Open*. 2019; 2(3).

<sup>13</sup> Onega T, Goodrich M, Dietrich A et al. The influence of smoking, gender, and family history on Colorectal adenomas. *Journal of Cancer Epidemiology*. 2010; doi:10.1155/2010/509347.

<sup>14</sup> Mucha L, Stephenson J, Morandi N et al. Meta-analysis of disease risk associated with smoking, by gender and intensity of smoking. *Gender Medicine*. 2006; 3(4): 279-91.



### **Tobacco Smoking and External Causes of Morbidity and Mortality**

The ICD-10 classification of External Causes of Morbidity and Mortality (ECMM; V01-Y98) includes injuries and harms that result from accidents, self-harm, assault, medical complications, and other external events. The Pirie study used to determine the RR values summarized in the above table suggests that there is an association between tobacco smoking and ECMM, even after adjusting for geographical region, age, body mass index, socioeconomic status, alcohol intake, and other variables. This study reported that the relative risk of ECMM was 1.47 for those who smoke <10 cigarettes per day, 1.65 for those who smoke 10-19 cigarettes per day, and 2.34 for those who smoke  $\geq 20$  cigarettes per day. However, there is little evidence to suggest whether the association between tobacco smoking and ECMM is causal, or is a result of other confounding factors or the combination of multiple factors, of which smoking is only one. The authors of the study acknowledge that some of these associations may be “partly or wholly non-causal.”<sup>15</sup>

Other studies have also accounted for all or part of this identified association to other confounding factors.<sup>16,17,18</sup> In their pivotal prospective study of male British doctors, Doll and colleagues stated that “the excess mortality from ‘external’ causes - accidents, injury, and poisoning - among smokers is unlikely to be due chiefly to smoking...but, rather, is likely to be due to other behavioural factors with which smoking is associated, such as the heavy consumption of alcohol or a willingness to take risks.”<sup>19</sup> While many studies adjust for potential confounding for alcohol, it is near impossible to account for innate characteristics, such as the willingness to take risks. The association is more likely to be causal for the ICD-10 codes X00-X09 (“exposure to smoke, fire and flames”) within the broader ECMM category; however, quantitative data in support of this conclusion is limited and weak.

As a result, we have excluded the possible casual effect of tobacco smoking on ECMM, assuming instead that there is no increased risk for smokers over non-smokers (i.e., RR = 1.0).

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<sup>15</sup> Pirie K, Peto R, Reeves GK et al. The 21st century hazards of smoking and benefits of stopping: a prospective study of one million women in the UK. *Lancet*. 2013; 381(9861): 133-41.

<sup>16</sup> Peto R, Boreham J, Lopez AD et al. Mortality from tobacco in developed countries: indirect estimation from national vital statistics. *Lancet*. 1992; 339(8804): 1268-78.

<sup>17</sup> Ezzati M and Lopez AD. Estimates of global mortality attributable to smoking in 2000. *Lancet*. 2003; 362(9387): 847-52.

<sup>18</sup> Doll R, Peto R, Boreham J et al. Mortality in relation to smoking: 50 years' observations on male British doctors. *British Medical Journal*. 2004; 328(7455): 1519.

<sup>19</sup> Doll R, Peto R, Boreham J et al. Mortality in relation to smoking: 50 years' observations on male British doctors. *British Medical Journal*. 2004; 328(7455): 1519.

## Estimating the Population Attributable Fraction

Since its introduction in the 1950s, the epidemiologic metric known as population attributable fraction (PAF; also often referred to as population attributable risk or PAR) has gained ascendancy in both research and practice arenas of public health. It is a powerful tool for understanding and communicating the burden of disease generated by a causal risk factor. For the current project, it is important to acknowledge the central role of the PAF metric in estimating the economic burden of disease attributable to a particular risk factor or group of factors.

PAF goes beyond RR in a number of important ways. Historically, the importance of a risk factor was often associated with the relative impact of the risk factor on the exposed group. That is, the higher the RR associated with the risk factor, the greater the importance and sense of urgency associated with that risk factor, at least within the exposed group. Thus, simply identifying a high RR could prompt action in, for instance, an occupational setting producing regular contact with a toxic chemical.

This approach, however, essentially ignores the importance of the *prevalence* of the risk factor in the general population, as noted more than 30 years ago by a McMaster University professor who was a pioneer in understanding and applying PAF: “When examining diseases with several risk factors varying both in their relative risks and prevalence rates, it seems inadequate to compare the epidemiological importance of these factors using relative risk alone.”<sup>20</sup> Indeed, a more suitable approach in this situation is to focus on PAF, a “measure which takes into account not only the strength of the physiologic effect of exposure, but also the number exposed to the risk factor in question.”<sup>21</sup>

There are different ways of conceptualizing (and calculating) PAF. Essentially, the measure “combines information on prevalence and a measure of association to provide a quantitative estimate of the proportion of disease in the population that is directly attributable to a particular exposure.”<sup>22</sup> Translating this idea into public health terms, PAF may be thought of as the proportion of disease that can be prevented if a risk factor were eliminated from the population. This is equivalent to the fraction of all cases that would not have occurred if the exposure had not occurred.<sup>23</sup>

### Calculation of PAF

In 1953, the epidemiologist Mort Levin published a now famous paper called *The Occurrence of Lung Cancer in Men*.<sup>24</sup> He was part of the contingent of epidemiologists in the middle of the twentieth century that established the carcinogenicity of tobacco smoke.<sup>25</sup> But Levin’s paper has also become well-known for introducing PAF and producing the first practical equation to calculate it.

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<sup>20</sup> Walter SD. The estimation and interpretation of attributable risk in health research. *Biometrics*. 1976; 32(4): 829-49.

<sup>21</sup> Walter SD. Calculation of attributable risks from epidemiological data. *International Journal of Epidemiology*. 1978; 7(2): 175-82.

<sup>22</sup> Natarajan S, Lipsitz SR and Rimm E. A simple method of determining confidence intervals for population attributable risk from complex surveys. *Statistics in Medicine*. 2007; 26(17): 3229-39.

<sup>23</sup> Hanley JA. A heuristic approach to the formulas for population attributable fraction. *Journal of Epidemiology and Community Health*. 2001; 55(7): 508-14.

<sup>24</sup> Levin ML. The occurrence of lung cancer in men. *Acta Unio Internationalis contra Cancrum*. 1953; 19: 531-41.

<sup>25</sup> Armenian HK and Szklo M. Morton Levin (1904-1995): history in the making. *American Journal of Epidemiology*. 1996; 143(6): 648-9.

That equation is:

$$PAF = \frac{E(RR - 1)}{E(RR - 1) + 1}$$

where E is the proportion of the population exposed to the factor of interest, and RR is the relative risk of cancer developing in the group exposed to the factor

The practical implication of this equation is that identifying credible data for E (exposure to a risk factor of interest) and RR (relative risk of diseases causally related to the factor) is all that is required to begin calculating PAF.

The basic PAF equation provides an accurate calculation of PAF precisely in the most simplistic risk factor scenario: the dichotomous system where the only two risk factor states that are considered are *exposed* and *not exposed*.

Individuals, however, are often exposed to a risk factor in a range of dosages – a phenomenon sometimes referred to as polytomous exposure. A typical example is the different intensities of cigarette smoking, and their association with varying levels of disease risk.

In our current model, tobacco smoking is conceived as a *tetrachotomous* exposure; that is, the following four categories of exposure are involved:

1. Non-smoker
2. Light smoker ( $E_{TSL}$ )
3. Moderate smoker ( $E_{TSM}$ )
4. Heavy smoker ( $E_{TSH}$ ).

The PAF calculation for tobacco smoking is thus as follows:

$$PAF = \frac{E_{TSL}(RR_{TSL} - 1) + E_{TSM}(RR_{TSM} - 1) + E_{TSH}(RR_{TSH} - 1)}{E_{TSL}(RR_{TSL} - 1) + E_{TSM}(RR_{TSM} - 1) + E_{TSH}(RR_{TSH} - 1) + 1}$$

PAF for Tobacco Smoking in Quebec and Ontario in 2018

Table 2 provides an overview of the results from combining the exposure and relative risk data for Quebec and Ontario. For example, in 2018, 32.4% of cancers of the lip, oral cavity, pharynx and larynx in Quebec males are attributable to tobacco smoking vs. 33.0% in females. The PAF is slightly lower in Ontario (31.3% in males and 27.9% in females) compared with Quebec due to a modestly lower prevalence of smoking in that province.

<b>Table 2: Population Attributable Fraction</b>					
<b>Associated with Tobacco Smoking</b>					
<b>In Quebec and Ontario, 2018</b>					
	<b>ICD-10 Code</b>	<b>Quebec</b>		<b>Ontario</b>	
		<b>Males</b>	<b>Females</b>	<b>Males</b>	<b>Females</b>
<b>Neoplasms</b>					
Lip, oral cavity, pharynx, larynx	C00-14, 30-32	32.4%	33.0%	31.3%	27.9%
Esophagus	C15	20.4%	21.9%	19.6%	18.1%
Stomach	C16	9.0%	12.3%	8.7%	9.8%
Colo-rectal	C18-20	4.8%	3.5%	4.5%	2.8%
Liver	C22	3.0%	6.9%	2.9%	5.4%
Pancreas	C25	12.3%	15.1%	11.8%	12.2%
Trachea, bronchus, lung	C33-34	79.1%	72.8%	78.2%	67.8%
Breast	C50		1.3%		1.1%
Kidney	C64	8.8%	11.8%	8.5%	9.5%
Urinary bladder	C67	19.4%	24.1%	18.9%	19.8%
<b>Endocrine, nutritional and metabolic diseases</b>					
Type 2 diabetes	E11-14	4.9%	6.6%	4.8%	5.4%
<b>Diseases of the circulatory system</b>					
Ischaemic heart diseases	I20-25	30.8%	31.9%	29.8%	26.8%
Pulmonary embolism	I26	2.5%	6.2%	2.4%	4.9%
Venous thromboembolism	I80-82	2.5%	6.2%	2.4%	4.9%
Cerebrovascular disease	I60-69	19.7%	21.8%	19.0%	17.9%
Aortic aneurysm	I71	37.8%	41.3%	37.1%	35.5%
<b>Diseases of the respiratory system</b>					
Pneumonia	J12-18	19.6%	21.3%	18.8%	17.5%
Chronic lung disease	J40-44	83.5%	82.7%	82.7%	78.9%
<b>Diseases of the digestive system</b>					
Intestinal Ischemia	K55	38.4%	38.7%	37.2%	33.0%
Cirrhosis of liver (incl alcoholic)	K70,74	22.5%	24.5%	21.7%	20.2%

## Estimating the Economic Burden Associated with the Risk Factor

In estimating the economic burden associated with tobacco smoking, we used a prevalence-based cost-of-illness methodology to generate direct (i.e., healthcare) costs.

### Calculation of Direct Costs

#### Allocation of Total Health Expenditures to Cost Categories and Diseases

In order to calculate direct costs, we adapted the approach that Anis et al. used to estimate the economic burden of obesity and overweight in Canada in 2006.<sup>26</sup> Total direct costs/health expenditures in Canada and by province for 2018, as estimated in the National Health Expenditure Database (NHEX), are shown on the following table.<sup>27</sup> Total estimated health expenditures in 2018 were \$254.5 billion in Canada, \$97.0 billion in Ontario and \$55.2 billion in Quebec (see Table 3).

**Table 3: Total Health Expenditure by Use of Funds in 2018**  
(\$' 000,000 )

	Population	Other			Other Professionals Vision Care				Drugs			Public			Other Health Spending			Grand Total	
		Hospitals	Institutions	Physicians	Dental Services	Services	Other	Sub-Total	Prescribed	Non- Prescribed	Sub-Total	Capital	Health	Admin	Health Research	Other	Sub-Total		
Canada	37,057,765	\$68,295.2	\$27,903.5	\$38,113.8	\$16,147.1	\$5,391.0	\$6,100.9	\$27,639.1	\$33,445.0	\$5,821.0	\$39,266.0	\$8,239.5	\$13,790.7	\$7,404.5	\$4,238.3	\$19,597.5	\$23,835.8	\$254,488.2	
British Columbia	5,001,170	\$8,447.1	\$2,990.7	\$4,837.0	\$2,349.3	\$784.4	\$887.7	\$4,021.3	\$3,381.1	\$588.5	\$3,969.6	\$1,086.6	\$2,076.1	\$1,091.7	\$550.7	\$2,546.5	\$3,097.2	\$31,617.4	
Alberta	4,300,721	\$9,437.8	\$2,309.6	\$5,391.4	\$2,264.1	\$755.9	\$855.5	\$3,875.5	\$3,752.1	\$653.0	\$4,405.2	\$1,438.9	\$2,144.7	\$797.4	\$549.7	\$2,541.8	\$3,091.5	\$32,892.1	
Saskatchewan	1,162,978	\$2,269.0	\$1,016.5	\$1,179.3	\$467.6	\$156.1	\$176.7	\$800.4	\$900.1	\$156.7	\$1,056.8	\$199.4	\$671.6	\$260.0	\$147.2	\$680.5	\$827.6	\$8,280.5	
Manitoba	1,353,403	\$2,925.3	\$1,183.8	\$1,435.1	\$523.3	\$174.7	\$197.7	\$895.8	\$946.0	\$164.6	\$1,110.6	\$141.7	\$714.2	\$362.2	\$200.5	\$927.2	\$1,127.7	\$9,896.3	
Ontario	14,318,545	\$25,280.0	\$9,180.3	\$14,685.9	\$6,142.1	\$2,050.7	\$2,320.7	\$10,513.4	\$13,973.1	\$2,432.0	\$16,405.1	\$3,069.8	\$6,172.3	\$2,748.5	\$1,598.1	\$7,389.7	\$8,987.9	\$97,043.1	
Quebec	8,387,632	\$13,700.5	\$8,813.4	\$8,262.5	\$3,517.6	\$1,174.4	\$1,329.1	\$6,021.1	\$8,154.3	\$1,419.2	\$9,573.6	\$1,610.2	\$1,210.6	\$1,440.2	\$807.7	\$3,734.7	\$4,542.4	\$55,174.6	
New Brunswick	770,921	\$1,670.7	\$560.9	\$683.2	\$272.5	\$91.0	\$102.9	\$466.4	\$746.1	\$129.9	\$876.0	\$208.6	\$209.1	\$172.3	\$96.2	\$444.7	\$540.8	\$5,388.0	
Nova Scotia	959,500	\$2,224.7	\$878.2	\$884.8	\$362.8	\$121.1	\$137.1	\$621.0	\$893.2	\$155.5	\$1,048.6	\$143.9	\$154.4	\$261.9	\$123.9	\$573.0	\$696.9	\$6,914.3	
PEI	153,584	\$342.3	\$173.8	\$149.8	\$52.7	\$17.6	\$19.9	\$90.3	\$123.7	\$21.5	\$145.3	\$49.4	\$53.3	\$27.4	\$15.0	\$69.2	\$84.2	\$1,115.9	
Newfoundland	525,604	\$1,366.1	\$553.8	\$509.2	\$151.3	\$50.5	\$57.2	\$258.9	\$489.0	\$85.1	\$574.2	\$131.6	\$152.7	\$123.3	\$100.8	\$466.2	\$567.1	\$4,236.9	
					Estimated														

Data Sources: Expenditures in Canada - CIHI National Health Expenditure Trends 1975–2019, Data Tables - Series A  
Expenditures in the provinces - CIHI National Health Expenditure Trends 1975–2019, Data Tables - Series D1  
Population from Statistics Canada, Table: 17-10-0005-01 (formerly CANSIM 051-0001)

The NHEX provides province-specific data on expenditures for hospital care, other institutions, physician services, other professionals, drugs, capital expenditures, public health, administration, and other health spending. A greater level of detail is provided for Canada as a whole while some cost categories are combined for the individual provinces. In these instances, we estimated (based on the Canada-wide distribution) the proportion of ‘other professionals’ that is spent on dental services and vision care services, the proportion of ‘drugs’ that is spent on prescribed and non-prescribed drugs, and the proportion of ‘other health spending’ that is spent on health research (see Table 3). Costs for ‘other institutions’ (which tend to be costs for long-term care facilities), dental services and capital costs, were excluded from our analysis. Total included expenditures are \$202.2 billion for Canada in 2018, \$78.7 billion in Ontario and \$41.2 billion in Quebec (see Table 4).

<sup>26</sup> Anis AH, Zhang W, Bansback N et al. Obesity and overweight in Canada: an updated cost-of-illness study. *Obesity Reviews*. 2010; 11(1): 31-40.

<sup>27</sup> Canadian Institute for Health Information. *National Health Expenditure Trends, 1975 – 2019*. Data specific to the provinces is not available for the highlighted cells. These were estimated based on the proportion of specific costs in Canada.

<b>Table 4: Health Expenditure Included in the Model</b>								
2018 (\$' 000,000 )								
	<b>Population</b>	<b>Hospitals</b>	<b>Physicians</b>	<b>Other Health Professionals</b>	<b>Drugs</b>	<b>Health Research</b>	<b>Other</b>	<b>Total</b>
<b>Canada</b>	37,057,765	\$68,295	\$38,114	\$11,492	\$39,266	\$4,238	\$40,793	<b>\$202,198</b>
<b>Ontario</b>	14,318,545	\$25,280	\$14,686	\$4,371	\$16,405	\$1,598	\$16,310	<b>\$78,651</b>
<b>Quebec</b>	8,387,632	\$13,700	\$8,263	\$2,504	\$9,574	\$808	\$6,386	<b>\$41,233</b>

Expenditures within the hospital, physician, and drug cost categories were allocated to comorbidities and sex using the province-specific weights from the Economic Burden of Illness in Canada (EBIC) for 2010.<sup>28</sup> For example, EBIC estimated that \$47.7 million in total hospital expenditures in 2010 in Ontario were for cancers of the trachea, bronchus and lung (ICD-10 codes 33-34) in males. This is equal to 0.47% of Ontario’s total hospital expenditures utilized by males that were allocated by EBIC in 2010. We therefore assumed that 0.47% of Ontario’s hospital expenditures utilized by males in 2018 were also used for treating male cancers of the trachea, bronchus and lung.

However, EBIC 2010 only allocates hospital, physician, and drug costs. To allocate other health professional, health research, and “other” expenditures we first separated these into costs incurred by males / females based on the proportion of males / females in the province in 2018.

Costs for each sex were then allocated to each disease category according to the combined EBIC 2010 weight of hospital, physician, and drug expenditures. For example, the combined hospital, physician, and drug expenditures for treating cancers of the trachea, bronchus and lung in 2010 was \$68.2 million, or 0.34% of Ontario’s total hospital, physician, and drug expenditures that were allocated by EBIC in 2010. We thus assumed that 0.34% of expenditures for other health professionals, health research, and “other” were also attributable to male cancers of the trachea, bronchus and lung.

#### **Allocating Health Expenditures for Diseases Not Specified in EBIC 2010**

EBIC 2010 cost data was not sufficiently detailed for a small number of comorbidities that we know are associated with tobacco smoking. We were therefore unable to use the weights from EBIC 2010 to estimate the proportion of costs that were attributable to these comorbidities. Instead, we estimated the costs based on the sex-specific number of acute hospital days in Canada in 2011/12<sup>29</sup> in which each disease was the most responsible diagnosis. For each of these cases, we selected a broader disease category that contained the given comorbidity (i.e., the “source disease category” in Table 5). We calculated the number of acute hospital days for the given comorbidity as a proportion of the number of acute hospital days for the source disease category that it falls within. We then applied this proportion to the EBIC costs for the source disease category in order to estimate the costs for the given disease. This same proportion was used to calculate all hospital, physician, other health professional, drug, health research, and other costs.

<sup>28</sup> Public Health Agency of Canada. *The Economic Burden of Illness in Canada, 2010*. 2017. Available online at <https://www.canada.ca/en/public-health/services/publications/science-research-data/economic-burden-illness-canada-2010.html>. Accessed May 2020.

<sup>29</sup> These data are not publicly available. We purchased them from CIHI specifically for this modelling.

**Table 5: Allocation of Expenditures for Diseases not Specified by EBIC 2010**  
*From Most Responsible Diagnosis for CIHI 2011/2012 Acute Hospital Days*

	ICD-10 Codes	% of Source Cost		Source Disease Category
		Male	Female	
Type 2 diabetes	E11-14	86.0%	81.0%	Diabetes Mellitus
Pulmonary embolism	I26	2.2%	3.2%	Diseases of the Circulatory System
Venous thromboembolism	I80-82	0.83%	1.29%	Diseases of the Circulatory System
Aortic aneurysm	I71	3.2%	1.3%	Diseases of the Circulatory System
Intestinal Ischemia	K55	2.2%	3.9%	Diseases of the Digestive System

For example, EBIC 2010 states that \$120 million in Ontario hospital costs were attributable to male diabetes mellitus (ICD-10 codes E10-14), but does not provide hospital costs for only Type 2 diabetes (ICD-10 codes E11-14). However, we know that in 2011/12, 86% of all hospital days for male diabetes mellitus (the source disease category) were, in fact, treating Type 2 diabetes. We therefore also assume that 86% of all costs for male diabetes mellitus were for Type 2 diabetes specifically.

See Appendix B for the total estimated health expenditures in 2018 dollars for all necessary diseases by sex and province.

### Calculation of Indirect Costs

In this model, indirect costs include costs attributable to premature mortality as well as long- and short-term disability.

The most common method in valuing indirect costs associated with premature mortality is the human-capital approach. In this approach, gender- and age-specific average earnings are combined with productivity trends and years-of-life lost due to a specific disease/condition to estimate unrealized lifetime earnings. An important criticism of this method is that it places a higher value on the years of life lost for someone with higher earning potential (e.g., males aged 35-55) than someone with lower earning potential (e.g., females aged 75+).<sup>30</sup> In particular, unpaid work and leisure time are not explicitly accounted for in the human-capital approach.<sup>31,32</sup> Another concern raised is that this approach values potential rather than actual productivity losses. For instance, it does not account for the fact that long-term absentees from the work force (whether due to death or long-term disability) are eventually replaced; from a societal perspective, this means that productivity is restored rather than permanently lost.

Some of the concerns associated with the human-capital model are addressed in the willingness-to-pay approach.<sup>33</sup> It involves valuing years of life lost by estimating the average amount that an individual is willing to pay to gain an additional year of life, regardless of earning potential. Yabroff, for example, implements this approach by applying a value of \$150,000 (USD) to each year of life lost, regardless of the gender or earning potential of the

<sup>30</sup> Yabroff KR, Bradley CJ, Mariotto AB et al. Estimates and projections of value of life lost from cancer deaths in the United States. *Journal of the National Cancer Institute*. 2008; 100(24): 1755-62.

<sup>31</sup> Tranmer JE, Guerriere DN, Ungar WJ et al. Valuing patient and caregiver time: a review of the literature. *Pharmacoeconomics*. 2005; 23(5): 449-59.

<sup>32</sup> Morris S, Cox B and Bosanquet N. Cost of skin cancer in England. *European Journal of Health Economics*. 2008: Epublished ahead of print.

<sup>33</sup> Koopmanschap MA, Rutten FF, van Ineveld BM et al. The friction cost method for measuring indirect costs of disease. *Journal of Health Economics*. 1995; 14(2): 171-89.

individual that died.<sup>34</sup> A key challenge of this approach involves determining how precisely to estimate the pertinent value.<sup>35</sup>

There is a final concern associated with the human-capital approach related to accounting for the reality of unproductive workers being replaced. This is addressed by the friction-cost method,<sup>36</sup> an approach that “advocates measuring actual production losses to society during the friction period between the start of an absence from work (resulting from short-term absence, long-term absence, disability and mortality) and the time at which original productivity levels are restored.”<sup>37</sup> The focus of this method is on lost production from the “perspective of firms, consumers and society, without accounting for the potential income lost on an individual basis.”<sup>38</sup>

A major challenge associated with the various models of indirect costing is that they each generate very different results when applied to the same population. Applying the willingness-to-pay approach in the U.S. context, Yabroff found that the estimated economic costs of premature mortality due to cancer were eight times higher than those based on the human-capital approach.<sup>39</sup> The largest differences, of course, were in the population age 65+ years. This is because, in contrast with the willingness-to-pay method, the human-capital approach does not value the ‘non-productive’ time related to this age group. On the other hand, our own research indicates that the friction-cost method tends to generate indirect costs that are just a fraction (6%) of the amount generated by the (modified) human-capital approach.<sup>40,41</sup> This wide variation, together with the fact that calculated indirect costs often dominate total direct costs, has generated substantial controversy among health economists and policy planners.

The *Economic Burden of Illness in Canada, 1998* (hereafter *EBIC, 1998*) report used a modified human-capital approach that attempted to address some of the issues involved with valuing non-productive time.<sup>42</sup> The details are elucidated in the following sections related to societal losses associated with mortality and morbidity.

In 2014, the Public Health Agency released the updated *Economic Burden of Illness in Canada, 2005-2008* in which they migrated to using the friction-cost method. As noted above, the focus of the friction-cost method is on lost production from the “perspective of firms, consumers and

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<sup>34</sup> Yabroff KR, Bradley CJ, Mariotto AB et al. Estimates and projections of value of life lost from cancer deaths in the United States. *Journal of the National Cancer Institute*. 2008; 100(24): 1755-62.

<sup>35</sup> Hirth RA, Chernew ME, Miller E et al. Willingness to pay for a quality-adjusted life year: in search of a standard. *Medical Decision Making*. 2000; 20(3): 332-42.

<sup>36</sup> Brouwer WB and Koopmanschap MA. The friction-cost method : replacement for nothing and leisure for free? *Pharmacoeconomics*. 2005; 23(2): 105-11.

<sup>37</sup> Birnbaum H. Friction-cost method as an alternative to the human-capital approach in calculating indirect costs. *Pharmacoeconomics*. 2005; 23(2): 103-4.

<sup>38</sup> Tranmer JE, Guerriere DN, Ungar WJ et al. Valuing patient and caregiver time: a review of the literature. *Pharmacoeconomics*. 2005; 23(5): 449-59.

<sup>39</sup> Yabroff KR, Bradley CJ, Mariotto AB et al. Estimates and projections of value of life lost from cancer deaths in the United States. *Journal of the National Cancer Institute*. 2008; 100(24): 1755-62.

<sup>40</sup> Krueger H, Krueger J, Koot J. Variation across Canada in the economic burden attributable to excess weight, tobacco smoking and physical inactivity. *Canadian Journal of Public Health*. 2015; 106(4): e171-7.

<sup>41</sup> Krueger H, Koot J, Rasali D et al. regional variations in the economic burden attributable to excess weight, physical inactivity and tobacco smoking across British Columbia. *Health Promotion and Chronic Disease in Canada*. 2016; 36(4): 76-86.

<sup>42</sup> Health Canada. *The Economic Burden of Illness in Canada, 1998*. 2002. Available at <http://publications.gc.ca/collections/Collection/H21-136-1998E.pdf>. Accessed July 2020.



society, without accounting for the potential income lost on an individual basis,”<sup>43</sup> nor does it value potential time lost due to morbidity or mortality. That is, while smoking may reduce a person’s life by an average of 11–12 years,<sup>44</sup> the friction cost method only applies a value on the time period that it takes to replace this individual in the workforce. Placing an economic value on time lost due to disability and premature mortality (as in the modified human capital approach) allows us to compare the broader effect of the risk factors on society as a whole, rather than from a narrow focus on production losses.

## EBIC, 1998: The Modified Human-Capital Approach

### **Mortality**

*EBIC, 1998* modified the standard human-capital approach by establishing a value not only for individuals in the paid workforce, but also for those doing unpaid work (e.g., volunteers) and those who are not in the formal workforce (e.g., retirees). The discounted present value of lost production was calculated by 5-year age group and sex. A discount rate of 5% was used with sensitivity analysis ranging from 0% to 7%. Death counts and expected years-of-life lost were calculated by diagnostic category, sex, 5-year age-group and province/ territory. The method accounts for “age- and sex-specific rates of life expectancy, average annual earnings, workforce participation rates, values of unpaid work, as well as labour productivity growth and the discounting of future production.”<sup>45</sup>

### **Morbidity**

#### *Long-Term Disability*

*EBIC, 1998* calculated the value of production lost due to long-term disability (>6 months) for both household and institutionalized populations. Weights for different levels of disability were assigned based on the severity of the disability. For example, a long-term disability that was reported as being somewhat severe in household populations was assigned a value of 0.5 (on a scale from 0.0 to 1.0). The adjusted estimates of long-term disability were then multiplied by age- and sex-specific average values of paid and unpaid labour.

#### *Short-Term Disability*

*EBIC, 1998* calculated the value of production lost due to short-term disability (<6 months) for household populations based on information from the 1996/97 National Population Health Survey. A “day spent in bed” was assigned a weight of 0.8, whereas a day in which the respondent had to “cut down on things” was assigned a weight of 0.5. Lost productivity due to short-term disability was then calculated by diagnostic category, province/territory, age, sex and values for both paid and unpaid work applied.

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<sup>43</sup> Tranmer JE, Guerriere DN, Ungar WJ et al. Valuing patient and caregiver time: a review of the literature. *Pharmacoeconomics*. 2005; 23(5): 449-59.

<sup>44</sup> Jha P, Ramasundarahettige C, Landsman V, et al. 21st-century hazards of smoking and benefits of cessation in the United States. *New England Journal of Medicine*. 2013; 368(4):341-50.

<sup>45</sup> Health Canada. *The Economic Burden of Illness in Canada, 1998*. 2002. Available at <http://publications.gc.ca/collections/Collection/H21-136-1998E.pdf>. Accessed July 2020.

## Application of *EBIC, 1998* for Estimating Indirect Costs

The diseases of interest in the current project fall within broader diagnostic categories within *EBIC, 1998*. Both the direct and indirect costs for these categories, as calculated in *EBIC, 1998*, are outlined in Table 6.

Diagnostic Category	Direct Costs					Indirect Costs				Total Costs (Direct + Indirect)
	Hospitals	Drugs	Physicians		Total Direct Costs	Mortality	Long-term Disability	Short-term Disability	Total Indirect Cost	
			Care	Additional						
Neoplasms	\$1,838.7	\$210.2	\$333.1	\$80.4	\$2,462.4	\$10,622.1	\$962.3	\$173.6	\$11,758.0	\$14,220.4
Endocrine, nutritional and metabolic diseases	\$477.0	\$818.2	\$255.6	\$33.8	\$1,584.6	\$1,012.3	\$815.7	\$51.7	\$1,879.7	\$3,464.3
Diseases of the circulatory system	\$4,161.8	\$1,772.8	\$822.3	\$61.2	\$6,818.1	\$8,250.0	\$3,151.5	\$253.3	\$11,654.8	\$18,472.9
Diseases of the respiratory system	\$1,560.6	\$1,109.7	\$776.7	\$14.4	\$3,461.4	\$1,646.8	\$985.1	\$2,437.8	\$5,069.7	\$8,531.1
Diseases of the digestive system	\$2,366.3	\$752.2	\$410.0	\$11.5	\$3,540.0	\$1,134.3	\$487.5	\$692.4	\$2,314.2	\$5,854.2

Source: Public Health Agency of Canada, *Economic Burden of Illness in Canada, 1998, 2002*.

This information was used to determine a ratio between indirect and direct costs for each of the diagnostic categories and the type of indirect cost (see Table 7). For example, the indirect costs associated with cancer are 4.8 times higher than the direct costs (478%), largely due to the premature mortality associated with this often deadly category of disease. On the other hand, indirect costs associated with diseases of the respiratory system are 1.5 times higher than direct costs (146%), but in this instance the majority of indirect costs are associated with short-term disability, rather than premature death.

Diagnostic Category	Indirect Costs			
	Mortality	Long-term Disability	Short-term Disability	Total Indirect
Neoplasms	431%	39%	7%	478%
Endocrine, nutritional and metabolic diseases	64%	51%	3%	119%
Diseases of the circulatory system	121%	46%	4%	171%
Diseases of the respiratory system	48%	28%	70%	146%
Diseases of the digestive system	32%	14%	20%	65%

The calculated ratios were then applied to the attributable direct costs by diagnostic category to estimate the indirect costs related to tobacco smoking. When estimating indirect costs associated with specific diseases, we assumed that the calculated ratios for a given diagnostic category would apply for all diseases within that category.

## The Economic Burden Attributable to Tobacco Smoking

At this point, the total estimated direct (health care expenditures) and indirect (premature mortality, short and long-term disability) costs for all necessary diseases have been generated in 2018 dollars by sex for both Quebec and Ontario. In order to determine the proportion of these health expenditures that are attributable to tobacco smoking, all disease expenditures were multiplied by the relevant PAF.

By multiplying the sex- and disease-specific PAF (see Table 2) with the estimated direct and indirect costs associated with that disease in each province in 2018, we generated the following results.

### Quebec

An estimated 1.3 million individuals in Quebec smoked cigarettes in 2018, or 17.5% of the population aged 12 and older (see Table 8).

The total economic burden attributable to tobacco smoking in Quebec in 2018 is estimated at \$3.79 billion. Of this \$3.79 billion, \$1.20 billion (32%) is for direct costs and \$2.59 billion (68%) is for indirect costs.

The economic burden attributable to tobacco smoking in 2018 *per individual smoker* is \$2,967. Of this amount, \$939 is for direct costs and \$2,028 is for indirect costs. As expected, the annual economic burden per smoker increases with smoking intensity, increasing from \$1,801 for a light smoker to \$4,878 for a heavy smoker. The annual economic burden is higher for males (\$3,477) than females (\$2,318), at least partially due to a higher proportion of heavy smokers in the male population (5.1% vs 2.6%).

Of the annual direct costs attributable to tobacco smoking *per individual smoker*, \$497 (53%) is for hospital costs, \$89 (10%) for physician costs, \$133 (14%) for drug costs and \$220 (23%) for 'other' costs.

Of the annual indirect costs attributable to tobacco smoking *per individual smoker*, \$1,453 (72%) is attributable to premature mortality, \$368 (18%) to long-term disability and \$207 (10%) to short-term disability costs.

**Table 8: Tobacco Smoking in Quebec**  
**Estimated Prevalence and Economic Burden**  
 2018 by Sex, Smoking Intensity and Cost Category

	% Population Age 12+ with RF	# Individuals with RF	Cost / Individual with RF (\$)										Total Cost (\$million)					Total Economic Burden				
			Hospital	Physician	Drug	'Other'	Direct Cost	Premature Mortality	LTD	STD	Indirect Cost	Total	Hospital	Physician	Drug	'Other'	Direct Cost		Premature Mortality	LTD	STD	Indirect Cost
<b>Males</b>																						
<b>Smokers</b>																						
Light	9.61%	349,224	\$385	\$64	\$72	\$142	\$663	\$1,081	\$260	\$135	\$1,476	\$2,139	\$135	\$22	\$25	\$49	\$232	\$378	\$91	\$47	\$515	\$747
Moderate	5.01%	182,033	\$707	\$136	\$245	\$295	\$1,383	\$2,155	\$566	\$251	\$2,972	\$4,356	\$129	\$25	\$45	\$54	\$252	\$392	\$103	\$46	\$541	\$793
Heavy	5.08%	184,513	\$844	\$159	\$275	\$347	\$1,624	\$2,550	\$658	\$311	\$3,519	\$5,143	\$156	\$29	\$51	\$64	\$300	\$471	\$121	\$57	\$649	\$949
<b>Subtotal - Male</b>	<b>19.70%</b>	<b>715,770</b>	<b>\$585</b>	<b>\$107</b>	<b>\$168</b>	<b>\$234</b>	<b>\$1,094</b>	<b>\$1,733</b>	<b>\$440</b>	<b>\$210</b>	<b>\$2,383</b>	<b>\$3,477</b>	<b>\$419</b>	<b>\$77</b>	<b>\$120</b>	<b>\$167</b>	<b>\$783</b>	<b>\$1,240</b>	<b>\$315</b>	<b>\$150</b>	<b>\$1,706</b>	<b>\$2,489</b>
<b>Females</b>																						
<b>Smokers</b>																						
Light	8.05%	296,158	\$252	\$37	\$34	\$121	\$443	\$670	\$158	\$131	\$959	\$1,403	\$75	\$11	\$10	\$36	\$131	\$198	\$47	\$39	\$284	\$415
Moderate	4.63%	170,298	\$436	\$86	\$126	\$242	\$891	\$1,298	\$341	\$226	\$1,865	\$2,755	\$74	\$15	\$22	\$41	\$152	\$221	\$58	\$38	\$318	\$469
Heavy	2.62%	96,196	\$706	\$126	\$184	\$380	\$1,396	\$2,053	\$522	\$391	\$2,966	\$4,362	\$68	\$12	\$18	\$37	\$134	\$197	\$50	\$38	\$285	\$420
<b>Subtotal - Female</b>	<b>15.30%</b>	<b>562,652</b>	<b>\$385</b>	<b>\$67</b>	<b>\$88</b>	<b>\$202</b>	<b>\$742</b>	<b>\$1,097</b>	<b>\$276</b>	<b>\$204</b>	<b>\$1,576</b>	<b>\$2,318</b>	<b>\$217</b>	<b>\$38</b>	<b>\$49</b>	<b>\$114</b>	<b>\$417</b>	<b>\$617</b>	<b>\$155</b>	<b>\$115</b>	<b>\$887</b>	<b>\$1,304</b>
<b>Both Sexes</b>																						
<b>Smokers</b>																						
Light	8.83%	645,382	\$324	\$52	\$55	\$132	\$562	\$893	\$213	\$133	\$1,239	\$1,801	\$209	\$33	\$35	\$85	\$363	\$576	\$138	\$86	\$800	\$1,162
Moderate	4.82%	352,331	\$576	\$112	\$188	\$270	\$1,145	\$1,741	\$457	\$239	\$2,437	\$3,582	\$203	\$39	\$66	\$95	\$403	\$613	\$161	\$84	\$859	\$1,262
Heavy	3.84%	280,709	\$796	\$148	\$244	\$358	\$1,546	\$2,380	\$611	\$338	\$3,329	\$4,875	\$224	\$42	\$68	\$101	\$434	\$668	\$172	\$95	\$935	\$1,369
<b>Total Smokers</b>	<b>17.49%</b>	<b>1,278,421</b>	<b>\$497</b>	<b>\$89</b>	<b>\$133</b>	<b>\$220</b>	<b>\$939</b>	<b>\$1,453</b>	<b>\$368</b>	<b>\$207</b>	<b>\$2,028</b>	<b>\$2,967</b>	<b>\$635</b>	<b>\$114</b>	<b>\$170</b>	<b>\$281</b>	<b>\$1,200</b>	<b>\$1,857</b>	<b>\$470</b>	<b>\$265</b>	<b>\$2,593</b>	<b>\$3,793</b>

RF = Risk Factor; LTD = Long-term Disability; STD = Short-term Disability

## Ontario

An estimated 1.9 million individuals in Ontario smoked cigarettes in 2018, or 15.2% of the population aged 12 and older (see Table 9).

The total economic burden attributable to tobacco smoking in Ontario in 2018 is estimated at \$5.36 billion. Of this \$5.36 billion, \$1.79 billion (33%) is for direct costs and \$3.57 billion (67%) is for indirect costs.

The economic burden attributable to tobacco smoking in 2018 *per individual smoker* is \$2,810. Of this amount, \$937 is for direct costs and \$1,872 is for indirect costs. As expected, the annual economic burden per smoker increases with smoking intensity, increasing from \$1,706 for a light smoker to \$4,545 for a heavy smoker. The annual economic burden is higher for males (\$3,198) than females (\$2,213), at least partially due to a higher proportion of heavy smokers in the male population (4.6% vs 2.1%).

Of the annual direct costs attributable to tobacco smoking *per individual smoker*, \$475 (51%) is for hospital costs, \$101 (11%) for physician costs, \$106 (11%) for drug costs and \$256 (27%) for 'other' costs.

Of the annual indirect costs attributable to tobacco smoking *per individual smoker*, \$1,294 (69%) is attributable to premature mortality, \$368 (20%) to long-term disability and \$210 (11%) to short-term disability costs.

**Table 9: Tobacco Smoking in Ontario  
Estimated Prevalence and Economic Burden  
2018 by Sex, Smoking Intensity and Cost Category**

	% Population Age 12+ with RF	# Individuals with RF	Cost / Individual with RF (\$)										Total Cost (\$million)									
			Hospital	Physician	Drug	'Other'	Direct Cost	Premature Mortality	LTD	STD	Indirect Cost	Total Economic Burden	Hospital	Physician	Drug	'Other'	Direct Cost	Premature Mortality	LTD	STD	Indirect Cost	Total Economic Burden
<b>Males</b>																						
<i>Smokers</i>																						
Light	9.08%	558,229	\$370	\$70	\$43	\$159	\$642	\$933	\$250	\$139	\$1,323	\$1,965	\$207	\$39	\$24	\$89	\$358	\$521	\$140	\$78	\$738	\$1,097
Moderate	5.14%	316,152	\$659	\$146	\$194	\$330	\$1,329	\$1,831	\$545	\$248	\$2,624	\$3,953	\$208	\$46	\$61	\$104	\$420	\$579	\$172	\$78	\$830	\$1,250
Heavy	4.58%	281,649	\$811	\$174	\$219	\$397	\$1,601	\$2,222	\$648	\$324	\$3,193	\$4,794	\$228	\$49	\$62	\$112	\$451	\$626	\$182	\$91	\$899	\$1,350
<b>Subtotal - Male</b>	<b>18.80%</b>	<b>1,156,030</b>	<b>\$557</b>	<b>\$116</b>	<b>\$127</b>	<b>\$264</b>	<b>\$1,064</b>	<b>\$1,493</b>	<b>\$428</b>	<b>\$214</b>	<b>\$2,134</b>	<b>\$3,198</b>	<b>\$643</b>	<b>\$134</b>	<b>\$147</b>	<b>\$305</b>	<b>\$1,230</b>	<b>\$1,726</b>	<b>\$494</b>	<b>\$247</b>	<b>\$2,467</b>	<b>\$3,697</b>
<b>Females</b>																						
<i>Smokers</i>																						
Light	5.98%	381,259	\$230	\$42	\$23	\$144	\$439	\$599	\$156	\$133	\$888	\$1,327	\$88	\$16	\$9	\$55	\$168	\$228	\$59	\$51	\$339	\$506
Moderate	3.68%	234,227	\$388	\$96	\$109	\$289	\$881	\$1,157	\$340	\$220	\$1,717	\$2,598	\$91	\$22	\$25	\$68	\$206	\$271	\$80	\$52	\$402	\$609
Heavy	2.14%	136,268	\$616	\$141	\$156	\$445	\$1,358	\$1,782	\$511	\$378	\$2,670	\$4,028	\$84	\$19	\$21	\$61	\$185	\$243	\$70	\$51	\$364	\$549
<b>Subtotal - Female</b>	<b>11.80%</b>	<b>751,755</b>	<b>\$349</b>	<b>\$77</b>	<b>\$74</b>	<b>\$244</b>	<b>\$744</b>	<b>\$987</b>	<b>\$278</b>	<b>\$204</b>	<b>\$1,469</b>	<b>\$2,213</b>	<b>\$262</b>	<b>\$58</b>	<b>\$56</b>	<b>\$183</b>	<b>\$559</b>	<b>\$742</b>	<b>\$209</b>	<b>\$154</b>	<b>\$1,105</b>	<b>\$1,664</b>
<b>Both Sexes</b>																						
<i>Smokers</i>																						
Light	7.50%	939,488	\$313	\$59	\$35	\$153	\$560	\$798	\$212	\$137	\$1,146	\$1,706	\$294	\$55	\$33	\$144	\$526	\$750	\$199	\$128	\$1,077	\$1,603
Moderate	4.40%	550,380	\$544	\$125	\$158	\$312	\$1,138	\$1,544	\$458	\$236	\$2,238	\$3,376	\$299	\$69	\$87	\$172	\$627	\$850	\$252	\$130	\$1,232	\$1,858
Heavy	3.34%	417,918	\$747	\$163	\$198	\$413	\$1,522	\$2,078	\$603	\$341	\$3,023	\$4,545	\$312	\$68	\$83	\$173	\$636	\$869	\$252	\$143	\$1,263	\$1,899
<b>Total Smokers</b>	<b>15.24%</b>	<b>1,907,785</b>	<b>\$475</b>	<b>\$101</b>	<b>\$106</b>	<b>\$256</b>	<b>\$937</b>	<b>\$1,294</b>	<b>\$368</b>	<b>\$210</b>	<b>\$1,872</b>	<b>\$2,810</b>	<b>\$906</b>	<b>\$192</b>	<b>\$202</b>	<b>\$488</b>	<b>\$1,789</b>	<b>\$2,468</b>	<b>\$703</b>	<b>\$401</b>	<b>\$3,572</b>	<b>\$5,361</b>

RF = Risk Factor; LTD = Long-term Disability; STD = Short-term Disability

## Cost Avoidance Associated with a Reduction in Tobacco Smoking Prevalence

In addition to understanding the current health care costs associated with tobacco smoking, it is important to understand how these costs can be expected to change in the future for purposes of long-term planning and prioritization. Specifically, how would a reduction in prevalence impact future healthcare costs?

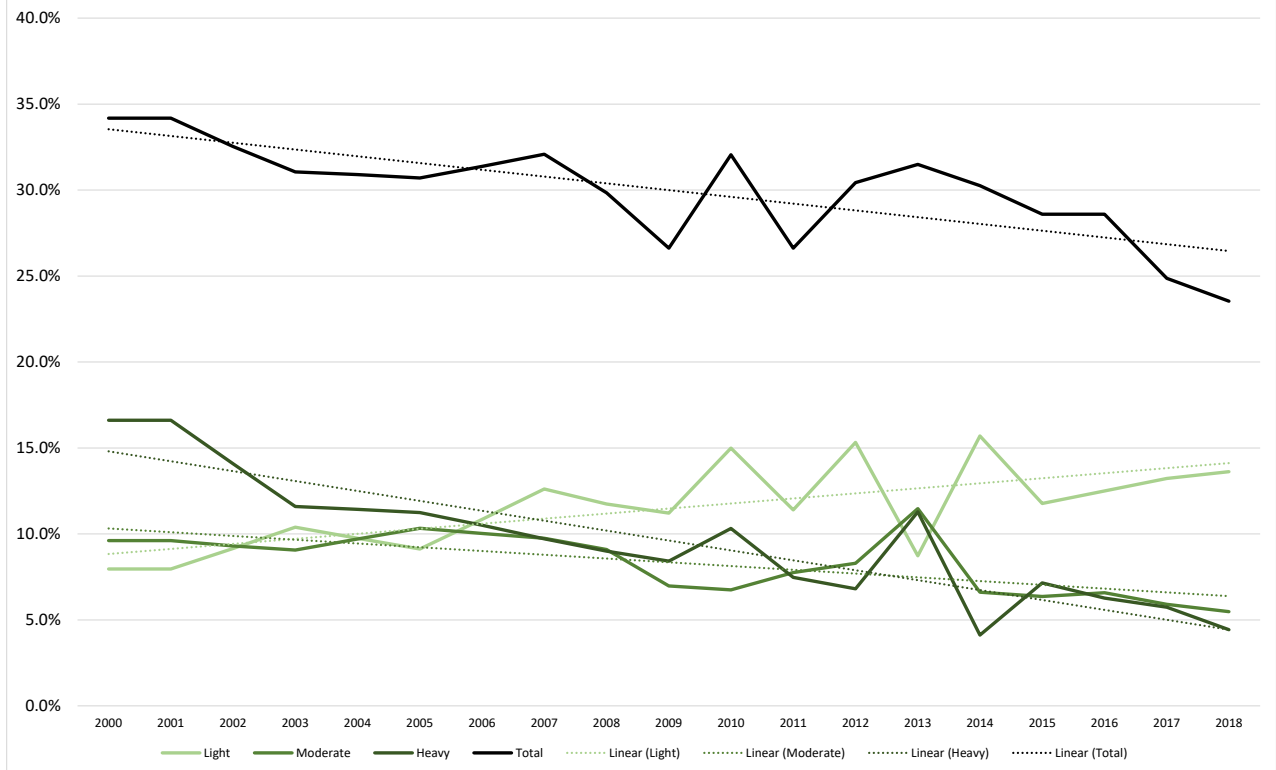
In the section to follow, we describe the methodology used to estimate the reduction in healthcare costs that would be realized through 2035 if sex- and age-specific tobacco-smoking rates were to decline such that a total of 5% of the population in each province continued to smoke tobacco.

### Prevalence of Tobacco Smoking – 2019 to 2035

The 2017/18 cycle of the CCHS is the most recent cycle for which PUMF data was available. To estimate the prevalence in 2019 and beyond, the linear prevalence trend for each sex, age group and smoking intensity was calculated using data from 2000 through 2018. The linear prevalence trend is a straight line that best fits the known annual data and can be used to project prevalence rates in the future, if current trends continue. The projected prevalence by sex, age group and smoking type is multiplied by the projected population of each age group to estimate the overall prevalence of smoking in the population each year.

Figure 7 illustrates this process, using Quebec males between 30 – 39 years old. For each level of smoking intensity, the prevalence is captured on the chart for 2000 – 2018. A series of linear trend lines (shown as dotted lines in the chart) is then generated from this information. The chart shows that while moderate and heavy smoking prevalence has been declining, leading to a decline in overall prevalence for this age group, the prevalence of light smoking has increased, suggesting a shift in categories from heavier to lighter smoking intensity. We assumed that each year after 2018 would have a prevalence on the trend line. This process was repeated for each combination of sex, age group, province and smoking intensity to arrive at projected prevalence rates for 2019 to 2035 by province.

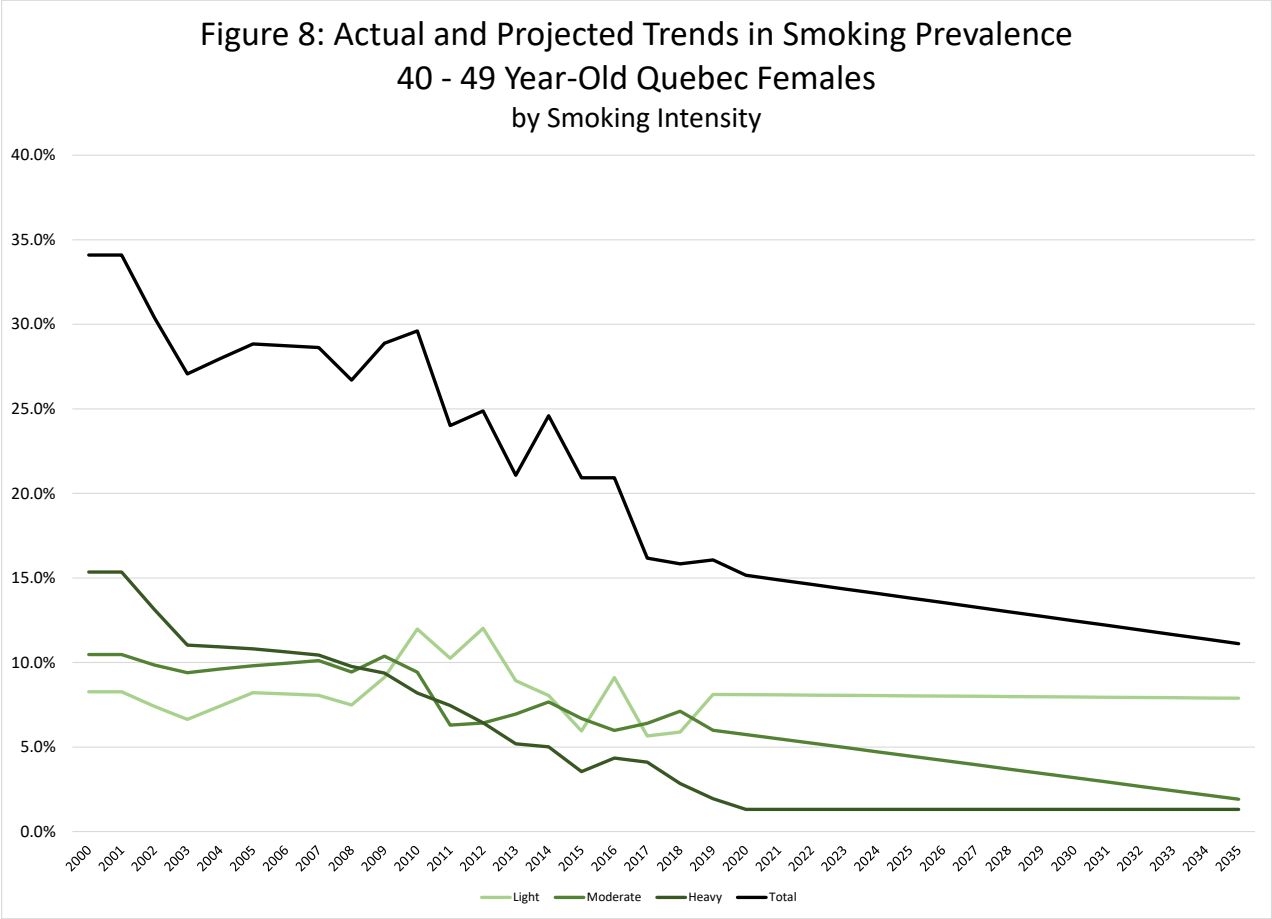
Figure 7: Smoking Prevalence in 30 - 39 Year-Old  
Quebec Males  
By Smoking Intensity



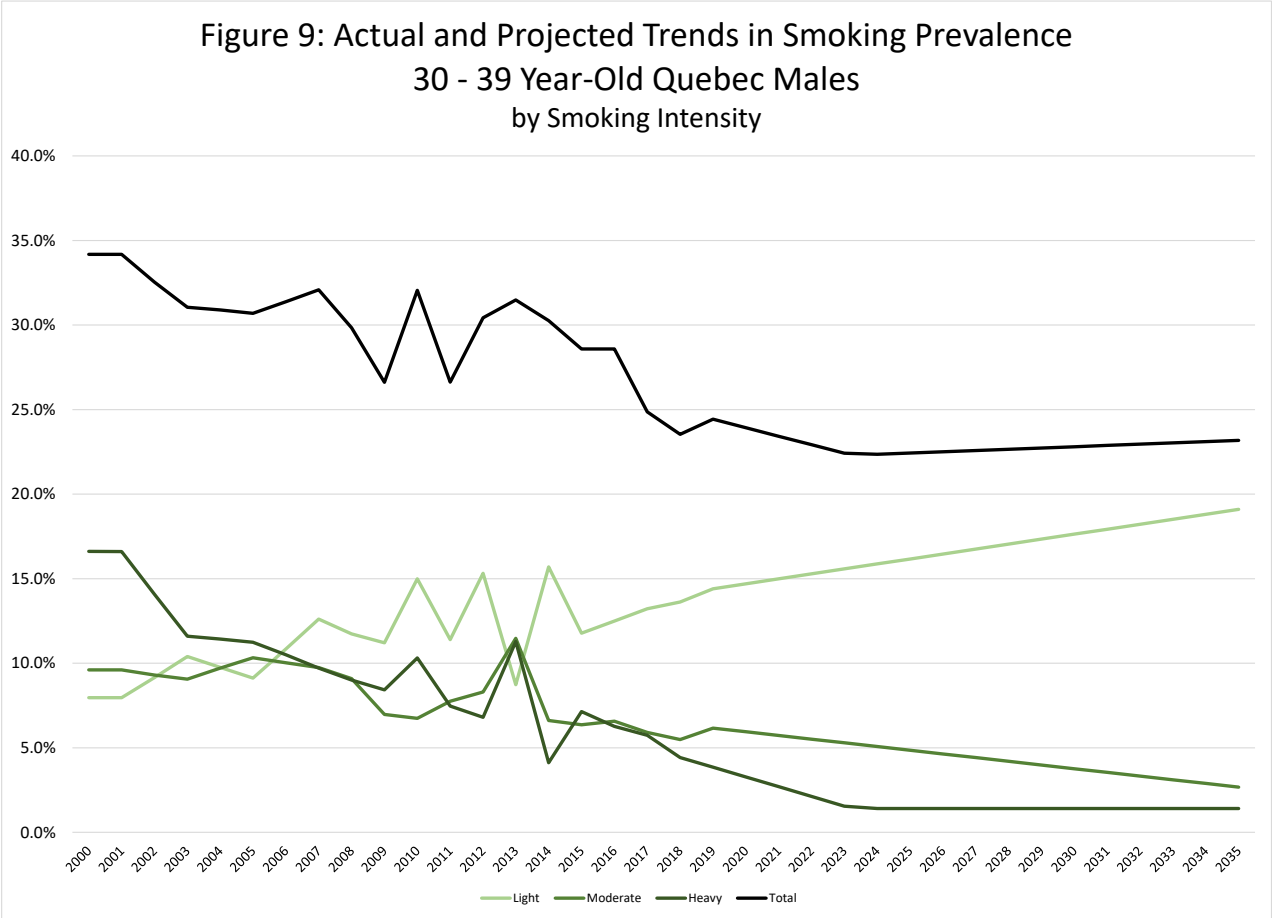
Initially, the current sex, age group and smoking intensity specific trend lines calculated from the 2000 – 2018 data were used to project prevalence from 2019 through 2035 for each province. Our projections, however, set a lower limit for each sex, age group, smoking intensity and province combination, such that the projected prevalence could not go negative or become zero, regardless of what the trendline projects. This lower limit was calculated as one-tenth (10%) of the average of the prevalence in the five years from 2000 to 2004. Two examples are provided below to illustrate the effects of this assumption.



In Figure 8, based on trends for 40-49 year old Quebec **females**, we see the light smoking rate remain relatively stable in the future while the moderate smoking rate continues to decline. The heavy smoking rate, however, quickly reaches the ‘10% limit’ of 1.3% (one-tenth of the 2000 – 2004 average of 13%) and is stabilized at 1.3%. The overall trend for this cohort continues to decline from 15.8% in 2018 to 11.1% in 2035, largely due to the decline in smokers in the moderate intensity smoking category.



In Figure 9, based on trends for 30-39 year old Quebec **males**, we see the light smoking rate increase in the future while the moderate smoking rate declines modestly. The heavy smoking rate, however, once again reaches the ‘10% limit’ of 1.4% (one-tenth of the 2000 – 2004 average of 14%) and is stabilized at 1.4% starting in 2024. The overall trend for this cohort thus initially declines, but then sees a modest upward trend through 2035, largely due to the application of the ‘10% limit’ together with the ongoing increase in the prevalence of light smokers.

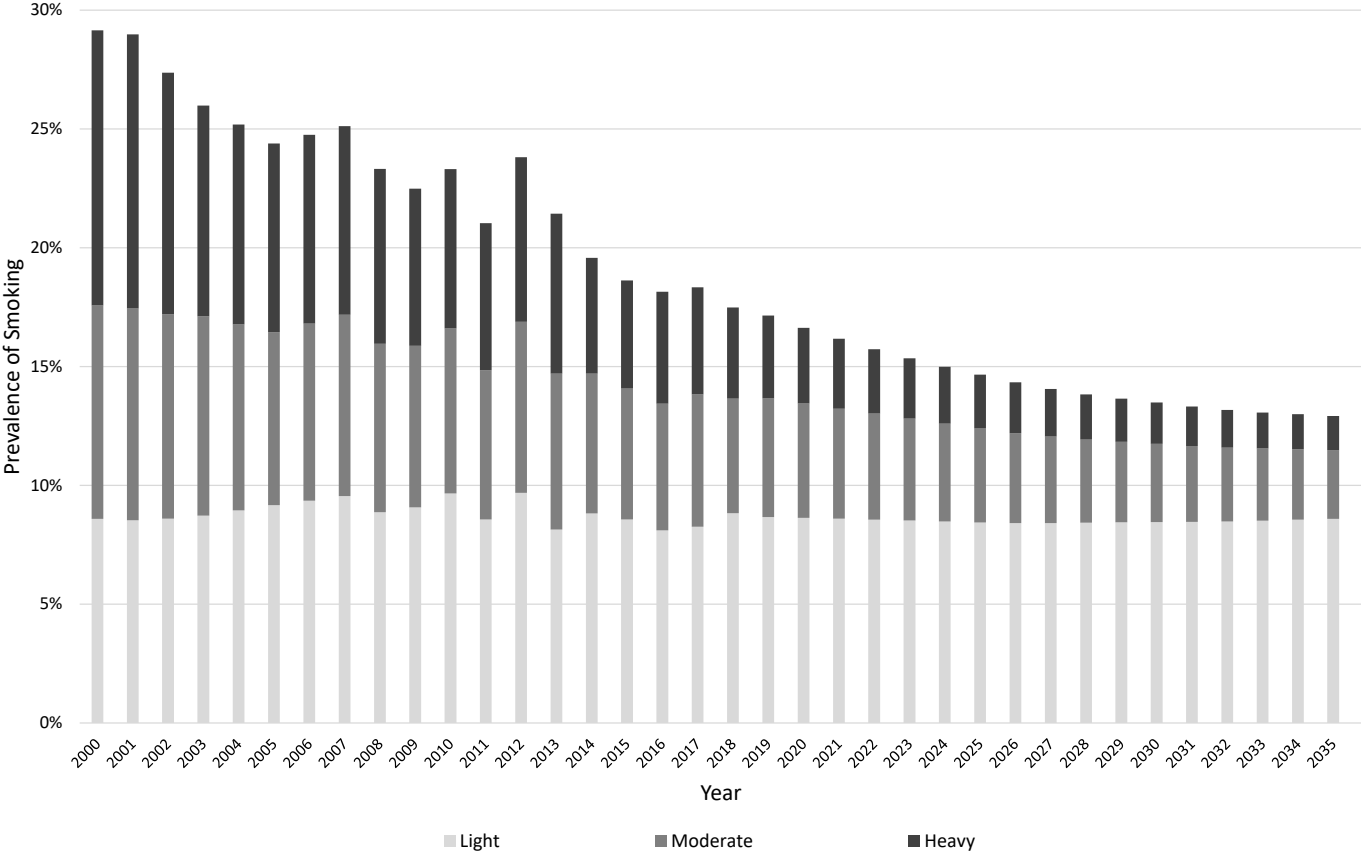


Projected Prevalence Based on Current Trends

**Quebec**

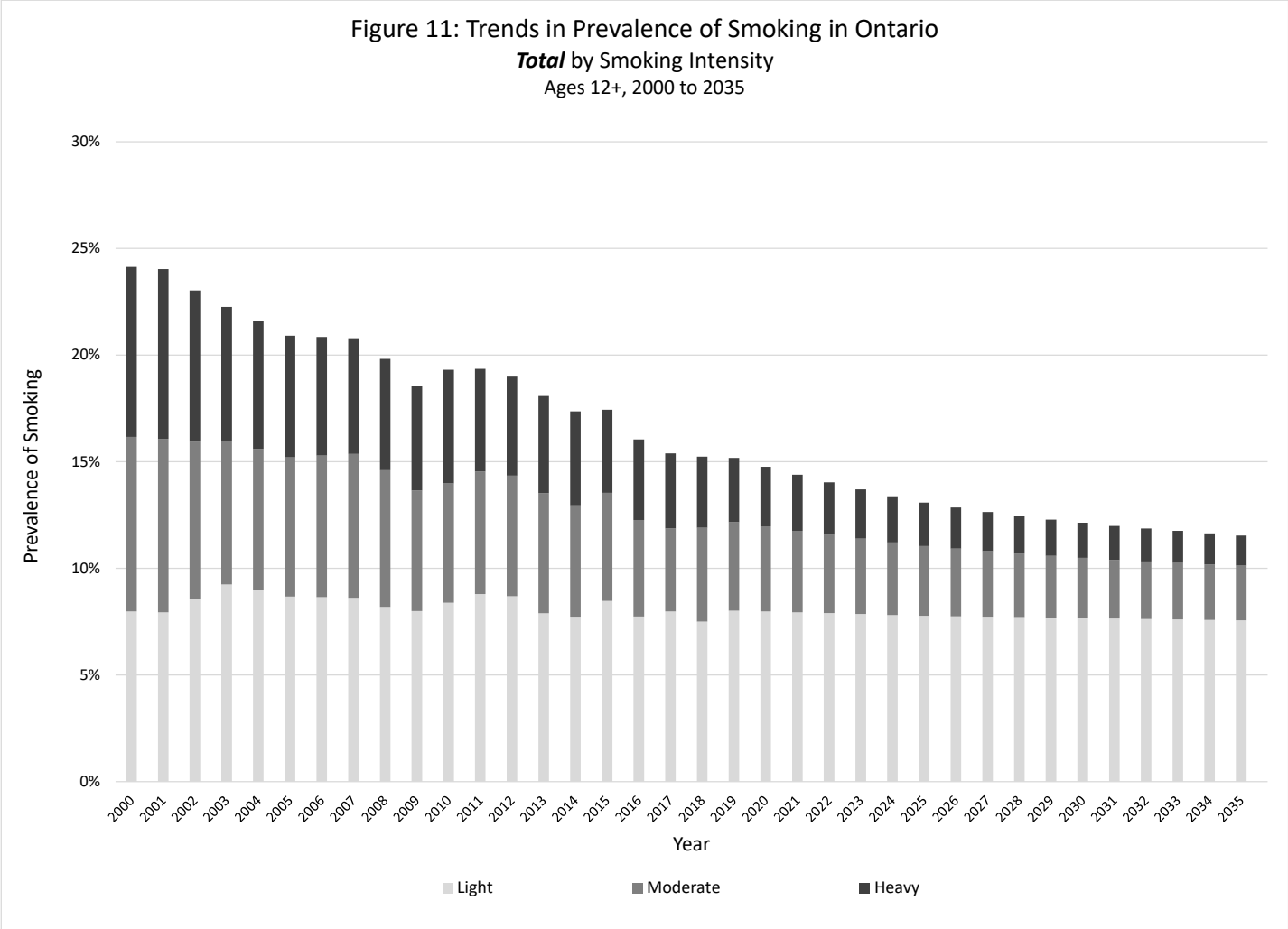
Based on this approach, we calculated that the overall prevalence of tobacco smoking would decrease from 17.5 % in 2018 to 12.9% in 2035 in Quebec (see Figure 10).

Figure 10: Trends in Prevalence of Smoking in Quebec  
**Total** by Smoking Intensity  
 Ages 12+, 2000 to 2035



**Ontario**

For Ontario, we calculated that the overall prevalence of tobacco smoking would decrease from 15.2% in 2018 to 11.5% in 2035 (see Figure 11).

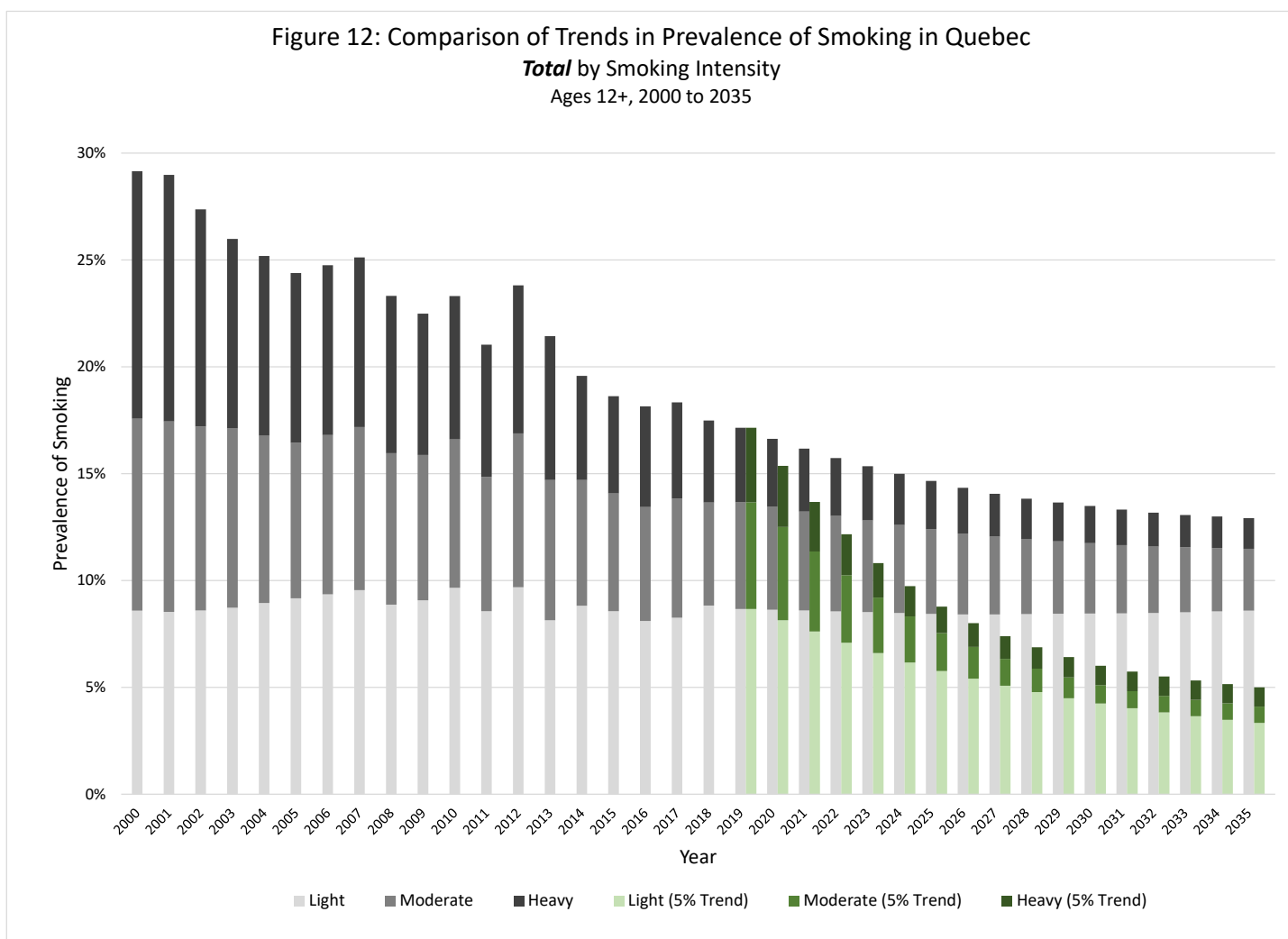


## Prevalence of Tobacco Smoking – 2019 to 2035 (5% Scenario)

To generate a 5% prevalence in 2035, the trend lines generated to estimate current trends from 2000 - 2018 data by sex, age group, smoking intensity and province were adjusted simultaneously until the smoking prevalence in 2035 equalled 5% for the overall population. That is, the slope of each trend line was adjusted by the same amount, until the end result was a 5% prevalence in 2035. The '10% limit' detailed above remained in force in the 5% scenario.

### Quebec

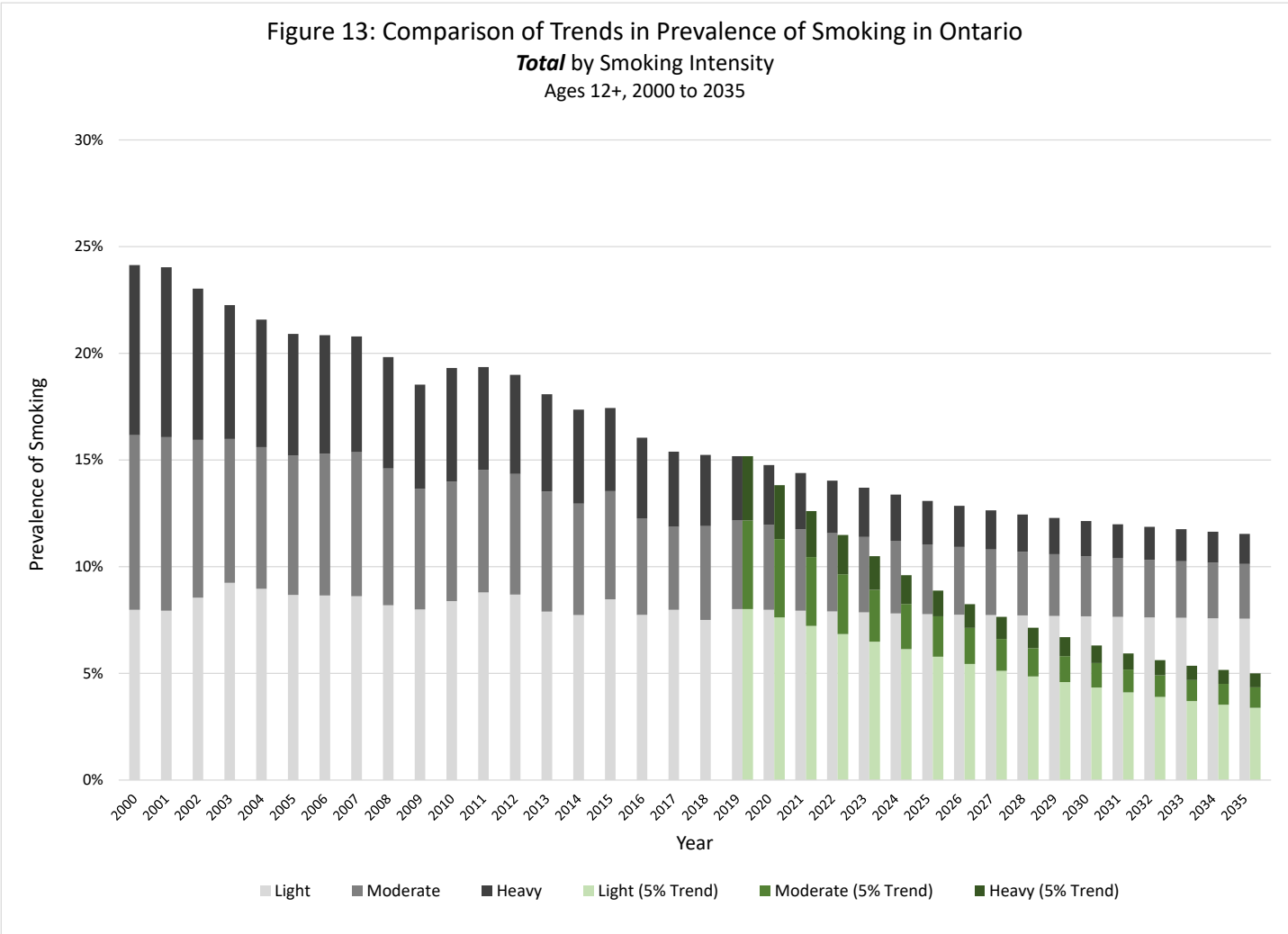
Figure 12 provides a comparison of smoking prevalence in Quebec based on an extrapolation of current trends and reducing the prevalence to 5% by 2035.



Ontario

Figure 13 provides a comparison of smoking prevalence in Ontario based on an extrapolation of current trends and reducing the prevalence to 5% by 2035.

Figure 13: Comparison of Trends in Prevalence of Smoking in Ontario  
**Total** by Smoking Intensity  
 Ages 12+, 2000 to 2035

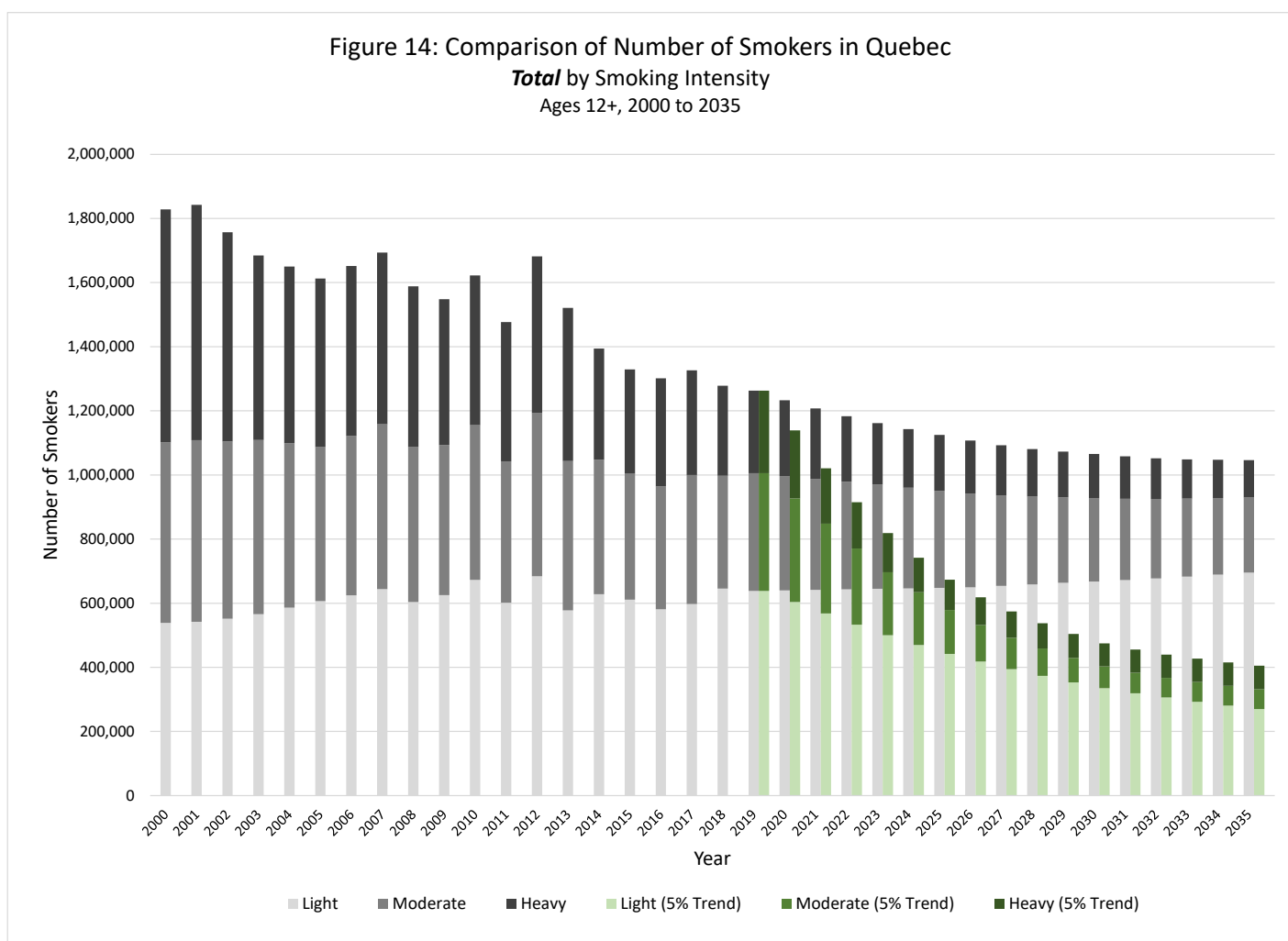


## Number of Smokers in the Current Trend and 5% Scenarios

### Quebec

In order to calculate the number of individuals in each smoking category by year, the projected population of each age group and sex was multiplied by the corresponding age- and sex-specific tobacco smoking prevalence. We used the Statistics Canada M1 projection scenario in the denominator in each age group and sex for 2019 - 2035.<sup>46</sup>

Given current trends and estimated population growth, there would be an estimated 1,046,000 smokers in Quebec in 2035. This would decline to an estimated 405,000 smokers under the 5% scenario, or 641,000 fewer smokers (see Figure 14 and Table 10). The reduction in the number of smokers under the 5% scenario consists of 426,000 (66% of the total) fewer light smokers, 172,000 (27%) fewer moderate smokers and 44,000 (7%) fewer heavy smokers.



<sup>46</sup> Statistics Canada. *Table 17-10-0057-01 Projected population, by projection scenario, age and sex, as of July 1 (x 1,000)*. 2020. Available at <https://www150.statcan.gc.ca/t1/tb11/en/tv.action?pid=1710005701>. Accessed May 2020.

**Table 10: Number of Total Smokers and Smoking Prevalence, Quebec**

2019 - 2035  
Ages 12+

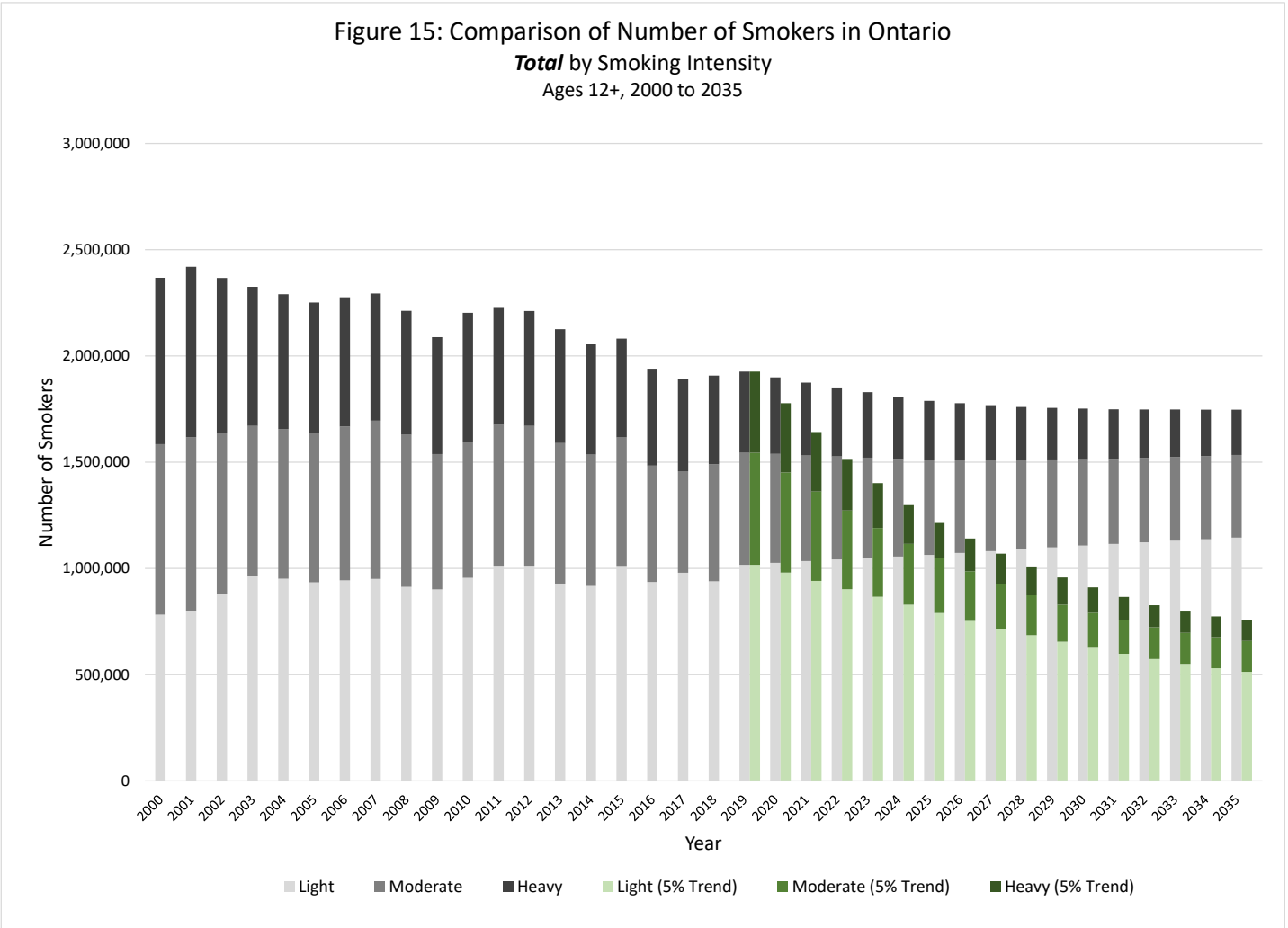
Year	Current Trends					5% Prevalence by 2035					Cumulative Difference in Number of Smokers				
	Light	Moderate	Heavy	Total	Prevalence	Light	Moderate	Heavy	Total	Prevalence	Light	Moderate	Heavy	Total	
2019	637,971	367,323	257,446	1,262,740	17.1%	637,971	367,323	257,446	1,262,740	17.1%	0	0	0	0	
2020	640,131	356,549	236,459	1,233,139	16.6%	603,616	323,418	211,946	1,138,980	15.4%	36,515	33,131	24,513	94,159	
2021	641,853	346,126	219,670	1,207,649	16.2%	568,295	279,834	172,894	1,021,022	13.7%	73,558	66,292	46,776	186,627	
2022	643,569	335,623	204,014	1,183,206	15.7%	532,785	237,750	144,451	914,987	12.2%	110,783	97,873	59,563	268,219	
2023	645,032	324,890	191,932	1,161,854	15.3%	500,187	196,593	121,739	818,519	10.8%	144,845	128,297	70,193	343,335	
2024	646,408	314,097	182,403	1,142,908	15.0%	469,821	164,490	107,694	742,005	9.7%	176,587	149,607	74,709	400,903	
2025	647,602	303,271	173,814	1,124,687	14.7%	441,900	136,679	94,959	673,537	8.8%	205,703	166,592	78,855	451,150	
2026	649,638	292,596	165,179	1,107,414	14.3%	417,825	114,293	86,149	618,267	8.0%	231,813	178,304	79,031	489,147	
2027	653,944	282,352	156,281	1,092,578	14.1%	394,408	97,775	82,242	574,426	7.4%	259,535	184,577	74,039	518,152	
2028	658,706	273,773	148,456	1,080,935	13.8%	373,535	85,452	78,429	537,415	6.9%	285,172	188,321	70,027	543,520	
2029	663,518	266,547	142,843	1,072,908	13.6%	353,016	76,498	74,774	504,288	6.4%	310,501	190,049	68,070	568,621	
2030	667,902	260,167	137,627	1,065,696	13.5%	335,013	67,772	72,190	474,976	6.0%	332,889	192,395	65,437	590,720	
2031	672,012	253,706	132,292	1,058,010	13.3%	319,191	63,824	72,346	455,360	5.7%	352,821	189,882	59,946	602,650	
2032	677,122	247,905	126,888	1,051,914	13.2%	305,788	61,452	72,544	439,784	5.5%	371,334	186,453	54,344	612,130	
2033	683,155	243,405	121,681	1,048,242	13.1%	292,528	61,679	72,739	426,945	5.3%	390,627	181,727	48,943	621,297	
2034	689,413	238,793	119,044	1,047,249	13.0%	280,449	61,889	72,920	415,258	5.2%	408,964	176,904	46,124	631,991	
2035	695,512	234,050	116,617	1,046,179	12.9%	269,671	62,080	73,075	404,825	5.0%	425,842	171,970	43,542	641,354	



## Ontario

Given current trends and estimated population growth, there would be an estimated 1,747,000 smokers in Ontario in 2035. This would decline to an estimated 758,000 smokers under the 5% scenario, or 990,000 fewer smokers (see Figure 15 and Table 11). The reduction in the number of smokers under the 5% scenario consists of 632,000 (64% of the total) fewer light smokers, 244,000 (25%) fewer moderate smokers and 114,000 (12%) fewer heavy smokers.

Figure 15: Comparison of Number of Smokers in Ontario  
**Total** by Smoking Intensity  
 Ages 12+, 2000 to 2035



**Table 11: Number of Total Smokers and Smoking Prevalence, Ontario**  
**2019 - 2035**  
**Ages 12+**

Year	Current Trends					5% Prevalence by 2035					Cumulative Difference in Number of Smokers				
	Light	Moderate	Heavy	Total	Prevalence	Light	Moderate	Heavy	Total	Prevalence	Light	Moderate	Heavy	Total	
2019	1,017,063	527,105	381,760	1,925,927	15.2%	1,017,063	527,105	381,760	1,925,927	15.2%	0	0	0	0	
2020	1,026,326	512,562	359,867	1,898,755	14.8%	980,441	471,455	325,898	1,777,794	13.8%	45,885	41,107	33,970	120,961	
2021	1,034,543	497,306	342,508	1,874,357	14.4%	941,571	419,776	280,641	1,641,988	12.6%	92,972	77,529	61,867	232,368	
2022	1,042,357	484,548	324,828	1,851,733	14.0%	902,713	369,707	243,040	1,515,461	11.5%	139,643	114,841	81,788	336,272	
2023	1,049,297	472,255	307,967	1,829,519	13.7%	866,417	323,557	211,296	1,401,270	10.5%	182,880	148,698	96,671	428,248	
2024	1,056,173	459,386	293,012	1,808,571	13.4%	829,087	286,385	182,165	1,297,638	9.6%	227,086	173,001	110,846	510,934	
2025	1,063,652	446,651	278,461	1,788,765	13.1%	790,602	258,795	164,816	1,214,213	8.9%	273,050	187,856	113,645	574,551	
2026	1,072,622	438,476	266,905	1,778,004	12.9%	752,818	233,977	153,828	1,140,622	8.2%	319,805	204,500	113,077	637,382	
2027	1,081,709	429,909	256,594	1,768,211	12.6%	716,201	208,999	144,754	1,069,954	7.6%	365,507	220,910	111,839	698,257	
2028	1,090,848	421,003	247,862	1,759,713	12.4%	685,961	187,420	136,121	1,009,502	7.1%	404,887	233,583	111,740	750,211	
2029	1,099,444	413,247	242,865	1,755,556	12.3%	655,674	174,073	127,563	957,310	6.7%	443,770	239,174	115,302	798,246	
2030	1,107,513	407,076	237,886	1,752,474	12.1%	626,491	165,037	119,059	910,587	6.3%	481,022	242,039	118,827	841,888	
2031	1,115,175	400,713	232,919	1,748,807	12.0%	598,814	156,391	110,592	865,797	5.9%	516,361	244,322	122,327	883,010	
2032	1,123,004	397,308	228,004	1,748,316	11.9%	573,630	149,593	103,883	827,105	5.6%	549,374	247,715	124,121	921,211	
2033	1,130,506	394,346	223,059	1,747,912	11.8%	550,589	146,536	99,637	796,763	5.4%	579,917	247,810	123,422	951,149	
2034	1,137,786	391,587	218,110	1,747,483	11.6%	530,440	145,913	98,193	774,546	5.2%	607,346	245,674	119,917	972,937	
2035	1,145,104	389,080	213,188	1,747,372	11.5%	513,471	145,243	98,856	757,570	5.0%	631,633	243,836	114,333	989,802	

## Projected Cost Avoidance Associated with the 5% Scenario

To this point we have calculated the annual health care costs associated with tobacco smoking and have done so specifically by sex, smoking intensity and province (see Tables 8 and 9). In addition, we have estimated the difference in the number of smokers in the future (to 2035) if we shifted from current trends in smoking prevalence to a 5% scenario in which a total of 5% of the population ages 12 and older smoked in each province by 2035. Again, this information was produced by sex (not shown), smoking intensity and province (see Tables 10 and 11).

To calculate potential healthcare costs avoided, we could simply multiply the sex, smoking intensity and province specific annual health care costs by the reduction in the number of smokers by sex, smoking intensity and province. This approach, however, does not take into account the lag time between when an individual ceases smoking (or moves to a lower intensity of smoking) and their health risks return to that of a non-smoker. That is, when an individual quits smoking, some of the associated health risks remain for many years following cessation and this lag time during which a former smoker is still at risk varies by disease.

### Incorporating Lag Time

To incorporate this lag time, we utilized the results of a study by Kenfield and colleagues.<sup>47</sup> They assessed the relationship between smoking and smoking cessation on mortality in 104,519 women. Hazard ratios (HR) were reported for vascular diseases, coronary heart diseases, cerebrovascular diseases, respiratory diseases, and cancers among quitters. These hazard ratios are presented in Table 12.

Years Since Quitting	Vascular Disease			Coronary Heart Disease			Cerebrovascular Disease			Respiratory Disease			All smoking-related cancers		
	HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI		HR	95% CI	
Smoker	1.00			1.00			1.00			1.00			1.00		
< 5	0.63	0.54	0.74	0.50	0.40	0.64	0.63	0.45	0.87	0.86	0.69	1.08	0.65	0.56	0.76
5 - <10	0.45	0.38	0.54	0.37	0.28	0.48	0.41	0.28	0.60	0.51	0.39	0.67	0.48	0.41	0.57
10 - <15	0.45	0.38	0.54	0.40	0.31	0.53	0.42	0.28	0.61	0.37	0.27	0.50	0.33	0.27	0.41
15 - <20	0.39	0.33	0.47	0.36	0.28	0.48	0.44	0.31	0.63	0.23	0.16	0.33	0.21	0.16	0.27
≥ 20	0.28	0.25	0.32	0.23	0.19	0.28	0.32	0.25	0.41	0.11	0.08	0.14	0.17	0.14	0.19
Never Smoker	0.33	0.31	0.37	0.30	0.26	0.34	0.36	0.30	0.43	0.08	0.07	0.10	0.14	0.12	0.15

Source: Kenfield et al., *Journal of the American Medical Association*, 2008.

HR values are reported in five-year increments since quitting; therefore we chose the median value of the five year range and extrapolate the intermediary years. In order to calculate the percent reduction in hazard ratio over time, we calculate the portion of excess risk that is retained after quitting. That is, the HR for a given year is expressed as a percentage of the excess risk for a current smoker compared to a never-smoker. The HR for a current smoker is always 1. The formula used is as follows:

$$\% \text{ reduction in HR at year } n = \frac{\text{HR at year } n - \text{HR of never smoker}}{\text{HR of current smoker} - \text{HR of never smoker}}$$

<sup>47</sup> Kenfield SA, Stampfer MJ, Rosner BA et al. Smoking and smoking cessation in relation to mortality in women. *JAMA* 2008; 299(17): 2037-47.

For example, the HR for vascular disease in a never-smoker is 0.33, and the HR for an individual who quit 5-10 years prior is 0.45. Therefore, the percent of remaining risk that exists for someone who quit 5-10 years prior is 17.9% (0.12/0.67).

We assumed that once the lower bounds of a HR's 95% confidence interval intercepts the HR for a never-smoker, there was essentially no increased risk remaining. When this occurs, the percent or remaining risk for a quitter becomes 0.

The HRs and percent of risk remaining that exists after quitting is presented in Table 13. Highlighted HRs are from Kenfield et al.; all others have been extrapolated.

We assumed that the lag time by disease type identified for females by Kenfield et al. would be the same for males.

<b>Table 13: Reduction in Risk of Mortality After Smoking Cessation</b>										
<b>Females, by Cause and by Year Since Smoking Cessation</b>										
Years since quitting	Vascular Disease		Coronary Heart Disease		Cerebrovascular Disease		Respiratory Disease		All smoking-related cancers	
	HR	% of risk remaining	HR	% of risk remaining	HR	% of risk remaining	HR	% of risk remaining	HR	% of risk remaining
Current Smoker	1.00	100.0%	1.00	100.0%	1.00	100.0%	1.00	100.0%	1.00	100.0%
1	0.88	81.6%	0.83	76.2%	0.88	80.7%	0.95	94.9%	0.88	86.4%
2	0.75	63.2%	0.67	52.4%	0.75	61.5%	0.91	89.9%	0.77	72.9%
3	0.63	44.8%	0.50	28.6%	0.63	42.2%	0.86	84.8%	0.65	59.3%
4	0.59	38.1%	0.47	14.3%	0.58	21.1%	0.77	75.3%	0.61	54.4%
5	0.54	31.3%	0.44	0.0%	0.52	0.0%	0.69	65.8%	0.57	49.4%
6	0.50	24.6%	0.40	0.0%	0.47	0.0%	0.60	56.3%	0.52	44.5%
7	0.45	17.9%	0.37	0.0%	0.41	0.0%	0.51	46.7%	0.48	39.5%
8	0.45	17.9%	0.38	0.0%	0.41	0.0%	0.48	43.7%	0.45	36.0%
9	0.45	17.9%	0.38	0.0%	0.41	0.0%	0.45	40.7%	0.42	32.6%
10	0.45	17.9%	0.39	0.0%	0.42	0.0%	0.43	37.6%	0.39	29.1%
11	0.45	17.9%	0.39	0.0%	0.42	0.0%	0.40	34.6%	0.36	25.6%
12	0.45	17.9%	0.40	0.0%	0.42	0.0%	0.37	31.5%	0.33	22.1%
13	0.44	11.9%	0.39	0.0%	0.42	0.0%	0.34	28.5%	0.31	19.3%
14	0.43	6.0%	0.38	0.0%	0.43	0.0%	0.31	25.4%	0.28	16.5%
15	0.41	0.0%	0.38	0.0%	0.43	0.0%	0.29	22.4%	0.26	13.7%
16	0.40	0.0%	0.37	0.0%	0.44	0.0%	0.26	19.3%	0.23	10.9%
17	0.39	0.0%	0.36	0.0%	0.44	0.0%	0.23	16.3%	0.21	8.1%
18	0.37	0.0%	0.34	0.0%	0.42	0.0%	0.21	10.9%	0.20	5.4%
19	0.35	0.0%	0.32	0.0%	0.40	0.0%	0.19	5.4%	0.20	2.7%
20	0.34	0.0%	0.30	0.0%	0.38	0.0%	0.17	0.0%	0.19	0.0%
21	0.32	0.0%	0.27	0.0%	0.36	0.0%	0.15	0.0%	0.18	0.0%
22	0.30	0.0%	0.25	0.0%	0.34	0.0%	0.13	0.0%	0.18	0.0%
23	0.28	0.0%	0.23	0.0%	0.32	0.0%	0.11	0.0%	0.17	0.0%
Never Smoked	<b>0.33</b>		<b>0.30</b>		<b>0.36</b>		<b>0.08</b>		<b>0.14</b>	

In order to determine the costs that would remain for a smoker after quitting, the direct cost per individual smoker was calculated for each smoking-associated disease, and categorized into the above disease groups for each province. Any diseases that did not fit into the above categories (i.e., type 2 diabetes, intestinal ischemia and cirrhosis of the liver) were categorized as "other." For these "other" diseases, no data is available on the risk reduction over time after quitting; the proportion of costs applicable to a former smoker each year after quitting are therefore calculated excluding these three cost categories (see Appendix C).

The total direct costs for each disease category (see Appendix C) was multiplied by the respective percentage of remaining smoking-related risk after quitting by disease category (Table 13), in order to determine the proportion of costs remaining after smoking cessation.

The total direct cost per former smoker (excluding costs associated with diseases categorized as “other”) was calculated by totalling the cost per smoker for each individual disease category, by year since quitting. In order to determine the proportion of costs remaining for a former smoker, the total direct costs for a given year since quitting was divided by the total costs for a current smoker. This was process was completed for both provinces (see Tables 14 and 15) and for both direct and indirect costs.

**Table 14: Reduction in Direct Costs After Smoking Cessation, Quebec**  
By Year Since Smoking Cessation

Years Since Quitting	Vascular Disease \$ / Quitter			Coronary Heart Disease \$ / Quitter			Cerebrovascular Disease \$ / Quitter			Respiratory Disease \$ / Quitter			All smoking-related cancers \$ / Quitter			\$ / Quitter		% of \$ vs. Smoker	
	HR	M	F	HR	M	F	HR	M	F	HR	M	F	HR	M	F	M	F	M	F
Current Smoker	100%	\$ 70.16	\$ 24.92	100%	\$ 387.67	\$ 153.68	100%	\$ 53.37	\$ 45.13	100%	\$ 233.64	\$ 245.62	100%	\$ 215.84	\$ 150.04	\$ 960.68	\$ 619.39	100%	100%
1	82%	\$ 57.24	\$ 20.33	76%	\$ 295.37	\$ 117.09	81%	\$ 43.09	\$ 36.43	95%	\$ 221.79	\$ 233.16	86%	\$ 186.56	\$ 129.68	\$ 804.05	\$ 536.70	84%	87%
2	63%	\$ 44.33	\$ 15.74	52%	\$ 203.06	\$ 80.50	61%	\$ 32.80	\$ 27.74	90%	\$ 209.94	\$ 220.70	73%	\$ 157.28	\$ 109.33	\$ 647.41	\$ 454.01	67%	73%
3	45%	\$ 31.41	\$ 11.16	29%	\$ 110.76	\$ 43.91	42%	\$ 22.52	\$ 19.04	85%	\$ 198.09	\$ 208.24	59%	\$ 128.00	\$ 88.98	\$ 490.78	\$ 371.33	51%	60%
4	38%	\$ 26.70	\$ 9.48	14%	\$ 55.38	\$ 21.95	21%	\$ 11.26	\$ 9.52	75%	\$ 175.87	\$ 184.88	54%	\$ 117.33	\$ 81.56	\$ 386.54	\$ 307.40	40%	50%
5	31%	\$ 21.99	\$ 7.81	0%	\$ -	\$ -	0%	\$ -	\$ -	66%	\$ 153.64	\$ 161.52	49%	\$ 106.67	\$ 74.15	\$ 282.30	\$ 243.48	29%	39%
6	25%	\$ 17.28	\$ 6.14	0%	\$ -	\$ -	0%	\$ -	\$ -	56%	\$ 131.42	\$ 138.16	44%	\$ 96.00	\$ 66.73	\$ 244.70	\$ 211.03	25%	34%
7	18%	\$ 12.57	\$ 4.46	0%	\$ -	\$ -	0%	\$ -	\$ -	47%	\$ 109.20	\$ 114.80	40%	\$ 85.33	\$ 59.32	\$ 207.10	\$ 178.58	22%	29%
8	18%	\$ 12.57	\$ 4.46	0%	\$ -	\$ -	0%	\$ -	\$ -	44%	\$ 102.09	\$ 107.33	36%	\$ 77.80	\$ 54.08	\$ 192.46	\$ 165.87	20%	27%
9	18%	\$ 12.57	\$ 4.46	0%	\$ -	\$ -	0%	\$ -	\$ -	41%	\$ 94.98	\$ 99.85	33%	\$ 70.27	\$ 48.85	\$ 177.82	\$ 153.16	19%	25%
10	18%	\$ 12.57	\$ 4.46	0%	\$ -	\$ -	0%	\$ -	\$ -	38%	\$ 87.87	\$ 92.37	29%	\$ 62.75	\$ 43.62	\$ 163.18	\$ 140.45	17%	23%
11	18%	\$ 12.57	\$ 4.46	0%	\$ -	\$ -	0%	\$ -	\$ -	35%	\$ 80.76	\$ 84.90	26%	\$ 55.22	\$ 38.38	\$ 148.54	\$ 127.74	15%	21%
12	18%	\$ 12.57	\$ 4.46	0%	\$ -	\$ -	0%	\$ -	\$ -	32%	\$ 73.65	\$ 77.42	22%	\$ 47.69	\$ 33.15	\$ 133.90	\$ 115.04	14%	19%
13	12%	\$ 8.38	\$ 2.98	0%	\$ -	\$ -	0%	\$ -	\$ -	28%	\$ 66.54	\$ 69.95	19%	\$ 41.66	\$ 28.96	\$ 116.58	\$ 101.89	12%	16%
14	6%	\$ 4.19	\$ 1.49	0%	\$ -	\$ -	0%	\$ -	\$ -	25%	\$ 59.43	\$ 62.47	17%	\$ 35.64	\$ 24.77	\$ 99.25	\$ 88.73	10%	14%
15	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	22%	\$ 52.32	\$ 55.00	14%	\$ 29.62	\$ 20.59	\$ 81.93	\$ 75.58	9%	12%
16	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	19%	\$ 45.20	\$ 47.52	11%	\$ 23.59	\$ 16.40	\$ 68.80	\$ 63.92	7%	10%
17	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	16%	\$ 38.09	\$ 40.05	8%	\$ 17.57	\$ 12.21	\$ 55.66	\$ 52.26	6%	8%
18	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	11%	\$ 25.40	\$ 26.70	5%	\$ 11.71	\$ 8.14	\$ 37.11	\$ 34.84	4%	6%
19	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	5%	\$ 12.70	\$ 13.35	3%	\$ 5.86	\$ 4.07	\$ 18.55	\$ 17.42	2%	3%
20	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	\$ -	\$ -	0%	0%

**Table 15: Reduction in Direct Costs After Smoking Cessation, Ontario**  
By Year Since Smoking Cessation

Years Since Quitting	Vascular Disease \$ / Quitter			Coronary Heart Disease \$ / Quitter			Cerebrovascular Disease \$ / Quitter			Respiratory Disease \$ / Quitter			All smoking-related cancers \$ / Quitter			\$ / Quitter		% of \$ vs. Smoker	
	HR	M	F	HR	M	F	HR	M	F	HR	M	F	HR	M	F	M	F	M	F
Current Smoker	100%	\$ 68.85	\$ 25.46	100%	\$ 395.57	\$ 167.59	100%	\$ 49.72	\$ 45.51	100%	\$ 243.33	\$ 246.07	100%	\$ 156.27	\$ 118.14	\$ 913.73	\$ 602.78	100%	100%
1	82%	\$ 56.17	\$ 20.77	76%	\$ 301.38	\$ 127.69	81%	\$ 40.14	\$ 36.74	95%	\$ 230.99	\$ 233.59	86%	\$ 135.07	\$ 102.12	\$ 763.75	\$ 520.91	84%	86%
2	63%	\$ 43.50	\$ 16.09	52%	\$ 207.20	\$ 87.79	61%	\$ 30.56	\$ 27.97	90%	\$ 218.64	\$ 221.10	73%	\$ 113.87	\$ 86.09	\$ 613.77	\$ 439.04	67%	73%
3	45%	\$ 30.83	\$ 11.40	29%	\$ 113.02	\$ 47.88	42%	\$ 20.97	\$ 19.20	85%	\$ 206.30	\$ 208.62	59%	\$ 92.67	\$ 70.06	\$ 463.79	\$ 357.17	51%	59%
4	38%	\$ 26.20	\$ 9.69	14%	\$ 56.51	\$ 23.94	21%	\$ 10.49	\$ 9.60	75%	\$ 183.16	\$ 185.22	54%	\$ 84.95	\$ 64.22	\$ 361.31	\$ 292.67	40%	49%
5	31%	\$ 21.58	\$ 7.98	0%	\$ -	\$ -	0%	\$ -	\$ -	66%	\$ 160.01	\$ 161.82	49%	\$ 77.23	\$ 58.38	\$ 258.82	\$ 228.18	28%	38%
6	25%	\$ 16.95	\$ 6.27	0%	\$ -	\$ -	0%	\$ -	\$ -	56%	\$ 136.87	\$ 138.41	44%	\$ 69.50	\$ 52.55	\$ 223.33	\$ 197.23	24%	33%
7	18%	\$ 12.33	\$ 4.56	0%	\$ -	\$ -	0%	\$ -	\$ -	47%	\$ 113.73	\$ 115.01	40%	\$ 61.78	\$ 46.71	\$ 187.84	\$ 166.28	21%	28%
8	18%	\$ 12.33	\$ 4.56	0%	\$ -	\$ -	0%	\$ -	\$ -	44%	\$ 106.32	\$ 107.52	36%	\$ 56.33	\$ 42.59	\$ 174.98	\$ 154.67	19%	26%
9	18%	\$ 12.33	\$ 4.56	0%	\$ -	\$ -	0%	\$ -	\$ -	41%	\$ 98.92	\$ 100.03	33%	\$ 50.88	\$ 38.47	\$ 162.13	\$ 143.06	18%	24%
10	18%	\$ 12.33	\$ 4.56	0%	\$ -	\$ -	0%	\$ -	\$ -	38%	\$ 91.51	\$ 92.54	29%	\$ 45.43	\$ 34.34	\$ 149.27	\$ 131.45	16%	22%
11	18%	\$ 12.33	\$ 4.56	0%	\$ -	\$ -	0%	\$ -	\$ -	35%	\$ 84.11	\$ 85.05	26%	\$ 39.98	\$ 30.22	\$ 136.41	\$ 119.84	15%	20%
12	18%	\$ 12.33	\$ 4.56	0%	\$ -	\$ -	0%	\$ -	\$ -	32%	\$ 76.70	\$ 77.56	22%	\$ 34.52	\$ 26.10	\$ 123.56	\$ 108.23	14%	18%
13	12%	\$ 8.22	\$ 3.04	0%	\$ -	\$ -	0%	\$ -	\$ -	28%	\$ 69.30	\$ 70.08	19%	\$ 30.16	\$ 22.80	\$ 107.68	\$ 95.92	12%	16%
14	6%	\$ 4.11	\$ 1.52	0%	\$ -	\$ -	0%	\$ -	\$ -	25%	\$ 61.89	\$ 62.59	17%	\$ 25.80	\$ 19.51	\$ 91.80	\$ 83.61	10%	14%
15	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	22%	\$ 54.48	\$ 55.10	14%	\$ 21.44	\$ 16.21	\$ 75.93	\$ 71.31	8%	12%
16	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	19%	\$ 47.08	\$ 47.61	11%	\$ 17.08	\$ 12.91	\$ 64.16	\$ 60.52	7%	10%
17	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	16%	\$ 39.67	\$ 40.12	8%	\$ 12.72	\$ 9.62	\$ 52.39	\$ 49.74	6%	8%
18	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	11%	\$ 26.45	\$ 26.75	5%	\$ 8.48	\$ 6.41	\$ 34.93	\$ 33.16	4%	6%
19	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	5%	\$ 13.22	\$ 13.37	3%	\$ 4.24	\$ 3.21	\$ 17.46	\$ 16.58	2%	3%
20	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	0%	\$ -	\$ -	\$ -	\$ -	0%	0%

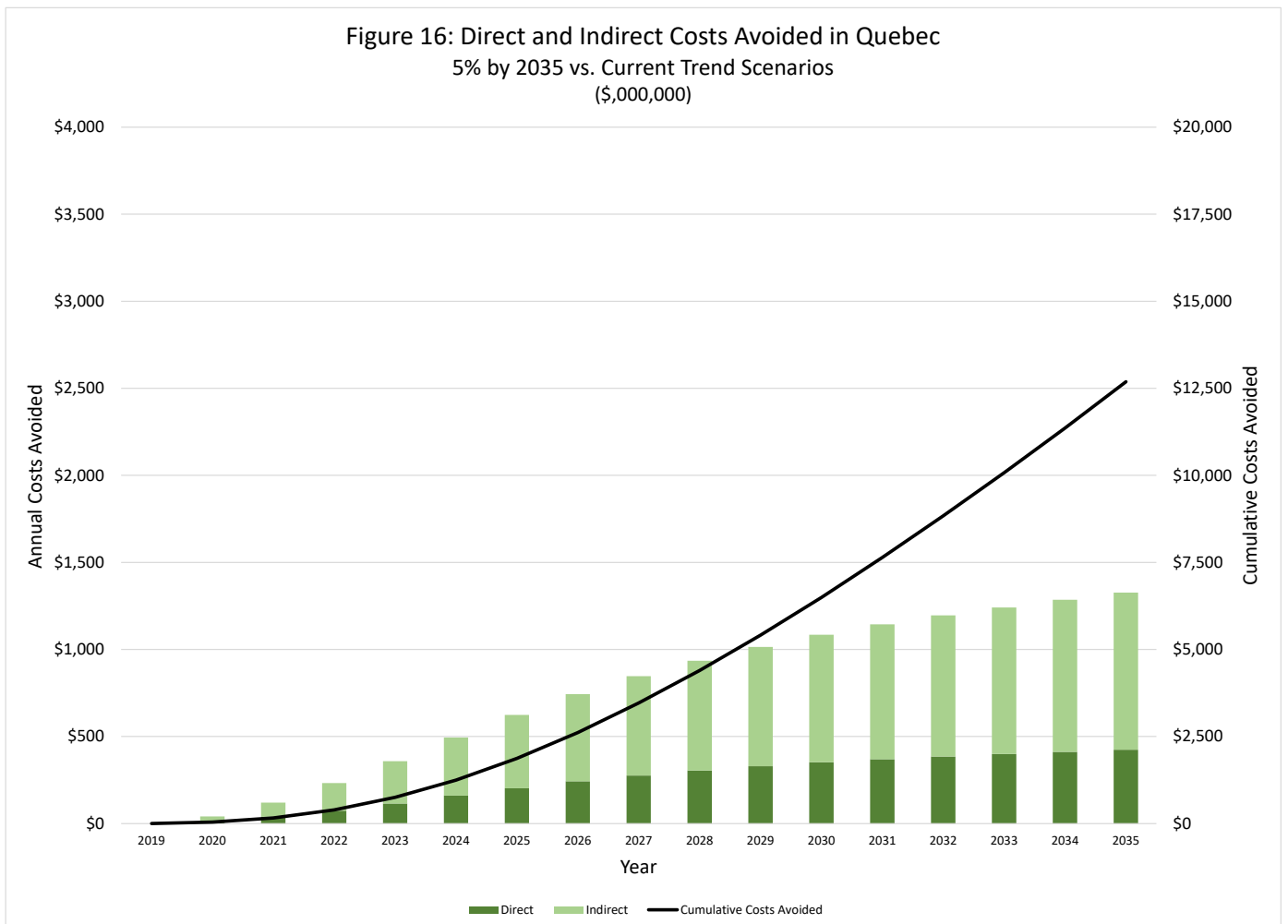
For example, an Ontario male who quit three years ago would incur \$30.83 per year in smoking-related costs for vascular disease, \$113.02 in costs for coronary heart disease, \$20.97 in costs for cerebrovascular disease, \$206.30 in costs for respiratory disease, and \$92.67 in costs for all smoking-related cancers. This totals \$463.79 in direct costs (for these disease categories only), which is 51% of the direct costs incurred for these disease categories for a current smoker.

A male former smoker from Ontario who quit one year ago would incur 84% of the direct costs of a current smoker, while a male former Ontario smoker who quit 19 years ago would incur 2% of the direct costs of a current smoker. After 20 years since quitting, the risk of disease associated with former smoking is considered the same as someone who has never smoked, and therefore a former smoker would incur no smoking-related costs.

### Costs Avoided between the Current Trend and 5% Scenarios

Quebec – 2018 Constant Dollars

In Quebec, the 5% scenario would result in a reduction of 641,000 smokers by 2035 compared with current trends (see Figure 14 and Table 10). This reduction in the number of smokers in the province, in turn, would lead to an annual cost avoided of \$1.33 billion in 2035 (\$424 million in direct costs and \$903 million in indirect costs). Cumulatively, costs avoided between 2020 and 2035 are estimated at \$12.7 billion (see Figure 16 and Tables 16 to 18).



**Table 16: Annual Direct and Indirect Costs, Quebec**

Current Trends Scenario, By Cost Category

2019 - 2035, Ages 12+

(\$,000,000)

Year	Annual Cost			Cost by Direct Cost Category					Cost by Indirect Cost Category			
	Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total
2019	\$1,180.8	\$2,550.5	\$3,731.3	\$625.1	\$112.4	\$167.0	\$276.3	\$1,180.8	\$1,827.2	\$462.6	\$260.7	\$2,550.5
2020	\$1,138.5	\$2,459.9	\$3,598.3	\$602.7	\$108.4	\$161.0	\$266.4	\$1,138.5	\$1,762.2	\$446.2	\$251.5	\$2,459.9
2021	\$1,102.2	\$2,382.1	\$3,484.3	\$583.5	\$104.9	\$155.9	\$257.9	\$1,102.2	\$1,706.6	\$432.1	\$243.5	\$2,382.1
2022	\$1,067.7	\$2,308.2	\$3,375.9	\$565.3	\$101.7	\$151.0	\$249.8	\$1,067.7	\$1,653.6	\$418.7	\$236.0	\$2,308.2
2023	\$1,038.6	\$2,246.1	\$3,284.7	\$549.9	\$98.9	\$146.9	\$243.0	\$1,038.6	\$1,609.1	\$407.4	\$229.6	\$2,246.1
2024	\$1,013.5	\$2,192.6	\$3,206.1	\$536.6	\$96.5	\$143.3	\$237.1	\$1,013.5	\$1,570.8	\$397.7	\$224.1	\$2,192.6
2025	\$989.8	\$2,142.1	\$3,131.9	\$524.0	\$94.2	\$140.0	\$231.6	\$989.8	\$1,534.6	\$388.5	\$219.0	\$2,142.1
2026	\$966.7	\$2,092.7	\$3,059.4	\$511.8	\$92.0	\$136.7	\$226.2	\$966.7	\$1,499.2	\$379.6	\$213.9	\$2,092.7
2027	\$944.5	\$2,045.6	\$2,990.1	\$500.0	\$89.9	\$133.6	\$221.0	\$944.5	\$1,465.5	\$371.0	\$209.1	\$2,045.6
2028	\$925.6	\$2,005.3	\$2,930.9	\$490.0	\$88.1	\$130.9	\$216.6	\$925.6	\$1,436.6	\$363.7	\$205.0	\$2,005.3
2029	\$911.3	\$1,974.8	\$2,886.1	\$482.4	\$86.8	\$128.9	\$213.2	\$911.3	\$1,414.7	\$358.2	\$201.9	\$1,974.8
2030	\$898.1	\$1,946.7	\$2,844.8	\$475.5	\$85.5	\$127.0	\$210.1	\$898.1	\$1,394.6	\$353.1	\$199.0	\$1,946.7
2031	\$884.5	\$1,917.7	\$2,802.2	\$468.3	\$84.2	\$125.1	\$207.0	\$884.5	\$1,373.8	\$347.8	\$196.0	\$1,917.7
2032	\$872.3	\$1,891.8	\$2,764.2	\$461.8	\$83.1	\$123.3	\$204.1	\$872.3	\$1,355.3	\$343.1	\$193.4	\$1,891.8
2033	\$863.0	\$1,872.0	\$2,735.0	\$456.9	\$82.2	\$122.0	\$201.9	\$863.0	\$1,341.1	\$339.5	\$191.4	\$1,872.0
2034	\$857.7	\$1,861.1	\$2,718.9	\$454.1	\$81.7	\$121.3	\$200.7	\$857.7	\$1,333.3	\$337.6	\$190.3	\$1,861.1
2035	\$852.6	\$1,850.5	\$2,703.0	\$451.4	\$81.2	\$120.6	\$199.5	\$852.6	\$1,325.7	\$335.6	\$189.2	\$1,850.5
<b>Total</b>	<b>\$16,507.6</b>	<b>\$35,739.6</b>	<b>\$52,247.3</b>	<b>\$8,739.3</b>	<b>\$1,571.7</b>	<b>\$2,334.2</b>	<b>\$3,862.5</b>	<b>\$16,507.6</b>	<b>\$25,603.8</b>	<b>\$6,482.2</b>	<b>\$3,653.6</b>	<b>\$35,739.6</b>

LTD = Long Term Disability, STD = Short Term Disability

**Table 17: Annual Direct and Indirect Costs, Quebec**

5% Prevalence Scenario, By Cost Category

2019 - 2035, Ages 12+

(\$,000,000)

Year	Annual Cost			Cost by Direct Cost Category					Cost by Indirect Cost Category			
	Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total
2019	\$1,180.8	\$2,550.5	\$3,731.3	\$625.1	\$112.4	\$167.0	\$276.3	\$1,180.8	\$1,827.2	\$462.6	\$260.7	\$2,550.5
2020	\$1,125.4	\$2,432.0	\$3,557.4	\$595.8	\$107.2	\$159.1	\$263.3	\$1,125.4	\$1,742.3	\$441.1	\$248.6	\$2,432.0
2021	\$1,063.8	\$2,300.0	\$3,363.8	\$563.2	\$101.3	\$150.4	\$248.9	\$1,063.8	\$1,647.7	\$417.2	\$235.1	\$2,300.0
2022	\$993.7	\$2,150.1	\$3,143.8	\$526.1	\$94.6	\$140.5	\$232.5	\$993.7	\$1,540.3	\$390.0	\$219.8	\$2,150.1
2023	\$923.5	\$2,002.7	\$2,926.2	\$488.9	\$87.9	\$130.6	\$216.1	\$923.5	\$1,434.7	\$363.2	\$204.7	\$2,002.7
2024	\$853.5	\$1,858.7	\$2,712.2	\$451.9	\$81.3	\$120.7	\$199.7	\$853.5	\$1,331.6	\$337.1	\$190.0	\$1,858.7
2025	\$786.9	\$1,721.4	\$2,508.3	\$416.6	\$74.9	\$111.3	\$184.1	\$786.9	\$1,233.2	\$312.2	\$176.0	\$1,721.4
2026	\$724.2	\$1,591.7	\$2,315.9	\$383.4	\$68.9	\$102.4	\$169.4	\$724.2	\$1,140.3	\$288.7	\$162.7	\$1,591.7
2027	\$668.3	\$1,475.0	\$2,143.3	\$353.8	\$63.6	\$94.5	\$156.4	\$668.3	\$1,056.7	\$267.5	\$150.8	\$1,475.0
2028	\$620.9	\$1,374.8	\$1,995.7	\$328.7	\$59.1	\$87.8	\$145.3	\$620.9	\$984.9	\$249.4	\$140.5	\$1,374.8
2029	\$581.6	\$1,290.6	\$1,872.2	\$307.9	\$55.4	\$82.2	\$136.1	\$581.6	\$924.6	\$234.1	\$131.9	\$1,290.6
2030	\$546.6	\$1,214.0	\$1,760.6	\$289.4	\$52.0	\$77.3	\$127.9	\$546.6	\$869.7	\$220.2	\$124.1	\$1,214.0
2031	\$514.6	\$1,143.0	\$1,657.6	\$272.4	\$49.0	\$72.8	\$120.4	\$514.6	\$818.8	\$207.3	\$116.8	\$1,143.0
2032	\$486.9	\$1,081.1	\$1,568.0	\$257.8	\$46.4	\$68.8	\$113.9	\$486.9	\$774.5	\$196.1	\$110.5	\$1,081.1
2033	\$464.0	\$1,029.7	\$1,493.7	\$245.7	\$44.2	\$65.6	\$108.6	\$464.0	\$737.6	\$186.8	\$105.3	\$1,029.7
2034	\$445.7	\$987.7	\$1,433.4	\$235.9	\$42.4	\$63.0	\$104.3	\$445.7	\$707.6	\$179.1	\$101.0	\$987.7
2035	\$428.5	\$947.9	\$1,376.4	\$226.8	\$40.8	\$60.6	\$100.3	\$428.5	\$679.1	\$171.9	\$96.9	\$947.9
<b>Total</b>	<b>\$12,408.8</b>	<b>\$27,150.9</b>	<b>\$39,559.6</b>	<b>\$6,569.3</b>	<b>\$1,181.5</b>	<b>\$1,754.6</b>	<b>\$2,903.4</b>	<b>\$12,408.8</b>	<b>\$19,450.8</b>	<b>\$4,924.4</b>	<b>\$2,775.6</b>	<b>\$27,150.9</b>

LTD = Long Term Disability, STD = Short Term Disability

**Table 18: Annual Direct and Indirect Costs Avoided, Quebec**

Moving from the Current to the 5% Scenario, By Cost Category

2019 - 2035, Ages 12+

(\$,000,000)

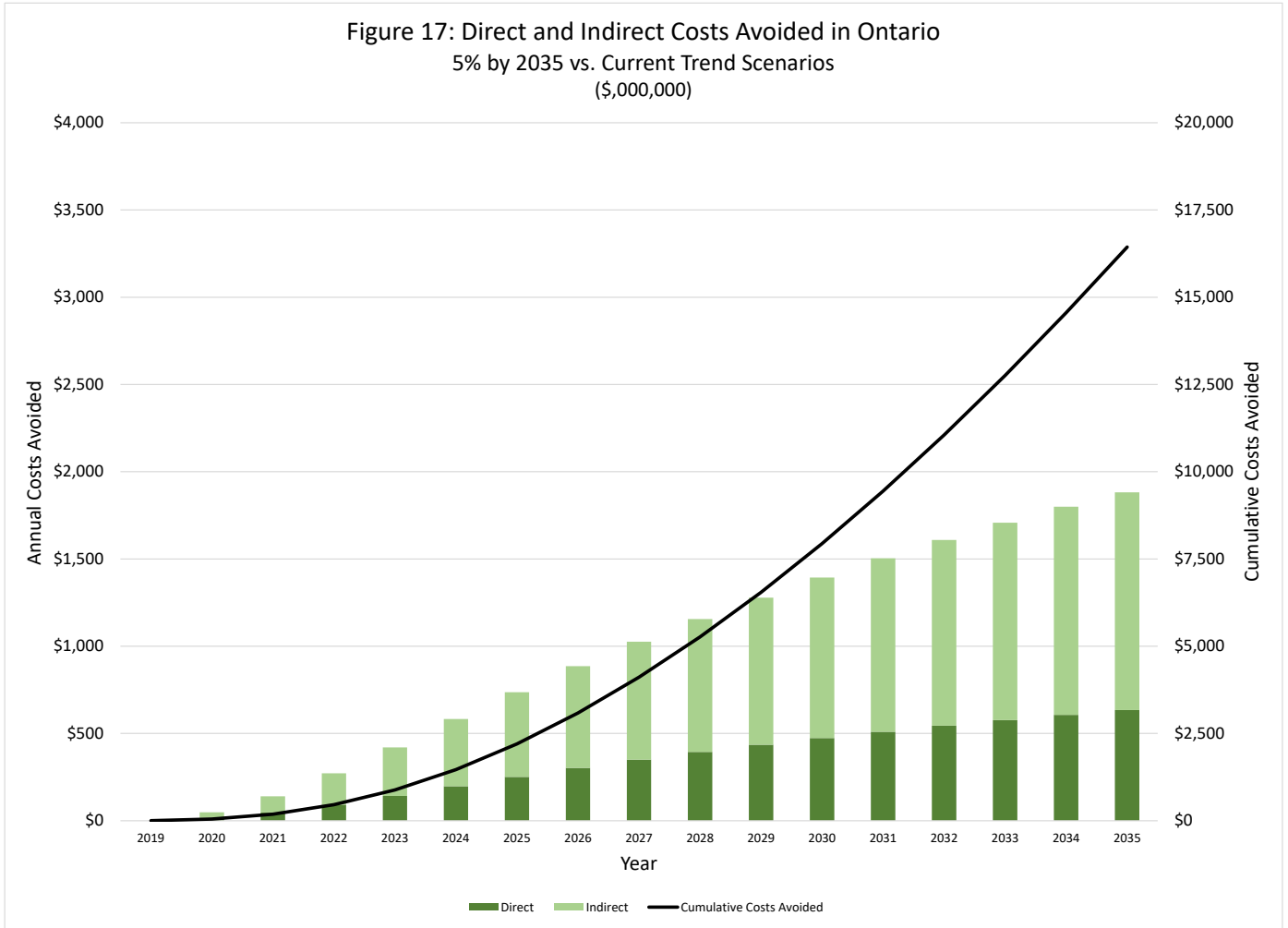
Year	Annual Cost Avoided			Cost Avoided by Direct Cost Category					Cost Avoided by Indirect Cost Category			
	Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total
2019	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
2020	\$13.1	\$27.9	\$40.9	\$6.9	\$1.2	\$1.8	\$3.1	\$13.1	\$20.0	\$5.1	\$2.9	\$27.9
2021	\$38.5	\$82.1	\$120.6	\$20.4	\$3.7	\$5.4	\$9.0	\$38.5	\$58.8	\$14.9	\$8.4	\$82.1
2022	\$74.0	\$158.2	\$232.2	\$39.2	\$7.0	\$10.5	\$17.3	\$74.0	\$113.3	\$28.7	\$16.2	\$158.2
2023	\$115.2	\$243.4	\$358.5	\$61.0	\$11.0	\$16.3	\$26.9	\$115.2	\$174.4	\$44.1	\$24.9	\$243.4
2024	\$160.0	\$333.9	\$493.9	\$84.7	\$15.2	\$22.6	\$37.4	\$160.0	\$239.2	\$60.6	\$34.1	\$333.9
2025	\$202.9	\$420.7	\$623.6	\$107.4	\$19.3	\$28.7	\$47.5	\$202.9	\$301.4	\$76.3	\$43.0	\$420.7
2026	\$242.5	\$501.0	\$743.5	\$128.4	\$23.1	\$34.3	\$56.7	\$242.5	\$358.9	\$90.9	\$51.2	\$501.0
2027	\$276.2	\$570.6	\$846.8	\$146.2	\$26.3	\$39.1	\$64.6	\$276.2	\$408.7	\$103.5	\$58.3	\$570.6
2028	\$304.7	\$630.5	\$935.2	\$161.3	\$29.0	\$43.1	\$71.3	\$304.7	\$451.7	\$114.3	\$64.5	\$630.5
2029	\$329.7	\$684.2	\$1,013.9	\$174.5	\$31.4	\$46.6	\$77.1	\$329.7	\$490.2	\$124.1	\$69.9	\$684.2
2030	\$351.6	\$732.7	\$1,084.3	\$186.1	\$33.5	\$49.7	\$82.3	\$351.6	\$524.9	\$132.9	\$74.9	\$732.7
2031	\$369.9	\$774.7	\$1,144.6	\$195.8	\$35.2	\$52.3	\$86.6	\$369.9	\$555.0	\$140.5	\$79.2	\$774.7
2032	\$385.4	\$810.7	\$1,196.1	\$204.1	\$36.7	\$54.5	\$90.2	\$385.4	\$580.8	\$147.0	\$82.9	\$810.7
2033	\$398.9	\$842.4	\$1,241.3	\$211.2	\$38.0	\$56.4	\$93.3	\$398.9	\$603.5	\$152.8	\$86.1	\$842.4
2034	\$412.1	\$873.4	\$1,285.5	\$218.1	\$39.2	\$58.3	\$96.4	\$412.1	\$625.7	\$158.4	\$89.3	\$873.4
2035	\$424.1	\$902.5	\$1,326.6	\$224.5	\$40.4	\$60.0	\$99.2	\$424.1	\$646.6	\$163.7	\$92.3	\$902.5
<b>Total</b>	<b>\$4,098.8</b>	<b>\$8,588.8</b>	<b>\$12,687.6</b>	<b>\$2,170.0</b>	<b>\$390.3</b>	<b>\$579.6</b>	<b>\$959.0</b>	<b>\$4,098.8</b>	<b>\$6,153.0</b>	<b>\$1,557.8</b>	<b>\$878.0</b>	<b>\$8,588.8</b>

LTD = Long Term Disability, STD = Short Term Disability



Ontario – 2018 Constant Dollars

In Ontario, the 5% scenario would result in a reduction of 990,000 smokers by 2035 compared with current trends (see Figure 15 and Table 11). This reduction in the number of smokers in the province, in turn, would lead to an annual cost avoided of \$1.88 billion in 2035 (\$634 million in direct costs and \$1.25 billion in indirect costs). Cumulatively, costs avoided between 2020 and 2035 are estimated at \$16.4 billion (see Figure 17 and Tables 19 to 21).



**Table 19: Annual Direct and Indirect Costs, Ontario**

Current Trends Scenario, By Cost Category

2019 - 2035, Ages 12+

(\$,000,000)

Year	Annual Cost			Cost by Direct Cost Category					Cost by Indirect Cost Category			
	Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total
2019	\$1,752.9	\$3,504.7	\$5,257.6	\$928.0	\$166.9	\$247.9	\$410.1	\$1,752.9	\$2,510.8	\$635.7	\$358.3	\$3,504.7
2020	\$1,711.1	\$3,422.6	\$5,133.7	\$905.9	\$162.9	\$241.9	\$400.4	\$1,711.1	\$2,451.9	\$620.8	\$349.9	\$3,422.6
2021	\$1,673.9	\$3,349.5	\$5,023.5	\$886.2	\$159.4	\$236.7	\$391.7	\$1,673.9	\$2,399.6	\$607.5	\$342.4	\$3,349.5
2022	\$1,638.0	\$3,278.9	\$4,916.9	\$867.2	\$156.0	\$231.6	\$383.3	\$1,638.0	\$2,349.0	\$594.7	\$335.2	\$3,278.9
2023	\$1,603.2	\$3,210.4	\$4,813.6	\$848.8	\$152.6	\$226.7	\$375.1	\$1,603.2	\$2,299.9	\$582.3	\$328.2	\$3,210.4
2024	\$1,570.8	\$3,146.7	\$4,717.4	\$831.6	\$149.6	\$222.1	\$367.5	\$1,570.8	\$2,254.3	\$570.7	\$321.7	\$3,146.7
2025	\$1,539.3	\$3,084.8	\$4,624.1	\$814.9	\$146.6	\$217.7	\$360.2	\$1,539.3	\$2,209.9	\$559.5	\$315.4	\$3,084.8
2026	\$1,519.2	\$3,045.6	\$4,564.8	\$804.3	\$144.7	\$214.8	\$355.5	\$1,519.2	\$2,181.8	\$552.4	\$311.3	\$3,045.6
2027	\$1,500.9	\$3,009.7	\$4,510.6	\$794.6	\$142.9	\$212.2	\$351.2	\$1,500.9	\$2,156.2	\$545.9	\$307.7	\$3,009.7
2028	\$1,484.7	\$2,978.4	\$4,463.1	\$786.0	\$141.4	\$209.9	\$347.4	\$1,484.7	\$2,133.7	\$540.2	\$304.5	\$2,978.4
2029	\$1,475.2	\$2,960.1	\$4,435.4	\$781.0	\$140.5	\$208.6	\$345.2	\$1,475.2	\$2,120.6	\$536.9	\$302.6	\$2,960.1
2030	\$1,466.8	\$2,944.0	\$4,410.8	\$776.5	\$139.7	\$207.4	\$343.2	\$1,466.8	\$2,109.1	\$534.0	\$301.0	\$2,944.0
2031	\$1,458.0	\$2,927.1	\$4,385.0	\$771.9	\$138.8	\$206.2	\$341.1	\$1,458.0	\$2,097.0	\$530.9	\$299.2	\$2,927.1
2032	\$1,452.0	\$2,915.8	\$4,367.8	\$768.7	\$138.2	\$205.3	\$339.7	\$1,452.0	\$2,088.9	\$528.8	\$298.1	\$2,915.8
2033	\$1,446.3	\$2,904.9	\$4,351.2	\$765.7	\$137.7	\$204.5	\$338.4	\$1,446.3	\$2,081.1	\$526.9	\$297.0	\$2,904.9
2034	\$1,440.7	\$2,894.3	\$4,335.0	\$762.7	\$137.2	\$203.7	\$337.1	\$1,440.7	\$2,073.5	\$525.0	\$295.9	\$2,894.3
2035	\$1,435.6	\$2,884.6	\$4,320.2	\$760.0	\$136.7	\$203.0	\$335.9	\$1,435.6	\$2,066.5	\$523.2	\$294.9	\$2,884.6
<b>Total</b>	<b>\$26,168.6</b>	<b>\$52,462.1</b>	<b>\$78,630.7</b>	<b>\$13,853.9</b>	<b>\$2,491.6</b>	<b>\$3,700.2</b>	<b>\$6,122.9</b>	<b>\$26,168.6</b>	<b>\$37,583.7</b>	<b>\$9,515.2</b>	<b>\$5,363.2</b>	<b>\$52,462.1</b>

LTD = Long Term Disability, STD = Short Term Disability

**Table 20: Annual Direct and Indirect Costs, Ontario**

5% Prevalence Scenario, By Cost Category

2019 - 2035, Ages 12+

(\$,000,000)

Year	Annual Cost			Cost by Direct Cost Category					Cost by Indirect Cost Category			
	Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total
2019	\$1,752.9	\$3,504.7	\$5,257.6	\$928.0	\$166.9	\$247.9	\$410.1	\$1,752.9	\$2,510.8	\$635.7	\$358.3	\$3,504.7
2020	\$1,695.0	\$3,390.5	\$5,085.5	\$897.3	\$161.4	\$239.7	\$396.6	\$1,695.0	\$2,429.0	\$615.0	\$346.6	\$3,390.5
2021	\$1,627.0	\$3,256.2	\$4,883.3	\$861.4	\$154.9	\$230.1	\$380.7	\$1,627.0	\$2,332.8	\$590.6	\$332.9	\$3,256.2
2022	\$1,547.2	\$3,098.2	\$4,645.4	\$819.1	\$147.3	\$218.8	\$362.0	\$1,547.2	\$2,219.5	\$561.9	\$316.7	\$3,098.2
2023	\$1,461.8	\$2,931.8	\$4,393.6	\$773.9	\$139.2	\$206.7	\$342.0	\$1,461.8	\$2,100.3	\$531.7	\$299.7	\$2,931.8
2024	\$1,373.2	\$2,761.6	\$4,134.7	\$727.0	\$130.7	\$194.2	\$321.3	\$1,373.2	\$1,978.4	\$500.9	\$282.3	\$2,761.6
2025	\$1,288.6	\$2,599.1	\$3,887.7	\$682.2	\$122.7	\$182.2	\$301.5	\$1,288.6	\$1,862.0	\$471.4	\$265.7	\$2,599.1
2026	\$1,217.0	\$2,461.7	\$3,678.7	\$644.3	\$115.9	\$172.1	\$284.8	\$1,217.0	\$1,763.5	\$446.5	\$251.7	\$2,461.7
2027	\$1,151.1	\$2,334.1	\$3,485.2	\$609.4	\$109.6	\$162.8	\$269.3	\$1,151.1	\$1,672.1	\$423.3	\$238.6	\$2,334.1
2028	\$1,090.8	\$2,216.5	\$3,307.4	\$577.5	\$103.9	\$154.2	\$255.2	\$1,090.8	\$1,587.9	\$402.0	\$226.6	\$2,216.5
2029	\$1,040.3	\$2,116.9	\$3,157.2	\$550.7	\$99.0	\$147.1	\$243.4	\$1,040.3	\$1,516.5	\$384.0	\$216.4	\$2,116.9
2030	\$993.3	\$2,023.6	\$3,016.9	\$525.8	\$94.6	\$140.4	\$232.4	\$993.3	\$1,449.7	\$367.0	\$206.9	\$2,023.6
2031	\$948.3	\$1,933.4	\$2,881.7	\$502.0	\$90.3	\$134.1	\$221.9	\$948.3	\$1,385.1	\$350.7	\$197.7	\$1,933.4
2032	\$907.7	\$1,851.6	\$2,759.3	\$480.5	\$86.4	\$128.3	\$212.4	\$907.7	\$1,326.5	\$335.8	\$189.3	\$1,851.6
2033	\$869.4	\$1,774.2	\$2,643.6	\$460.3	\$82.8	\$122.9	\$203.4	\$869.4	\$1,271.0	\$321.8	\$181.4	\$1,774.2
2034	\$833.9	\$1,702.0	\$2,536.0	\$441.5	\$79.4	\$117.9	\$195.1	\$833.9	\$1,219.3	\$308.7	\$174.0	\$1,702.0
2035	\$801.8	\$1,636.3	\$2,438.1	\$424.5	\$76.3	\$113.4	\$187.6	\$801.8	\$1,172.2	\$296.8	\$167.3	\$1,636.3
<b>Total</b>	<b>\$20,599.4</b>	<b>\$41,592.4</b>	<b>\$62,191.8</b>	<b>\$10,905.5</b>	<b>\$1,961.3</b>	<b>\$2,912.7</b>	<b>\$4,819.8</b>	<b>\$20,599.4</b>	<b>\$29,796.7</b>	<b>\$7,543.8</b>	<b>\$4,252.0</b>	<b>\$41,592.4</b>

LTD = Long Term Disability, STD = Short Term Disability

**Table 21: Annual Direct and Indirect Costs Avoided, Ontario**

Moving from the Current to the 5% Scenario, By Cost Category

2019 - 2035, Ages 12+

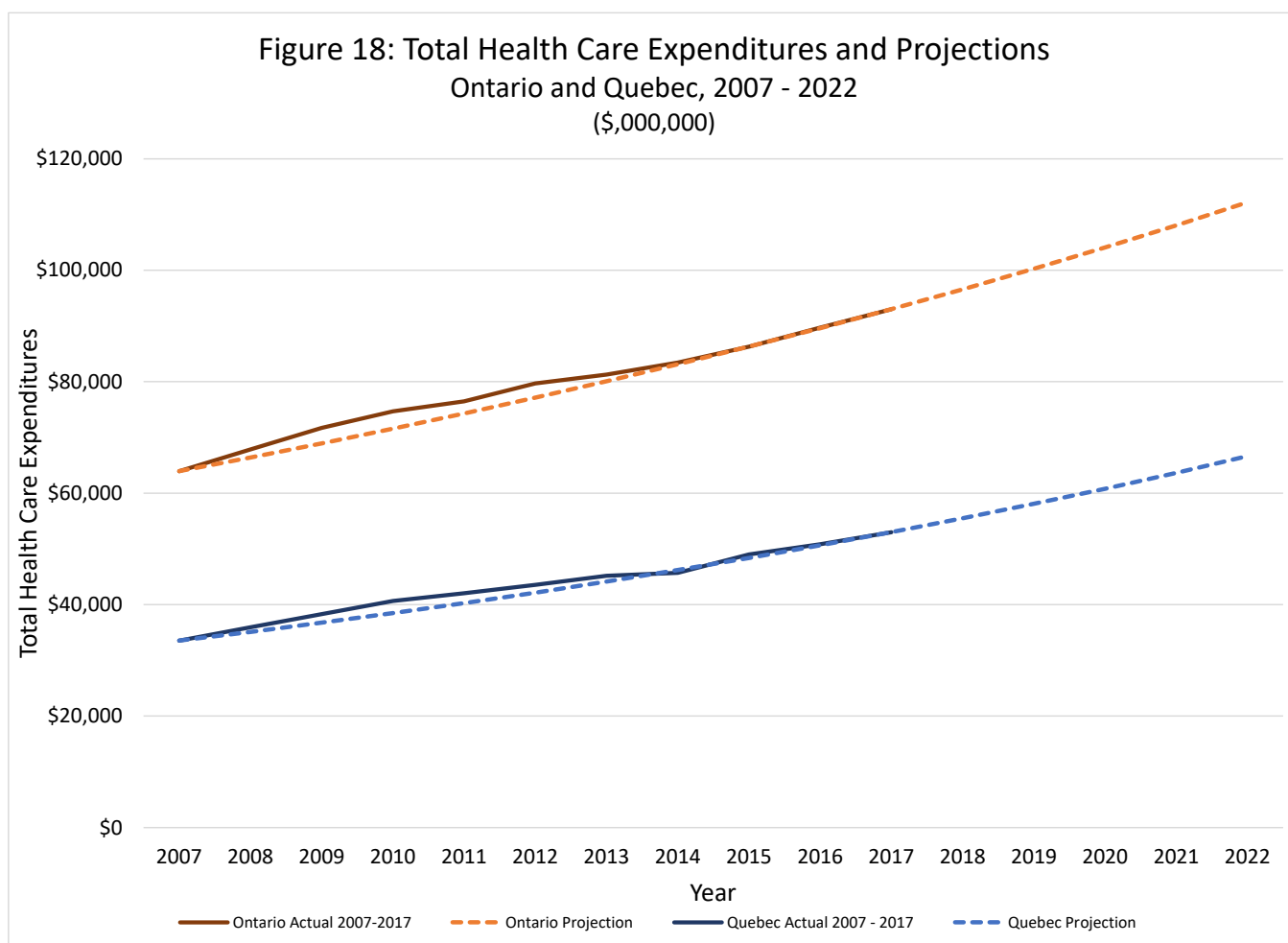
(\$,000,000)

Year	Annual Cost Avoided			Cost Avoided by Direct Cost Category					Cost Avoided by Indirect Cost Category			
	Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total
2019	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
2020	\$16.1	\$32.0	\$48.2	\$8.2	\$1.7	\$1.8	\$4.4	\$16.1	\$22.1	\$6.3	\$3.6	\$32.0
2021	\$46.9	\$93.3	\$140.2	\$23.8	\$5.0	\$5.3	\$12.8	\$46.9	\$64.5	\$18.4	\$10.5	\$93.3
2022	\$90.8	\$180.7	\$271.5	\$46.0	\$9.8	\$10.3	\$24.8	\$90.8	\$124.9	\$35.6	\$20.3	\$180.7
2023	\$141.4	\$278.6	\$420.0	\$71.6	\$15.2	\$16.0	\$38.6	\$141.4	\$192.5	\$54.8	\$31.3	\$278.6
2024	\$197.6	\$385.1	\$582.7	\$100.1	\$21.2	\$22.4	\$53.9	\$197.6	\$266.1	\$75.8	\$43.2	\$385.1
2025	\$250.7	\$485.7	\$736.4	\$127.0	\$26.9	\$28.3	\$68.4	\$250.7	\$335.6	\$95.6	\$54.5	\$485.7
2026	\$302.2	\$583.9	\$886.1	\$153.1	\$32.5	\$34.2	\$82.5	\$302.2	\$403.5	\$114.9	\$65.5	\$583.9
2027	\$349.8	\$675.7	\$1,025.5	\$177.2	\$37.6	\$39.6	\$95.5	\$349.8	\$466.8	\$133.0	\$75.8	\$675.7
2028	\$393.9	\$761.8	\$1,155.7	\$199.5	\$42.3	\$44.5	\$107.5	\$393.9	\$526.4	\$149.9	\$85.5	\$761.8
2029	\$434.9	\$843.2	\$1,278.2	\$220.3	\$46.7	\$49.2	\$118.7	\$434.9	\$582.6	\$166.0	\$94.7	\$843.2
2030	\$473.5	\$920.4	\$1,393.9	\$239.9	\$50.9	\$53.6	\$129.3	\$473.5	\$635.9	\$181.1	\$103.3	\$920.4
2031	\$509.7	\$993.6	\$1,503.3	\$258.2	\$54.7	\$57.6	\$139.1	\$509.7	\$686.6	\$195.6	\$111.5	\$993.6
2032	\$544.3	\$1,064.2	\$1,608.5	\$275.7	\$58.5	\$61.6	\$148.6	\$544.3	\$735.3	\$209.4	\$119.4	\$1,064.2
2033	\$576.8	\$1,130.7	\$1,707.5	\$292.2	\$61.9	\$65.2	\$157.5	\$576.8	\$781.3	\$222.5	\$126.9	\$1,130.7
2034	\$606.8	\$1,192.3	\$1,799.1	\$307.3	\$65.2	\$68.6	\$165.6	\$606.8	\$823.8	\$234.7	\$133.8	\$1,192.3
2035	\$633.8	\$1,248.4	\$1,882.1	\$321.0	\$68.1	\$71.7	\$173.0	\$633.8	\$862.6	\$245.7	\$140.1	\$1,248.4
<b>Total</b>	<b>\$5,569.2</b>	<b>\$10,869.7</b>	<b>\$16,438.9</b>	<b>\$2,821.0</b>	<b>\$598.1</b>	<b>\$629.9</b>	<b>\$1,520.2</b>	<b>\$5,569.2</b>	<b>\$7,510.4</b>	<b>\$2,139.2</b>	<b>\$1,220.1</b>	<b>\$10,869.7</b>

LTD = Long Term Disability, STD = Short Term Disability

### Adjusting for Inflation in Total Annual Health Care Expenditures and Projections

In order to adjust for inflation in health care costs, we calculated the average annual increase in total health care expenditures for Quebec and Ontario between 2008 and 2017.<sup>48</sup> Between 2008 and 2017, total health care expenditures in Quebec increased from \$33.5 to \$53.0 billion, an average annual increase of 4.69%. Between 2008 and 2017, total health care expenditures in Ontario increased from \$63.9 to \$93.0 billion, an average annual increase of 3.82%. Figure 18 shows the actual data (solid line) and the calculated rate (dotted line) projected through 2022 (for illustrative purposes).



<sup>48</sup> Canadian Institute for Health Information. *National Health Expenditure Trends, 1975 to 2019: Data Tables — Series D1*. Available online at <https://www.cihi.ca/en/national-health-expenditure-trends-1975-to-2019>. Accessed June 2020.

Quebec

The Quebec average annual increase of 4.69% was applied to the data summarized in Table 18, resulting in the cost estimates in Table 22. With adjustments for inflation, the 5% scenario would lead to an annual cost avoided of \$2.89 billion in 2035 (compared with \$1.33 billion in unadjusted costs). Cumulatively, costs avoided between 2020 and 2035 are estimated at \$22.2 billion (compared with \$12.7 billion in unadjusted costs).

Table 22: Annual Direct and Indirect Costs Avoided, Quebec															
Adjusted for Inflation, by Cost Category															
2019 - 2035, Ages 12+															
(\$,000,000)															
Year	Target Prevalence	Annual Cost Avoided			Cost Avoided by Direct Cost Category					Cost Avoided by Indirect Cost Category					
		Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total		
2019	17.1%	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
2020	15.4%	\$14.3	\$30.6	\$44.9	\$7.3	\$1.5	\$1.6	\$3.9	\$14.3	\$21.1	\$6.0	\$3.4	\$30.6	\$65.1	\$18.5
2021	13.7%	\$44.1	\$94.2	\$138.3	\$22.3	\$4.7	\$5.0	\$12.0	\$44.1	\$65.1	\$18.5	\$10.6	\$94.2	\$131.3	\$37.4
2022	12.2%	\$88.9	\$190.0	\$278.8	\$45.0	\$9.5	\$10.1	\$24.3	\$88.9	\$131.3	\$37.4	\$21.3	\$190.0	\$211.4	\$60.2
2023	10.8%	\$144.8	\$306.0	\$450.8	\$73.3	\$15.5	\$16.4	\$39.5	\$144.8	\$211.4	\$60.2	\$34.3	\$306.0	\$303.6	\$86.5
2024	9.7%	\$210.6	\$439.4	\$650.1	\$106.7	\$22.6	\$23.8	\$57.5	\$210.6	\$303.6	\$86.5	\$49.3	\$439.4	\$400.5	\$114.1
2025	8.8%	\$279.6	\$579.6	\$859.3	\$141.6	\$30.0	\$31.6	\$76.3	\$279.6	\$400.5	\$114.1	\$65.1	\$579.6	\$499.3	\$142.2
2026	8.0%	\$349.8	\$722.7	\$1,072.5	\$177.2	\$37.6	\$39.6	\$95.5	\$349.8	\$499.3	\$142.2	\$81.1	\$722.7	\$595.3	\$169.6
2027	7.4%	\$417.1	\$861.5	\$1,278.6	\$211.3	\$44.8	\$47.2	\$113.9	\$417.1	\$595.3	\$169.6	\$96.7	\$861.5	\$688.6	\$196.1
2028	6.9%	\$481.7	\$996.6	\$1,478.2	\$244.0	\$51.7	\$54.5	\$131.5	\$481.7	\$688.6	\$196.1	\$111.9	\$996.6	\$782.3	\$222.8
2029	6.4%	\$545.6	\$1,132.2	\$1,677.8	\$276.3	\$58.6	\$61.7	\$148.9	\$545.6	\$782.3	\$222.8	\$127.1	\$1,132.2	\$877.0	\$249.8
2030	6.0%	\$609.0	\$1,269.3	\$1,878.3	\$308.5	\$65.4	\$68.9	\$166.2	\$609.0	\$877.0	\$249.8	\$142.5	\$1,269.3	\$970.7	\$276.5
2031	5.7%	\$670.9	\$1,404.9	\$2,075.7	\$339.8	\$72.0	\$75.9	\$183.1	\$670.9	\$970.7	\$276.5	\$157.7	\$1,404.9	\$1,063.4	\$302.9
2032	5.5%	\$731.7	\$1,539.0	\$2,270.7	\$370.6	\$78.6	\$82.8	\$199.7	\$731.7	\$1,063.4	\$302.9	\$172.8	\$1,539.0	\$1,156.7	\$329.5
2033	5.3%	\$792.8	\$1,674.1	\$2,466.9	\$401.6	\$85.1	\$89.7	\$216.4	\$792.8	\$1,156.7	\$329.5	\$187.9	\$1,674.1	\$1,255.5	\$357.6
2034	5.2%	\$857.3	\$1,817.1	\$2,674.4	\$434.2	\$92.1	\$97.0	\$234.0	\$857.3	\$1,255.5	\$357.6	\$204.0	\$1,817.1	\$1,358.2	\$386.9
2035	5.0%	\$923.7	\$1,965.7	\$2,889.4	\$467.9	\$99.2	\$104.5	\$252.1	\$923.7	\$1,358.2	\$386.9	\$220.6	\$1,965.7	\$1,380.1	\$2,956.6
<b>Total</b>		<b>\$7,161.9</b>	<b>\$15,022.9</b>	<b>\$22,184.8</b>	<b>\$3,627.8</b>	<b>\$769.2</b>	<b>\$810.0</b>	<b>\$1,955.0</b>	<b>\$7,161.9</b>	<b>\$10,380.1</b>	<b>\$2,956.6</b>	<b>\$1,686.3</b>	<b>\$15,022.9</b>		

LTD = Long Term Disability, STD = Short Term Disability

Ontario

The Ontario average annual increase of 3.82% was applied to the data summarized in Table 21, resulting in the cost estimates in Table 23. With adjustments for inflation, the 5% scenario would lead to an annual cost avoided of \$3.56 billion in 2035 (compared with \$1.88 billion in unadjusted costs). Cumulatively, costs avoided between 2020 and 2035 are estimated at \$26.1 billion (compared with \$16.4 billion in unadjusted costs).

Year	Target Prevalence	Annual Cost Avoided		Cost Avoided by Direct Cost Category						Cost Avoided by Indirect Cost Category			
		Direct	Indirect	Total	Hospital	Physician	Drug	Other	Total	Mortality	LTD	STD	Total
2019	15.2%	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0	\$0.0
2020	13.8%	\$17.4	\$34.5	\$51.9	\$8.8	\$1.9	\$2.0	\$4.7	\$17.4	\$23.9	\$6.8	\$3.9	\$34.5
2021	12.6%	\$52.5	\$104.4	\$156.9	\$26.6	\$5.6	\$5.9	\$14.3	\$52.5	\$72.1	\$20.5	\$11.7	\$104.4
2022	11.5%	\$105.5	\$209.9	\$315.4	\$53.4	\$11.3	\$11.9	\$28.8	\$105.5	\$145.1	\$41.3	\$23.6	\$209.9
2023	10.5%	\$170.6	\$336.0	\$506.5	\$86.4	\$18.3	\$19.3	\$46.6	\$170.6	\$232.2	\$66.1	\$37.7	\$336.0
2024	9.6%	\$247.5	\$482.2	\$729.6	\$125.3	\$26.6	\$28.0	\$67.5	\$247.5	\$333.2	\$94.9	\$54.1	\$482.2
2025	8.9%	\$325.8	\$631.4	\$957.2	\$165.0	\$35.0	\$36.9	\$88.9	\$325.8	\$436.3	\$124.3	\$70.9	\$631.4
2026	8.2%	\$407.9	\$788.0	\$1,195.9	\$206.6	\$43.8	\$46.1	\$111.3	\$407.9	\$544.5	\$155.1	\$88.5	\$788.0
2027	7.6%	\$490.1	\$946.6	\$1,436.8	\$248.3	\$52.6	\$55.4	\$133.8	\$490.1	\$654.1	\$186.3	\$106.3	\$946.6
2028	7.1%	\$572.9	\$1,108.2	\$1,681.1	\$290.2	\$61.5	\$64.8	\$156.4	\$572.9	\$765.7	\$218.1	\$124.4	\$1,108.2
2029	6.7%	\$656.8	\$1,273.4	\$1,930.2	\$332.7	\$70.5	\$74.3	\$179.3	\$656.8	\$879.9	\$250.6	\$142.9	\$1,273.4
2030	6.3%	\$742.4	\$1,443.0	\$2,185.3	\$376.0	\$79.7	\$84.0	\$202.6	\$742.4	\$997.0	\$284.0	\$162.0	\$1,443.0
2031	5.9%	\$829.6	\$1,617.3	\$2,446.9	\$420.2	\$89.1	\$93.8	\$226.5	\$829.6	\$1,117.5	\$318.3	\$181.5	\$1,617.3
2032	5.6%	\$919.8	\$1,798.2	\$2,718.0	\$465.9	\$98.8	\$104.0	\$251.1	\$919.8	\$1,242.5	\$353.9	\$201.8	\$1,798.2
2033	5.4%	\$1,011.9	\$1,983.6	\$2,995.6	\$512.6	\$108.7	\$114.5	\$276.2	\$1,011.9	\$1,370.6	\$390.4	\$222.7	\$1,983.6
2034	5.2%	\$1,105.1	\$2,171.6	\$3,276.7	\$559.8	\$118.7	\$125.0	\$301.7	\$1,105.1	\$1,500.4	\$427.4	\$243.8	\$2,171.6
2035	5.0%	\$1,198.4	\$2,360.5	\$3,558.8	\$607.0	\$128.7	\$135.5	\$327.1	\$1,198.4	\$1,631.0	\$464.5	\$265.0	\$2,360.5
<b>Total</b>		<b>\$8,854.0</b>	<b>\$17,288.9</b>	<b>\$26,142.9</b>	<b>\$4,484.9</b>	<b>\$950.9</b>	<b>\$1,001.4</b>	<b>\$2,416.9</b>	<b>\$8,854.0</b>	<b>\$11,945.7</b>	<b>\$3,402.5</b>	<b>\$1,940.6</b>	<b>\$17,288.9</b>

LTD = Long Term Disability, STD = Short Term Disability

## Sensitivity Analysis

Any modelling work is based on a series of assumptions that include inherent uncertainty. In this section we adjust changes in the prevalence of smoking and relative risks to assess the effect of these changes on our base model results.

### Changes in the Prevalence of Tobacco Smoking

To determine the upper and lower bounds for prevalence used in our sensitivity analysis, we used province-specific 95% confidence intervals published by Statistics Canada based on the results of the CCHS.<sup>49</sup> We used the 95% confidence intervals for the total population prevalence of daily and occasional smoking combined. For each year and province, we calculated how much the high and low confidence interval differed from the reported prevalence. We took the average difference, as a percentage, of the last four years of available data (2015 – 2018) to determine the upper and lower bounds for our sensitivity analysis. The age- and smoking category- specific rates in 2018 for each province were adjusted up or down by the average difference to estimate the upper and lower prevalence bounds for the sensitivity analysis.

For **Quebec**, changes in the prevalence of tobacco smoking resulted in an overall estimated prevalence of +5.9% / -5.7%, with the base estimate of 17.5% in 2018 ranging from 16.5% to 18.5%. The base estimate for the total number of smokers of 1.28 million ranged from 1.21 to 1.35 million (see Table 24).

For **Ontario**, changes in the prevalence of tobacco smoking resulted in an overall estimated prevalence of +6.1% / -5.9%, with the base estimate of 15.2% in 2018 ranging from 14.3% to 16.2%. The base estimate for the total number of smokers of 1.91 million ranged from 1.80 to 2.02 million (see Table 24).

	Quebec						Ontario					
	% Pop Age 12+ with RF			# Individuals with RF			% Pop Age 12+ with RF			# Individuals with RF		
	Base	Low	High	Base	Low	High	Base	Low	High	Base	Low	High
<b>Males</b>												
<i>Smokers</i>												
Light	9.6%	9.1%	10.2%	349,224	329,318	369,828	9.1%	8.5%	9.6%	558,229	525,293	592,281
Moderate	5.0%	4.7%	5.3%	182,033	171,657	192,773	5.1%	4.8%	5.5%	316,152	297,499	335,438
Heavy	5.1%	4.8%	5.4%	184,513	173,995	195,399	4.6%	4.3%	4.9%	281,649	265,032	298,830
<b>Subtotal - Male</b>	<b>19.7%</b>	<b>18.6%</b>	<b>20.9%</b>	<b>715,770</b>	<b>674,971</b>	<b>758,000</b>	<b>18.8%</b>	<b>17.7%</b>	<b>19.9%</b>	<b>1,156,030</b>	<b>1,087,825</b>	<b>1,226,548</b>
<b>Females</b>												
<i>Smokers</i>												
Light	8.1%	7.6%	8.5%	296,158	279,277	313,631	6.0%	5.6%	6.3%	381,259	358,765	404,516
Moderate	4.6%	4.4%	4.9%	170,298	160,591	180,346	3.7%	3.5%	3.9%	234,227	220,408	248,515
Heavy	2.6%	2.5%	2.8%	96,196	90,713	101,871	2.1%	2.0%	2.3%	136,268	128,229	144,581
<b>Subtotal - Female</b>	<b>15.3%</b>	<b>14.4%</b>	<b>16.2%</b>	<b>562,652</b>	<b>530,580</b>	<b>595,848</b>	<b>11.8%</b>	<b>11.1%</b>	<b>12.5%</b>	<b>751,755</b>	<b>707,401</b>	<b>797,612</b>
<b>Both Sexes</b>												
<i>Smokers</i>												
Light	8.8%	8.3%	9.3%	645,382	608,595	683,459	7.5%	7.1%	8.0%	939,488	884,058	996,797
Moderate	4.8%	4.5%	5.1%	352,331	332,248	373,118	4.4%	4.1%	4.7%	550,380	517,907	583,953
Heavy	3.8%	3.6%	4.1%	280,709	264,708	297,270	3.3%	3.1%	3.5%	417,918	393,260	443,411
<b>Total Smokers</b>	<b>17.5%</b>	<b>16.5%</b>	<b>18.5%</b>	<b>1,278,421</b>	<b>1,205,551</b>	<b>1,353,848</b>	<b>15.2%</b>	<b>14.3%</b>	<b>16.2%</b>	<b>1,907,785</b>	<b>1,795,226</b>	<b>2,024,160</b>
RF = Risk Factor												

<sup>49</sup> Statistics Canada. Table 13-10-0096-01 Health characteristics, annual estimates. 2018. Available at: <https://www150.statcan.gc.ca/t1/tb11/en/tv.action?pid=1310009601>. Accessed July 2020.

The ranges in the prevalence of tobacco smoking were the included in the economic burden model to assess their impact on the overall economic burden.

For **Quebec**, changes in the prevalence of tobacco smoking resulted in an overall estimated change in the economic burden of +/-3.0%, with the base estimate of \$3.79 billion in 2018 ranging from \$3.70 to \$3.91 billion (see Table 25).

For **Ontario**, changes in the prevalence of tobacco smoking resulted in an overall estimated change in the economic burden of +/-3.4%, with the base estimate of \$5.36 billion in 2018 ranging from \$5.18 to \$5.54 billion (see Table 25).

<b>Table 25: Economic Burden Attributable to Tobacco Smoking</b>						
In Quebec and Ontario, 2018						
Sensitivity Analysis - Change in Prevalence						
(\$ millions)						
	Quebec			Ontario		
	Base	Low	High	Base	Low	High
<b>Direct Costs</b>						
Hospital	\$635	\$617	\$653	\$906	\$877	\$935
Physician	\$114	\$110	\$119	\$192	\$184	\$200
Drug	\$170	\$163	\$177	\$202	\$193	\$212
Other	\$281	\$272	\$290	\$488	\$471	\$506
<b>Subtotal - Direct Costs</b>	<b>\$1,200</b>	<b>\$1,162</b>	<b>\$1,239</b>	<b>\$1,789</b>	<b>\$1,725</b>	<b>\$1,852</b>
<b>Indirect Costs</b>						
Premature Mortality	\$1,857	\$1,804	\$1,911	\$2,468	\$2,385	\$2,550
Long-term Disability	\$470	\$454	\$486	\$703	\$677	\$729
Short-term Disability	\$265	\$259	\$271	\$401	\$392	\$410
<b>Subtotal - Indirect Costs</b>	<b>\$2,593</b>	<b>\$2,517</b>	<b>\$2,668</b>	<b>\$3,572</b>	<b>\$3,454</b>	<b>\$3,690</b>
<b>Total Economic Burden</b>	<b>\$3,793</b>	<b>\$3,679</b>	<b>\$3,907</b>	<b>\$5,361</b>	<b>\$5,179</b>	<b>\$5,542</b>



## Changes in Relative Risk

To assess the effect of changes in relative risk, we estimated the 95% confidence intervals associated with each disease category (see *Estimating the Relative Risk* section) and applied these estimates in the economic burden model to assess their impact on the overall economic burden.

For **Quebec**, changes in the relative risk resulted in an overall estimated change in the economic burden of -12.7% to +14.2%, with the base estimate of \$3.79 billion in 2018 ranging from \$3.31 to \$4.33 billion (see Table 26).

For **Ontario**, changes in the relative risk resulted in an overall estimated change in the economic burden of -14.1% to +16.0%, with the base estimate of \$5.36 billion in 2018 ranging from \$4.60 to \$6.22 billion (see Table 26).

<b>Table 26: Economic Burden Attributable to Tobacco Smoking</b>						
<b>In Quebec and Ontario, 2018</b>						
<b>Sensitivity Analysis - Change in Relative Risk</b>						
<b>(\$ millions)</b>						
	<b>Quebec</b>			<b>Ontario</b>		
	<b>Base</b>	<b>Low</b>	<b>High</b>	<b>Base</b>	<b>Low</b>	<b>High</b>
<b>Direct Costs</b>						
Hospital	\$635	\$577	\$697	\$906	\$818	\$1,001
Physician	\$114	\$94	\$138	\$192	\$158	\$231
Drug	\$170	\$118	\$232	\$202	\$125	\$295
Other	\$281	\$241	\$325	\$488	\$414	\$572
<b>Subtotal - Direct Costs</b>	<b>\$1,200</b>	<b>\$1,030</b>	<b>\$1,392</b>	<b>\$1,789</b>	<b>\$1,515</b>	<b>\$2,099</b>
<b>Indirect Costs</b>						
Premature Mortality	\$1,857	\$1,640	\$2,099	\$2,468	\$2,136	\$2,840
Long-term Disability	\$470	\$397	\$553	\$703	\$585	\$839
Short-term Disability	\$265	\$243	\$289	\$401	\$367	\$437
<b>Subtotal - Indirect Costs</b>	<b>\$2,593</b>	<b>\$2,280</b>	<b>\$2,941</b>	<b>\$3,572</b>	<b>\$3,088</b>	<b>\$4,116</b>
<b>Total Economic Burden</b>	<b>\$3,793</b>	<b>\$3,310</b>	<b>\$4,333</b>	<b>\$5,361</b>	<b>\$4,604</b>	<b>\$6,216</b>

## Changes in the Prevalence and Relative Risk

Finally, we assessed the effect of modifying changes in the prevalence of smoking and relative risks simultaneously.

For **Quebec**, simultaneous changes in the prevalence of tobacco smoking and relative risk resulted in an overall estimated change in the economic burden of -15.3% to +17.7%, with the base estimate of \$3.79 billion in 2018 ranging from \$3.21 to \$4.47 billion (see Table 27).

For **Ontario**, simultaneous changes in the prevalence of tobacco smoking and relative risk resulted in an overall estimated change in the economic burden of -17.0% to +19.9%, with the base estimate of \$5.36 billion in 2018 ranging from \$4.45 to \$6.43 billion (see Table 27).

<b>Table 27: Economic Burden Attributable to Tobacco Smoking</b>						
In Quebec and Ontario, 2018						
Sensitivity Analysis - Change in Prevalence and Relative Risk						
(\$ millions)						
	Quebec			Ontario		
	Base	Low	High	Base	Low	High
<b>Direct Costs</b>						
Hospital	\$635	\$561	\$717	\$906	\$792	\$1,032
Physician	\$114	\$90	\$143	\$192	\$151	\$241
Drug	\$170	\$113	\$242	\$202	\$120	\$309
Other	\$281	\$234	\$336	\$488	\$400	\$593
<b>Subtotal - Direct Costs</b>	<b>\$1,200</b>	<b>\$998</b>	<b>\$1,437</b>	<b>\$1,789</b>	<b>\$1,463</b>	<b>\$2,175</b>
<b>Indirect Costs</b>						
Premature Mortality	\$1,857	\$1,594	\$2,160	\$2,468	\$2,066	\$2,936
Long-term Disability	\$470	\$384	\$572	\$703	\$564	\$871
Short-term Disability	\$265	\$237	\$295	\$401	\$359	\$447
<b>Subtotal - Indirect Costs</b>	<b>\$2,593</b>	<b>\$2,216</b>	<b>\$3,027</b>	<b>\$3,572</b>	<b>\$2,989</b>	<b>\$4,254</b>
<b>Total Economic Burden</b>	<b>\$3,793</b>	<b>\$3,214</b>	<b>\$4,465</b>	<b>\$5,361</b>	<b>\$4,452</b>	<b>\$6,428</b>

In the concluding section of this report, we apply a reduction of 15.3% and an increase of 17.7% to our calculated results for Quebec to estimate a lower and upper bound for the economic burden of tobacco smoking. Similarly, a reduction of 17.0% and an increase of 19.9% are applied to the calculated values for Ontario to provide lower and upper bound estimates in that province. The results are shown as ranges in parentheses in the concluding section of the report and in the Executive Summary.

Figure 19 and 20 provide a visual representation of these upper and lower bounds as applied to the potential costs avoided associated with the 5% scenario in both Quebec (Figure 19) and Ontario (Figure 20).

Figure 19: Total Costs Avoided in Quebec, with Upper and Lower Bounds  
 5% by 2035 vs. Current Trend Scenarios  
 (\$,000,000,000)

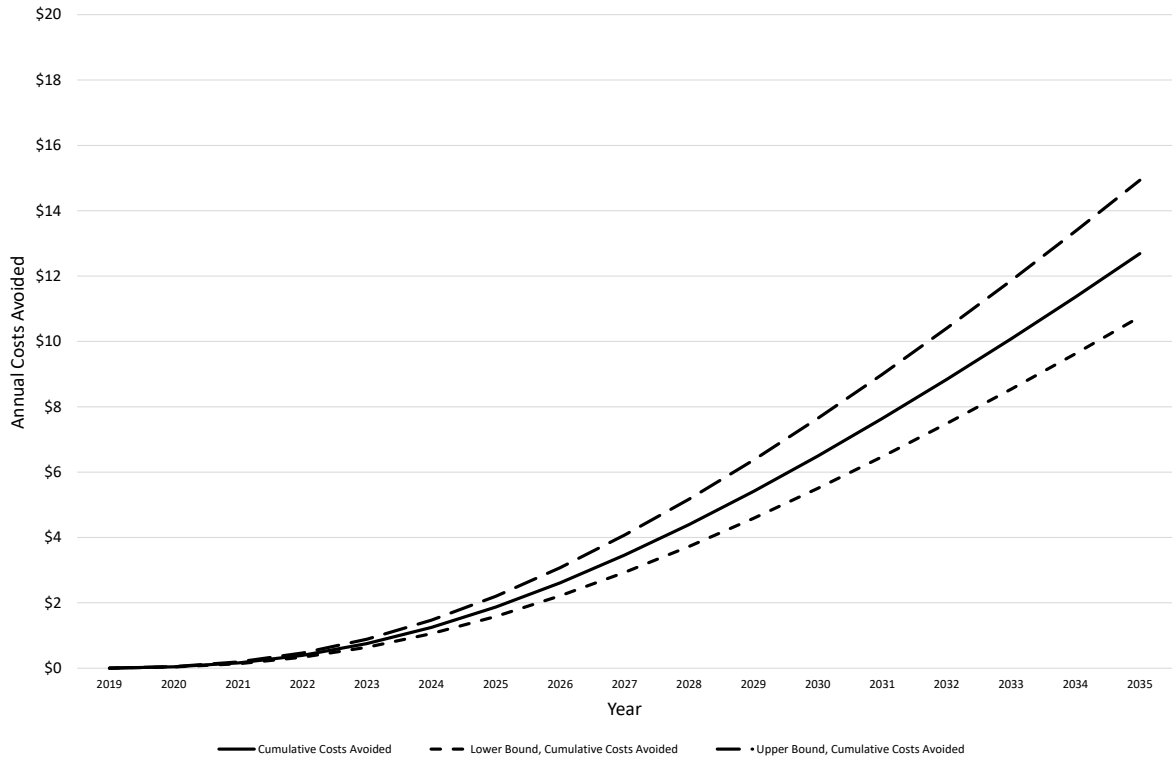
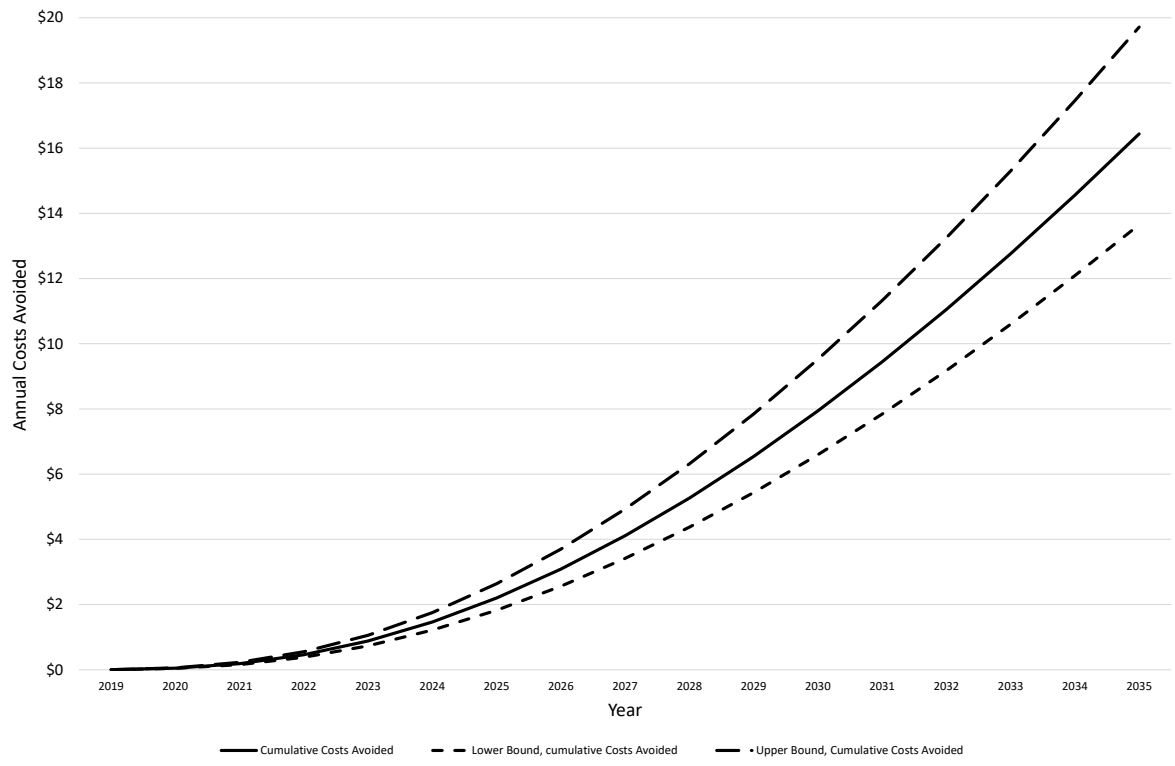


Figure 20: Total Costs Avoided in Ontario, with Upper and Lower Bounds  
 5% by 2035 vs. Current Trend Scenarios  
 (\$,000,000,000)



## Comparison with Previous Estimates

In our previous work, we estimated the economic burden attributable to tobacco smoking in Canada in 2013 to be \$19.49 billion, \$6.65 billion in direct and \$12.83 billion in indirect costs.<sup>50</sup> Unpublished estimates for Quebec and Ontario from this study were \$5.37 billion (\$1.74 billion in direct and \$3.63 billion in indirect costs) and \$6.25 billion (\$2.16 billion in direct and \$4.09 billion in indirect costs).

The difference between our previous study and the current work for **Quebec** is substantial (\$5.37 to \$3.79 billion, a change of \$1.58 billion or 29%; a decrease from \$1.74 billion to \$1.20 billion in direct costs and from \$3.63 billion to \$2.59 billion in indirect costs). Costs per smoker have decreased from an estimated \$3,198 in 2013 to \$2,967 in 2018. In the current work, we adjusted our model to reflect the lower overall relative risk observed in males for most tobacco-related diseases.<sup>51</sup> This would result in a decrease in the overall economic burden for males compared with our previous work. Much more important, however, is the recent dramatic decline in smoking rates observed in the province. Between 2013 and 2018, smoking rates in Quebec have declined from 21.4% to 17.5% of the population ages 12 and older, an 18.4% decrease. In particular, rates of heavy smoking have declined by 43.0%.

The difference between our previous study and the current work for **Ontario** is much lower (\$6.25 to \$5.36 billion, a change \$0.89 billion or 14.2%; a decrease from \$2.16 billion to \$1.79 billion in direct costs and from \$4.09 billion to \$3.57 billion in indirect costs). Costs per smoker have remained relatively constant at \$2,812 in 2013 and \$2,810 in 2018. The prevalence of tobacco smoking in Ontario has declined from 18.1% in 2013 to 15.2% in 2018, a reduction of 15.7%. Rates of heavy smoking have declined by 26.8%.

As in Quebec, it is likely this significant decline in the rate of heavy smokers that has resulted in an overall reduction in the economic burden attributable to tobacco smoking in the province between 2013 and 2018, despite inflationary increases during that time (see *Adjusting for Inflation in Total Annual Health Care Expenditures and Projections* above).

The recent report by the Canadian Centre on Substance Use and Addiction (CCSA) estimated the economic burden attributable to tobacco smoking in Canada to be \$12.28 billion in 2017.<sup>52</sup> These costs consist of \$6.39 billion in direct costs and \$5.89 billion in indirect costs (the report refers to these as lost productivity costs). The \$6.39 billion in direct costs are within the range of our 2013 estimate of \$6.65 billion. The CCSA report does note that their total direct costs are missing costs on inpatient hospitalizations, day surgeries and emergency department visits from Quebec.

The CCSA estimate for indirect costs of \$5.89 billion is substantially lower than our 2013 estimate of \$12.83 billion. The CCSA approach used the human capital method in assessing the indirect costs attributable to premature mortality but they did not modify the approach (as we have in both the 2013 estimates and the current work) to incorporate unpaid work and leisure time. As noted in the section on the *Calculation of Indirect Costs*, the approach used can have a significant effect on estimates. Not valuing unpaid work and leisure time, as per the CCSA

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<sup>50</sup> Krueger H, Koot J, Andres E. The economic benefits of fruit and vegetable consumption in Canada. *Canadian Journal of Public Health*. 2017; 108(2): e152-61.

<sup>51</sup> Mucha L, Stephenson J, Morandi N et al. Meta-analysis of disease risk associated with smoking, by gender and intensity of smoking. *Gender Medicine*. 2006; 3(4): 279-91.

<sup>52</sup> Canadian Substance Use Costs and Harms Scientific Working Group. *Canadian substance use costs and harms 2015–2017*. 2020. Available online at <https://www.ccsa.ca/sites/default/files/2020-06/CSUCH-Canadian-Substance-Use-Costs-Harms-Report-2020-en.pdf>. Accessed July 2020.

report, would result in substantially lower indirect costs attributable to premature mortality as many of the deaths attributable to tobacco smoking would occur in the elderly, retired population.

The 2017 report by the Conference Board of Canada estimated the economic burden attributable to tobacco use in Canada in 2012 to be \$16.2 billion, \$6.74 billion in direct costs and \$9.49 billion in indirect costs.<sup>53</sup> The \$6.74 billion in direct costs are within the range of our 2013 estimate of \$6.65 billion. Once again, however, the indirect costs of \$9.49 billion are lower than our 2013 estimate of \$12.83 billion. Like the CCSA work, the analysis for the Conference Board of Canada used the human capital approach but did not include any modifications to value unpaid work and leisure time.

The Conference Board of Canada report also provides results by province.<sup>54</sup> In 2012, the direct costs in Quebec were estimated at \$1.87 billion, compared with our 2013 estimate of \$1.74 billion. In 2012, the direct costs in Ontario were estimated at \$2.26 billion, compared with our 2013 estimate of \$2.16 billion.

The 2013-14 Quebec government budget estimated direct health care costs attributable to smoking to be \$1.6 billion in 2012.<sup>55</sup> This estimate compares with our estimates of tobacco-attributable direct costs in Quebec of \$1.74 billion in 2013 and \$1.20 billion in 2018.

An earlier report by Cremieux and colleagues estimated the direct costs attributable to tobacco smoking in Quebec in 2007/08 to be \$995 million.<sup>56</sup> This compares with our 2018 estimate of \$1,200 million. As we have noted earlier, there have been significant reductions in smoking prevalence in Quebec, even just between 2013 and 2018. These reductions, together with health care cost increases between 2007/08 and 2018 mean that the two estimates are not comparable.

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<sup>53</sup> Dobrescu A, Bhandari A, Sutherland G et al. *The Costs of Tobacco Use in Canada, 2012*. 2017. Ottawa: The Conference Board of Canada. Available online at [https://www.conferenceboard.ca/temp/7eee428e-4732-4728-b76e-01d3e8684c18/9185\\_Costs-Tobacco-Use\\_RPT.pdf](https://www.conferenceboard.ca/temp/7eee428e-4732-4728-b76e-01d3e8684c18/9185_Costs-Tobacco-Use_RPT.pdf). Accessed July 2020.

<sup>54</sup> Dobrescu A, Bhandari A, Sutherland G et al. *The Costs of Tobacco Use in Canada, 2012*. 2017. Ottawa: The Conference Board of Canada. Available online at [https://www.conferenceboard.ca/temp/7eee428e-4732-4728-b76e-01d3e8684c18/9185\\_Costs-Tobacco-Use\\_RPT.pdf](https://www.conferenceboard.ca/temp/7eee428e-4732-4728-b76e-01d3e8684c18/9185_Costs-Tobacco-Use_RPT.pdf). Accessed July 2020. See Table 17 on page 52.

<sup>55</sup> Government of Quebec. *Plan Budgétaire. Budget 2013-2014*. Available at <http://www.budget.finances.gouv.qc.ca/budget/2013-2014/fr/documents/Planbudgetaire.pdf>. Accessed August 2020.

<sup>56</sup> Cremieux P, Pinheiro L, Ginn M et al. Impact direct du tabagisme sur le système de santé qu Québec. Groupe d'Analyse. 2010. Available online at [http://cqct.qc.ca/Documents\\_docs/DOCU\\_2010/ETUD\\_10\\_08\\_10\\_GroupeDAnalyse\\_FardeauTabac\\_FINAL.pdf](http://cqct.qc.ca/Documents_docs/DOCU_2010/ETUD_10_08_10_GroupeDAnalyse_FardeauTabac_FINAL.pdf). Accessed July 2020.

## Conclusions

### Quebec

In 2000, in Quebec, an estimated 29.2% of the population ages 12 and older smoked (30.9% of males and 27.5% of females). This has decreased to an estimated 17.5% in 2018 (19.7% for males and 15.3% for females) or 1.3 million smokers (716,000 males and 563,000 females).

The total economic burden attributable to tobacco smoking in Quebec in 2018 is estimated at \$3.79 billion (ranging from \$3.27 to \$4.57 billion). Of this \$3.79 billion, \$1.20 billion (ranging from \$1.02 to \$1.48 billion) is for direct costs and \$2.59 billion (ranging from \$2.25 to \$3.09 billion) is for indirect costs.

Given current trends and estimated population growth, there would be an estimated 1,046,000 smokers in Quebec in 2035. This would decline to an estimated 405,000 smokers under the 5% scenario, or 641,000 fewer smokers. The reduction in the number of smokers under the 5% scenario consists of 426,000 (66% of the total) fewer light smokers, 172,000 (27%) fewer moderate smokers and 44,000 (7%) fewer heavy smokers.

This reduction in the number of smokers in the province, in turn, would lead to a reduction in the economic burden attributable to tobacco smoking of \$1.33 billion (ranging from \$1.12 to \$1.56 billion) in 2035, with \$424 million (ranging from \$359 to \$499 million) in direct costs and \$903 million (ranging from \$765 to \$1,062 million) in indirect costs. Cumulatively, costs avoided between 2020 and 2035 are estimated at \$12.7 billion, ranging from \$10.7 to \$14.9 billion (using constant 2018 dollars).

Between 2008 and 2017, Quebec saw an average annual increase of 4.69% in health care expenditures. If we assume a similar annual rate of increase through 2035, the 5% scenario in Quebec would lead to a reduction in the economic burden attributable to tobacco smoking of \$2.89 billion (ranging from \$2.45 to \$3.40 billion) in 2035 and cumulative costs avoided between 2020 and 2035 of \$22.2 billion (ranging from \$18.8 to \$26.1 billion).

### Ontario

In 2000, in Ontario, an estimated 24.1% of the population ages 12 and older smoked (27.0% of males and 21.4% of females). This has decreased to an estimated 15.2% in 2018 (18.8% for males and 11.8% for females) or 1.91 million smokers (1,156,000 males and 752,000 females).

The total economic burden attributable to tobacco smoking in Ontario in 2018 is estimated at \$5.36 billion (ranging from \$4.45 to \$6.43 billion). Of this \$5.36 billion, \$1.79 billion (ranging from \$1.46 to \$2.18 billion) is for direct costs and \$3.57 billion (ranging from \$2.99 to \$4.25 billion) is for indirect costs.

Given current trends and estimated population growth, there would be an estimated 1,747,000 smokers in Ontario in 2035. This would decline to an estimated 758,000 smokers under the 5% scenario, or 990,000 fewer smokers. The reduction in the number of smokers under the 5% scenario consists of 632,000 (64% of the total) fewer light smokers, 244,000 (25%) fewer moderate smokers and 114,000 (12%) fewer heavy smokers.

This reduction in the number of smokers in the province, in turn, would lead to a reduction in the economic burden attributable to tobacco smoking of \$1.88 billion (ranging from \$1.56 to \$2.26 billion) in 2035, with \$634 million (ranging from \$526 to \$760 million) in direct costs and \$1,248 million (ranging from \$1,037 to \$1,497 million) in indirect costs. Cumulatively,

costs avoided between 2020 and 2035 are estimated at \$16.4 billion, ranging from \$13.7 to \$19.7 billion (using constant 2018 dollars).

Between 2008 and 2017, Ontario saw an average annual increase of 3.82% in health care expenditures. If we assume a similar annual rate of increase through 2035, the 5% scenario in Ontario would lead to a reduction in the economic burden attributable to tobacco smoking of \$3.56 billion (ranging from \$2.96 to \$4.27 billion) in 2035 and cumulative costs avoided between 2020 and 2035 of \$26.1 billion (ranging from \$21.7 to \$31.4 billion).

## Appendix A: Detailed Smoking Prevalence Trend Data

### Quebec

#### Trend in the Prevalence of Tobacco Smoking in Quebec By Sex, Age Group and Smoking Intensity 2000 to 2018

Age Group	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Total Population Age 12 and Older</b>																			
<i>Smoking Intensity - Less than 10 Cigarettes / Day</i>																			
12 to 19	14.8%	14.8%	13.3%	11.7%	11.3%	10.9%	10.7%	10.6%	10.7%	11.1%	11.7%	10.3%	10.1%	10.1%	7.1%	6.3%	6.5%	8.2%	5.1%
20 to 29	13.3%	13.3%	13.7%	14.0%	15.3%	16.6%	16.4%	16.2%	16.2%	17.4%	15.0%	16.0%	16.7%	16.8%	17.9%	15.5%	13.6%	13.6%	16.2%
30 to 39	8.7%	8.7%	9.5%	10.4%	10.1%	9.8%	10.9%	12.1%	12.1%	10.9%	12.6%	12.3%	13.3%	13.2%	13.0%	12.6%	11.5%	11.6%	13.7%
40 to 49	7.3%	7.3%	7.2%	7.2%	7.8%	8.3%	7.9%	7.5%	7.5%	9.0%	12.1%	9.5%	11.3%	11.3%	8.4%	8.5%	8.0%	7.2%	8.6%
50 to 59	5.7%	5.7%	6.1%	6.6%	6.7%	6.9%	7.4%	7.9%	7.9%	6.6%	6.8%	6.3%	6.2%	6.2%	6.2%	7.1%	7.6%	8.1%	7.2%
60 to 69	4.9%	4.9%	4.8%	4.8%	4.7%	4.6%	4.3%	4.0%	4.0%	4.8%	4.5%	4.4%	5.2%	5.2%	4.3%	4.9%	5.0%	5.5%	6.3%
70 to 79	4.3%	4.3%	4.2%	4.0%	4.4%	4.8%	4.7%	4.6%	4.6%	3.2%	3.5%	3.6%	3.4%	3.4%	4.6%	5.3%	4.0%	4.1%	3.4%
≥ 80	4.4%	4.4%	4.4%	4.3%	4.2%	4.0%	3.8%	3.7%	3.7%	3.2%	2.4%	3.2%	4.5%	4.5%	2.5%	1.2%	3.0%	2.2%	4.0%
<b>Total</b>	<b>8.6%</b>	<b>8.5%</b>	<b>8.6%</b>	<b>8.7%</b>	<b>8.9%</b>	<b>9.2%</b>	<b>9.4%</b>	<b>9.5%</b>	<b>8.9%</b>	<b>9.1%</b>	<b>9.7%</b>	<b>8.6%</b>	<b>9.7%</b>	<b>8.1%</b>	<b>8.8%</b>	<b>8.6%</b>	<b>8.1%</b>	<b>8.3%</b>	<b>8.8%</b>
<i>Smoking Intensity - 10 to 19 Cigarettes / Day</i>																			
12 to 19	7.7%	7.7%	7.0%	6.4%	5.0%	3.7%	3.9%	4.1%	4.2%	3.1%	2.4%	2.8%	3.1%	3.1%	2.6%	1.1%	1.6%	1.5%	1.6%
20 to 29	13.3%	13.3%	13.8%	14.2%	12.2%	10.3%	10.2%	10.2%	10.2%	8.0%	8.2%	10.6%	12.1%	12.1%	7.1%	7.4%	7.1%	7.7%	4.7%
30 to 39	10.4%	10.4%	10.2%	10.0%	10.0%	10.1%	9.5%	8.9%	8.9%	8.0%	6.9%	8.5%	8.3%	8.3%	6.0%	6.6%	6.4%	6.3%	4.5%
40 to 49	10.0%	10.0%	8.9%	7.9%	7.9%	7.8%	8.7%	9.6%	9.6%	8.5%	8.7%	6.8%	6.9%	6.9%	8.6%	7.2%	6.2%	7.2%	6.3%
50 to 59	8.1%	8.1%	8.1%	8.0%	7.4%	6.7%	7.1%	7.5%	7.5%	8.7%	10.0%	8.2%	9.2%	9.2%	8.0%	6.9%	6.7%	6.8%	6.5%
60 to 69	5.6%	5.6%	5.5%	5.4%	5.5%	5.6%	5.4%	5.3%	5.3%	5.9%	5.6%	4.9%	5.7%	5.7%	4.5%	4.8%	4.9%	4.7%	5.9%
70 to 79	4.6%	4.6%	4.2%	3.7%	3.8%	4.0%	3.7%	3.5%	3.5%	4.0%	5.1%	2.7%	3.3%	3.3%	3.4%	3.2%	3.4%	3.8%	3.4%
≥ 80	1.1%	1.0%	1.7%	2.3%	2.6%	2.8%	1.9%	1.0%	1.0%	2.0%	2.0%	1.5%	0.7%	0.7%	0.5%	0.4%	1.4%	1.4%	1.6%
<b>Total</b>	<b>9.0%</b>	<b>8.9%</b>	<b>8.6%</b>	<b>8.4%</b>	<b>7.8%</b>	<b>7.3%</b>	<b>7.4%</b>	<b>7.6%</b>	<b>7.1%</b>	<b>6.8%</b>	<b>6.9%</b>	<b>6.3%</b>	<b>7.2%</b>	<b>6.6%</b>	<b>5.9%</b>	<b>5.5%</b>	<b>5.3%</b>	<b>5.6%</b>	<b>4.8%</b>
<i>Smoking Intensity - 20 or More Cigarettes / Day</i>																			
12 to 19	3.6%	3.6%	2.8%	2.0%	1.8%	1.7%	1.3%	1.1%	1.1%	1.7%	1.8%	1.4%	1.3%	1.3%	1.6%	0.4%	0.8%	0.1%	0.3%
20 to 29	9.1%	9.1%	7.5%	5.9%	5.6%	5.4%	5.8%	6.2%	6.2%	6.0%	4.8%	4.7%	5.1%	5.1%	3.3%	2.5%	3.2%	2.6%	3.0%
30 to 39	14.3%	14.3%	12.2%	10.0%	9.2%	8.4%	7.7%	6.9%	6.8%	7.5%	9.6%	5.3%	4.4%	4.4%	3.7%	5.0%	4.6%	4.1%	3.4%
40 to 49	18.2%	18.2%	16.1%	14.1%	13.4%	12.7%	13.0%	13.3%	13.3%	9.3%	8.8%	10.2%	11.2%	11.2%	6.7%	4.8%	6.2%	5.0%	4.0%
50 to 59	15.3%	15.3%	14.7%	14.2%	13.2%	12.2%	11.6%	11.0%	11.0%	10.1%	9.6%	12.2%	13.1%	13.2%	8.6%	7.7%	8.0%	8.1%	6.4%
60 to 69	9.4%	9.4%	8.1%	6.8%	7.0%	7.3%	7.5%	7.8%	7.8%	7.3%	7.1%	7.0%	6.7%	6.7%	5.4%	8.2%	5.0%	7.2%	6.3%
70 to 79	4.0%	4.0%	3.8%	3.5%	3.6%	3.6%	3.4%	3.1%	3.1%	3.0%	2.8%	3.0%	3.3%	3.3%	3.1%	1.3%	3.6%	3.1%	2.4%
≥ 80	2.5%	2.5%	2.0%	1.5%	1.5%	1.4%	1.5%	1.7%	1.7%	0.9%	1.3%	0.9%	1.3%	1.3%	1.7%	0.2%	1.7%	0.6%	0.7%
<b>Total</b>	<b>11.6%</b>	<b>11.5%</b>	<b>10.2%</b>	<b>8.9%</b>	<b>8.4%</b>	<b>7.9%</b>	<b>7.9%</b>	<b>7.9%</b>	<b>7.4%</b>	<b>6.6%</b>	<b>6.7%</b>	<b>6.2%</b>	<b>6.9%</b>	<b>6.7%</b>	<b>4.9%</b>	<b>4.6%</b>	<b>4.7%</b>	<b>4.5%</b>	<b>3.8%</b>
<i>All Smoking Intensity Categories Combined</i>																			
12 to 19	26.2%	26.0%	23.2%	20.2%	18.2%	16.3%	15.9%	15.8%	16.0%	15.9%	15.9%	14.6%	14.5%	14.5%	11.2%	7.8%	8.9%	9.7%	7.0%
20 to 29	35.7%	35.7%	34.9%	34.1%	33.2%	32.3%	32.4%	32.5%	32.5%	31.3%	28.0%	31.3%	33.9%	33.9%	28.3%	25.5%	23.9%	23.9%	23.8%
30 to 39	33.3%	33.3%	31.9%	30.4%	29.3%	28.3%	28.1%	27.9%	27.9%	26.4%	29.0%	26.1%	25.9%	25.9%	22.7%	24.2%	22.6%	22.1%	21.5%
40 to 49	35.4%	35.4%	32.3%	29.1%	29.0%	28.8%	29.6%	30.4%	30.4%	26.8%	29.6%	26.6%	29.3%	29.3%	23.8%	20.5%	20.4%	19.5%	18.9%
50 to 59	29.1%	29.1%	28.9%	28.7%	27.3%	25.9%	26.1%	26.4%	26.4%	25.4%	26.3%	26.6%	28.5%	28.5%	22.8%	21.8%	22.3%	23.0%	20.1%
60 to 69	19.9%	19.9%	18.5%	17.0%	17.2%	17.5%	17.3%	17.1%	17.1%	18.0%	17.3%	16.3%	17.6%	17.6%	14.3%	17.9%	14.9%	17.4%	18.5%
70 to 79	13.0%	13.0%	12.1%	11.2%	11.8%	12.3%	11.8%	11.3%	11.3%	10.2%	11.5%	9.3%	10.0%	10.0%	11.1%	9.9%	11.0%	11.0%	9.3%
≥ 80	7.9%	7.9%	8.1%	8.2%	8.2%	8.2%	7.3%	6.4%	6.4%	6.1%	5.7%	5.6%	6.5%	6.5%	4.8%	1.8%	6.0%	4.2%	6.3%
<b>Total Pop.</b>	<b>29.2%</b>	<b>29.0%</b>	<b>27.4%</b>	<b>26.0%</b>	<b>25.2%</b>	<b>24.4%</b>	<b>24.7%</b>	<b>25.1%</b>	<b>23.3%</b>	<b>22.5%</b>	<b>23.3%</b>	<b>21.0%</b>	<b>23.8%</b>	<b>21.4%</b>	<b>19.6%</b>	<b>18.6%</b>	<b>18.1%</b>	<b>18.3%</b>	<b>17.5%</b>



## Trend in the Prevalence of Tobacco Smoking in Quebec

### By Sex, Age Group and Smoking Intensity

2000 to 2018

Age Group	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Males</b>																			
<i>Smoking Intensity - Less than 10 Cigarettes / Day</i>																			
12 to 19	13.2%	13.1%	11.7%	10.2%	9.5%	8.9%	9.9%	10.9%	10.3%	11.4%	14.5%	8.9%	9.9%	9.1%	7.8%	5.2%	5.4%	7.0%	4.0%
20 to 29	12.8%	12.8%	13.0%	13.2%	14.5%	15.8%	16.1%	16.5%	15.3%	17.9%	16.4%	15.0%	19.1%	17.1%	22.2%	15.7%	13.0%	16.3%	19.7%
30 to 39	8.0%	8.0%	9.2%	10.4%	9.8%	9.1%	10.8%	12.6%	11.7%	11.2%	15.0%	11.4%	15.3%	8.7%	15.7%	11.8%	12.5%	13.2%	13.6%
40 to 49	6.2%	6.2%	7.1%	7.9%	8.3%	8.6%	8.1%	7.5%	7.0%	8.7%	12.3%	7.9%	10.6%	6.8%	8.8%	11.0%	6.9%	8.7%	11.2%
50 to 59	5.4%	5.5%	6.0%	6.5%	6.9%	7.3%	7.4%	7.6%	7.1%	5.7%	7.4%	4.5%	5.1%	8.5%	5.2%	7.9%	4.8%	7.4%	5.7%
60 to 69	2.8%	2.8%	4.1%	5.4%	4.9%	4.4%	4.0%	3.5%	3.2%	4.6%	5.2%	3.1%	3.9%	3.5%	4.3%	4.6%	5.1%	4.6%	6.3%
70 to 79	4.1%	4.1%	4.1%	4.1%	3.6%	3.2%	3.7%	4.2%	3.9%	3.3%	3.6%	4.2%	3.3%	2.6%	5.0%	7.2%	2.4%	3.9%	4.6%
≥ 80	4.2%	4.2%	4.1%	4.1%	4.4%	4.7%	4.3%	3.9%	3.7%	3.4%	2.5%	3.6%	5.7%	1.8%	3.3%	1.2%	2.6%	1.2%	4.1%
<b>Total</b>	<b>7.9%</b>	<b>7.8%</b>	<b>8.2%</b>	<b>8.7%</b>	<b>8.7%</b>	<b>8.8%</b>	<b>9.1%</b>	<b>9.4%</b>	<b>8.7%</b>	<b>9.3%</b>	<b>11.0%</b>	<b>8.0%</b>	<b>10.0%</b>	<b>8.3%</b>	<b>10.1%</b>	<b>9.1%</b>	<b>7.4%</b>	<b>8.8%</b>	<b>9.6%</b>
<i>Smoking Intensity - 10 to 19 Cigarettes / Day</i>																			
12 to 19	7.3%	7.3%	7.1%	7.0%	5.6%	4.3%	4.4%	4.7%	4.5%	3.3%	2.9%	2.0%	2.6%	2.6%	3.3%	0.9%	2.1%	2.7%	2.5%
20 to 29	14.6%	14.6%	14.4%	14.3%	11.9%	9.5%	10.5%	11.5%	10.7%	8.9%	10.4%	10.0%	12.4%	8.0%	7.8%	8.5%	8.3%	8.6%	5.7%
30 to 39	9.6%	9.6%	9.3%	9.1%	9.7%	10.3%	10.0%	9.8%	9.1%	7.0%	6.7%	7.8%	8.3%	11.5%	6.6%	6.4%	6.6%	5.9%	5.5%
40 to 49	9.5%	9.5%	8.0%	6.5%	6.3%	6.1%	7.9%	9.9%	9.2%	6.7%	8.0%	6.5%	7.4%	8.4%	9.5%	7.7%	6.3%	8.1%	5.5%
50 to 59	7.2%	7.2%	7.1%	7.1%	6.2%	5.3%	6.1%	6.9%	6.4%	8.4%	10.6%	6.8%	9.5%	5.7%	6.9%	8.2%	6.1%	6.5%	5.7%
60 to 69	4.8%	4.8%	5.0%	5.2%	5.2%	5.0%	4.8%	4.4%	5.5%	5.7%	4.1%	5.1%	5.3%	5.2%	5.4%	4.4%	4.0%	5.7%	
70 to 79	6.0%	6.0%	4.7%	3.4%	3.7%	4.0%	3.9%	3.8%	3.5%	4.2%	6.0%	2.0%	3.0%	3.2%	2.9%	3.2%	4.2%	3.4%	4.1%
≥ 80	0.8%	0.8%	1.8%	2.8%	3.4%	4.0%	2.6%	1.2%	1.2%	3.2%	3.8%	1.7%	1.3%	3.2%	0.8%	0.1%	0.9%	1.2%	0.8%
<b>Total</b>	<b>8.9%</b>	<b>8.9%</b>	<b>8.4%</b>	<b>7.9%</b>	<b>7.3%</b>	<b>6.7%</b>	<b>7.2%</b>	<b>7.8%</b>	<b>7.2%</b>	<b>6.6%</b>	<b>7.5%</b>	<b>6.0%</b>	<b>7.4%</b>	<b>6.8%</b>	<b>6.3%</b>	<b>6.1%</b>	<b>5.5%</b>	<b>5.8%</b>	<b>5.0%</b>
<i>Smoking Intensity - 20 or More Cigarettes / Day</i>																			
12 to 19	3.8%	3.8%	3.3%	2.8%	2.5%	2.2%	1.7%	1.2%	1.2%	2.2%	2.3%	1.4%	1.9%	0.4%	1.7%	0.7%	0.3%	0.1%	0.3%
20 to 29	11.4%	11.4%	9.4%	7.6%	7.4%	7.2%	8.3%	9.4%	8.8%	8.5%	7.1%	6.4%	8.8%	9.0%	4.7%	3.6%	4.5%	3.7%	4.6%
30 to 39	16.6%	16.6%	14.1%	11.6%	11.4%	11.2%	10.5%	9.7%	9.0%	8.4%	10.3%	7.5%	6.8%	11.3%	4.1%	7.1%	6.3%	5.7%	4.4%
40 to 49	21.0%	21.0%	19.1%	17.3%	16.0%	14.7%	15.9%	17.2%	16.0%	9.0%	9.5%	11.6%	15.9%	7.6%	8.4%	6.0%	8.1%	5.9%	5.1%
50 to 59	19.5%	19.5%	17.3%	15.3%	15.1%	14.8%	13.9%	13.1%	12.1%	11.5%	11.9%	14.3%	17.8%	11.1%	10.9%	9.7%	9.8%	11.2%	7.7%
60 to 69	11.5%	11.6%	9.9%	8.2%	8.8%	9.4%	10.4%	11.4%	10.6%	9.5%	10.2%	8.2%	9.6%	10.7%	5.7%	12.1%	5.7%	7.2%	8.7%
70 to 79	4.9%	4.9%	4.6%	4.3%	4.8%	5.3%	5.3%	5.2%	4.9%	3.7%	2.5%	3.5%	4.2%	3.7%	4.5%	2.0%	3.9%	4.1%	3.1%
≥ 80	5.7%	5.7%	3.8%	2.0%	1.9%	1.9%	2.2%	2.4%	2.3%	0.9%	1.6%	0.5%	0.6%	2.1%	2.6%	0.4%	1.6%	0.3%	0.6%
<b>Total</b>	<b>14.1%</b>	<b>14.1%</b>	<b>12.3%</b>	<b>10.6%</b>	<b>10.3%</b>	<b>9.9%</b>	<b>10.2%</b>	<b>10.3%</b>	<b>9.6%</b>	<b>7.9%</b>	<b>8.2%</b>	<b>8.2%</b>	<b>10.0%</b>	<b>8.2%</b>	<b>6.1%</b>	<b>6.3%</b>	<b>5.9%</b>	<b>5.7%</b>	<b>5.1%</b>
<i>All Smoking Intensity Categories Combined</i>																			
12 to 19	24.3%	24.2%	22.1%	20.0%	17.6%	15.4%	16.0%	16.8%	15.9%	17.0%	19.7%	12.3%	14.4%	12.1%	11.3%	7.9%	7.9%	9.8%	6.9%
20 to 29	38.8%	38.8%	36.9%	35.1%	33.8%	32.5%	34.9%	37.4%	34.8%	35.3%	33.9%	31.3%	40.3%	34.0%	32.0%	29.4%	29.4%	28.6%	30.0%
30 to 39	34.2%	34.2%	32.5%	31.1%	30.9%	30.7%	31.4%	32.1%	29.8%	26.6%	32.1%	26.6%	30.4%	31.5%	30.3%	28.6%	28.6%	24.9%	23.5%
40 to 49	36.8%	36.8%	34.2%	31.7%	30.6%	29.4%	32.0%	34.6%	32.3%	24.5%	29.9%	26.0%	33.9%	22.9%	25.5%	25.8%	25.8%	22.7%	21.9%
50 to 59	32.2%	32.1%	30.4%	28.9%	28.1%	27.3%	27.5%	27.6%	25.6%	25.6%	30.0%	25.6%	32.4%	25.4%	28.8%	25.6%	25.6%	25.1%	19.0%
60 to 69	19.2%	19.2%	19.0%	18.9%	18.9%	19.0%	19.4%	19.7%	18.3%	19.6%	21.1%	15.4%	18.6%	19.5%	19.5%	19.5%	19.5%	15.8%	20.7%
70 to 79	15.0%	15.0%	13.4%	11.8%	12.1%	12.4%	12.8%	13.3%	12.3%	11.2%	12.1%	9.7%	10.5%	9.4%	9.9%	11.0%	11.0%	11.4%	11.8%
≥ 80	10.7%	10.7%	9.7%	8.8%	9.7%	10.5%	9.1%	7.6%	7.1%	7.5%	7.8%	5.8%	7.6%	7.1%	7.8%	5.1%	5.1%	2.7%	5.5%
<b>Total Males</b>	<b>30.9%</b>	<b>30.8%</b>	<b>28.9%</b>	<b>27.2%</b>	<b>26.3%</b>	<b>25.4%</b>	<b>26.5%</b>	<b>27.5%</b>	<b>25.5%</b>	<b>23.8%</b>	<b>26.7%</b>	<b>22.2%</b>	<b>27.4%</b>	<b>23.3%</b>	<b>22.4%</b>	<b>21.5%</b>	<b>18.8%</b>	<b>20.3%</b>	<b>19.7%</b>

## Trend in the Prevalence of Tobacco Smoking in Quebec By Sex, Age Group and Smoking Intensity 2000 to 2018

Age Group	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Females</b>																			
<i>Smoking Intensity - Less than 10 Cigarettes / Day</i>																			
12 to 19	16.5%	16.5%	15.0%	13.6%	13.4%	13.3%	12.2%	11.1%	10.5%	10.5%	8.8%	10.7%	10.4%	5.2%	6.3%	7.5%	7.6%	9.4%	6.2%
20 to 29	13.7%	13.8%	14.4%	15.2%	16.5%	17.8%	17.5%	17.3%	16.1%	16.3%	13.7%	15.3%	14.5%	14.8%	13.4%	15.3%	14.2%	10.8%	12.4%
30 to 39	9.4%	9.4%	10.0%	10.7%	10.6%	10.6%	11.6%	12.6%	11.8%	10.3%	10.2%	11.8%	11.2%	10.1%	10.2%	13.5%	10.5%	10.0%	13.7%
40 to 49	8.3%	8.3%	7.4%	6.6%	7.4%	8.2%	8.1%	8.1%	7.5%	9.1%	12.0%	10.3%	12.0%	8.9%	8.0%	6.0%	9.1%	5.7%	5.9%
50 to 59	5.9%	5.9%	6.3%	6.8%	6.7%	6.6%	7.7%	8.8%	8.2%	7.5%	6.2%	7.5%	7.3%	6.7%	7.2%	6.3%	10.5%	8.9%	8.8%
60 to 69	6.7%	6.7%	5.5%	4.3%	4.6%	4.9%	4.9%	4.9%	4.6%	4.9%	3.9%	5.4%	6.5%	5.9%	4.4%	5.2%	5.0%	6.4%	6.3%
70 to 79	4.5%	4.5%	4.2%	3.9%	5.0%	6.1%	5.7%	5.3%	4.9%	3.1%	3.5%	2.8%	3.6%	4.7%	4.1%	3.7%	5.5%	4.3%	2.4%
≥ 80	4.5%	4.5%	4.5%	4.5%	4.1%	3.7%	3.8%	3.8%	3.5%	3.1%	2.4%	2.7%	3.9%	1.7%	2.0%	1.2%	3.2%	2.8%	3.9%
<b>Total</b>	<b>9.3%</b>	<b>9.2%</b>	<b>8.9%</b>	<b>8.8%</b>	<b>9.2%</b>	<b>9.6%</b>	<b>9.6%</b>	<b>9.7%</b>	<b>9.0%</b>	<b>8.9%</b>	<b>8.4%</b>	<b>9.1%</b>	<b>9.4%</b>	<b>8.0%</b>	<b>7.6%</b>	<b>8.0%</b>	<b>8.8%</b>	<b>7.7%</b>	<b>8.1%</b>
<i>Smoking Intensity - 10 to 19 Cigarettes / Day</i>																			
12 to 19	8.1%	8.1%	7.0%	6.0%	4.5%	3.1%	3.5%	3.9%	3.7%	2.8%	2.0%	3.4%	3.6%	3.6%	1.8%	1.4%	1.1%	0.2%	0.6%
20 to 29	12.0%	12.0%	13.1%	14.4%	12.8%	11.3%	10.5%	9.7%	9.0%	6.8%	5.8%	9.9%	11.8%	8.9%	6.3%	6.3%	5.9%	6.7%	3.6%
30 to 39	11.2%	11.2%	11.1%	11.1%	10.6%	10.1%	9.5%	8.9%	8.2%	8.9%	7.1%	8.3%	8.4%	5.6%	5.3%	6.9%	6.2%	6.8%	3.4%
40 to 49	10.5%	10.5%	9.9%	9.4%	9.6%	9.8%	10.0%	10.1%	9.4%	10.4%	9.4%	6.3%	6.4%	7.0%	7.7%	6.7%	6.0%	6.4%	7.1%
50 to 59	9.1%	9.1%	9.0%	9.0%	8.6%	8.3%	8.5%	8.8%	8.2%	8.9%	9.4%	8.8%	8.9%	9.4%	9.1%	5.7%	7.2%	7.1%	7.2%
60 to 69	6.3%	6.4%	6.1%	5.8%	6.0%	6.2%	6.2%	6.2%	5.8%	6.3%	5.6%	5.1%	6.4%	6.6%	3.8%	4.3%	5.4%	5.3%	6.2%
70 to 79	3.6%	3.6%	3.8%	4.0%	4.0%	4.0%	3.8%	3.6%	3.4%	3.7%	4.5%	3.0%	3.5%	2.7%	3.9%	3.1%	2.6%	4.3%	2.8%
≥ 80	1.1%	1.1%	1.6%	2.1%	2.2%	2.3%	1.7%	1.0%	1.0%	1.3%	1.0%	1.2%	0.5%	1.1%	0.4%	0.6%	1.7%	1.6%	2.1%
<b>Total</b>	<b>9.0%</b>	<b>8.9%</b>	<b>8.8%</b>	<b>8.8%</b>	<b>8.3%</b>	<b>7.8%</b>	<b>7.7%</b>	<b>7.5%</b>	<b>7.0%</b>	<b>7.0%</b>	<b>6.4%</b>	<b>6.5%</b>	<b>7.0%</b>	<b>6.4%</b>	<b>5.5%</b>	<b>5.0%</b>	<b>5.1%</b>	<b>5.4%</b>	<b>4.6%</b>
<i>Smoking Intensity - 20 or More Cigarettes / Day</i>																			
12 to 19	3.4%	3.4%	2.3%	1.2%	1.2%	1.1%	1.0%	1.0%	0.9%	1.1%	1.2%	1.3%	0.7%	2.1%	1.4%	0.0%	1.2%	0.0%	0.3%
20 to 29	6.6%	6.6%	5.4%	4.2%	3.9%	3.7%	3.5%	3.3%	3.1%	3.0%	2.5%	2.2%	1.4%	5.1%	1.9%	1.4%	1.9%	1.4%	1.3%
30 to 39	11.9%	11.9%	10.2%	8.6%	7.1%	5.6%	5.0%	4.5%	4.2%	6.4%	8.9%	2.2%	1.9%	6.4%	3.3%	2.7%	3.0%	2.4%	2.3%
40 to 49	15.3%	15.4%	13.1%	11.0%	10.9%	10.8%	10.6%	10.4%	9.8%	9.4%	8.2%	7.5%	6.4%	5.2%	5.0%	3.6%	4.4%	4.1%	2.8%
50 to 59	11.2%	11.2%	12.2%	13.3%	11.7%	10.0%	9.9%	9.9%	9.2%	8.3%	7.3%	8.2%	8.6%	8.5%	6.3%	5.7%	6.1%	5.0%	5.1%
60 to 69	7.5%	7.5%	6.5%	5.5%	5.4%	5.3%	5.2%	5.1%	4.7%	4.8%	4.2%	4.9%	3.9%	5.6%	5.2%	4.3%	4.2%	7.2%	4.0%
70 to 79	3.3%	3.3%	3.1%	3.0%	2.7%	2.4%	2.0%	1.7%	1.5%	2.4%	3.1%	2.2%	2.6%	3.4%	1.8%	0.7%	3.3%	2.1%	1.8%
≥ 80	1.0%	1.0%	1.2%	1.4%	1.3%	1.2%	1.3%	1.4%	1.3%	0.8%	1.2%	1.1%	1.7%	0.5%	1.2%	0.0%	1.7%	0.8%	0.8%
<b>Total</b>	<b>9.2%</b>	<b>9.1%</b>	<b>8.1%</b>	<b>7.2%</b>	<b>6.6%</b>	<b>6.0%</b>	<b>5.8%</b>	<b>5.6%</b>	<b>5.2%</b>	<b>5.3%</b>	<b>5.2%</b>	<b>4.3%</b>	<b>3.9%</b>	<b>5.3%</b>	<b>3.7%</b>	<b>2.8%</b>	<b>3.5%</b>	<b>3.3%</b>	<b>2.6%</b>
<i>All Smoking Intensity Categories Combined</i>																			
12 to 19	28.1%	28.0%	24.3%	20.8%	19.1%	17.5%	16.7%	16.0%	15.2%	14.4%	12.1%	15.4%	14.7%	10.9%	8.5%	8.6%	8.6%	9.6%	7.2%
20 to 29	32.4%	32.4%	32.9%	33.8%	33.3%	32.8%	31.5%	30.3%	28.2%	26.1%	22.0%	27.4%	27.7%	28.8%	22.7%	24.4%	24.4%	18.9%	17.2%
30 to 39	32.4%	32.4%	31.2%	30.3%	28.3%	26.3%	26.2%	26.0%	24.2%	25.6%	26.1%	22.2%	21.5%	22.1%	21.6%	21.9%	21.9%	19.2%	19.4%
40 to 49	34.1%	34.1%	30.4%	27.1%	28.0%	28.8%	28.7%	28.6%	26.7%	28.9%	29.6%	24.0%	24.9%	21.1%	24.6%	20.9%	20.9%	16.2%	15.8%
50 to 59	26.2%	26.2%	27.4%	29.1%	27.0%	24.9%	26.2%	27.5%	25.6%	24.7%	22.9%	24.6%	24.8%	24.6%	24.5%	23.6%	23.6%	20.9%	21.1%
60 to 69	20.5%	20.6%	18.0%	15.6%	16.0%	16.4%	16.3%	16.2%	15.1%	16.0%	13.7%	15.4%	16.8%	18.0%	15.4%	15.4%	15.4%	18.9%	16.5%
70 to 79	11.5%	11.5%	11.1%	11.0%	11.8%	12.5%	11.5%	10.6%	9.8%	9.2%	11.1%	8.0%	9.7%	10.8%	10.6%	10.0%	10.0%	10.7%	6.9%
≥ 80	6.7%	6.7%	7.3%	8.0%	7.6%	7.2%	6.7%	6.2%	5.8%	5.3%	4.7%	5.0%	6.0%	3.3%	4.1%	4.2%	4.2%	5.1%	6.8%
<b>Total Females</b>	<b>27.5%</b>	<b>27.2%</b>	<b>25.9%</b>	<b>24.8%</b>	<b>24.1%</b>	<b>23.4%</b>	<b>23.1%</b>	<b>22.8%</b>	<b>21.2%</b>	<b>21.2%</b>	<b>20.0%</b>	<b>19.9%</b>	<b>20.3%</b>	<b>19.6%</b>	<b>16.8%</b>	<b>15.8%</b>	<b>17.5%</b>	<b>16.4%</b>	<b>15.3%</b>

Ontario

**Trend in the Prevalence of Tobacco Smoking in Ontario**  
 By Sex, Age Group and Smoking Intensity  
 2000 to 2018

Age Group	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Total Population Age 12 and Older</b>																			
<i>Smoking Intensity - Less than 10 Cigarettes / Day</i>																			
12 to 19	9.2%	9.2%	9.3%	9.3%	8.3%	7.3%	6.8%	6.3%	6.4%	6.1%	6.5%	4.6%	5.1%	5.2%	4.9%	5.3%	5.1%	6.7%	4.1%
20 to 29	13.7%	13.7%	15.3%	16.9%	16.2%	15.5%	16.1%	16.6%	16.6%	14.8%	16.1%	16.3%	17.0%	17.0%	15.8%	16.3%	12.1%	13.9%	11.5%
30 to 39	9.2%	9.2%	9.6%	10.0%	10.5%	10.9%	10.3%	9.7%	9.7%	10.3%	9.7%	12.4%	11.8%	11.8%	9.3%	10.5%	11.5%	9.3%	11.1%
40 to 49	7.7%	7.7%	8.7%	9.7%	9.1%	8.5%	8.5%	8.5%	8.5%	7.7%	7.7%	9.5%	8.8%	8.8%	8.1%	8.9%	6.3%	7.6%	9.1%
50 to 59	5.0%	5.0%	5.8%	6.5%	6.2%	5.8%	5.9%	6.1%	6.1%	6.9%	6.8%	7.0%	7.1%	7.1%	6.3%	8.0%	9.0%	7.3%	6.9%
60 to 69	4.2%	4.2%	4.1%	4.1%	4.7%	5.3%	5.1%	4.9%	4.9%	5.0%	5.4%	4.2%	3.8%	3.8%	5.0%	5.1%	5.1%	6.5%	5.0%
70 to 79	3.6%	3.6%	3.5%	3.3%	3.3%	3.3%	3.4%	3.6%	3.6%	3.7%	3.6%	3.5%	3.9%	3.9%	2.8%	2.6%	3.7%	3.4%	3.8%
≥ 80	1.9%	1.9%	2.2%	2.6%	3.0%	3.4%	2.5%	1.6%	1.6%	2.5%	3.1%	2.1%	3.2%	3.2%	1.8%	1.9%	1.6%	2.7%	1.1%
<b>Total</b>	<b>8.0%</b>	<b>7.9%</b>	<b>8.5%</b>	<b>9.2%</b>	<b>9.0%</b>	<b>8.7%</b>	<b>8.7%</b>	<b>8.6%</b>	<b>8.2%</b>	<b>8.0%</b>	<b>8.4%</b>	<b>8.8%</b>	<b>8.7%</b>	<b>7.9%</b>	<b>7.7%</b>	<b>8.5%</b>	<b>7.7%</b>	<b>8.0%</b>	<b>7.5%</b>
<i>Smoking Intensity - 10 to 19 Cigarettes / Day</i>																			
12 to 19	5.2%	5.2%	4.2%	3.1%	2.8%	2.4%	2.4%	2.3%	2.4%	2.0%	2.1%	1.5%	1.2%	1.2%	1.1%	1.8%	0.4%	0.5%	0.6%
20 to 29	12.2%	12.2%	10.9%	9.5%	9.6%	9.7%	9.5%	9.4%	9.4%	7.1%	7.1%	6.2%	6.6%	6.6%	5.9%	3.6%	4.1%	3.4%	3.8%
30 to 39	10.8%	10.8%	9.5%	8.2%	8.3%	8.4%	8.4%	8.5%	8.5%	6.8%	6.6%	7.5%	6.2%	6.2%	6.1%	7.3%	6.4%	4.9%	5.3%
40 to 49	9.1%	9.1%	8.9%	8.7%	8.4%	8.1%	8.0%	8.1%	8.0%	7.5%	6.9%	6.7%	6.5%	6.5%	6.7%	6.4%	5.5%	4.6%	5.3%
50 to 59	6.6%	6.6%	6.6%	6.6%	6.5%	6.4%	6.6%	6.8%	6.9%	6.7%	5.8%	7.8%	8.1%	8.0%	8.0%	8.6%	7.1%	6.1%	6.0%
60 to 69	5.9%	5.9%	5.3%	4.6%	4.7%	4.8%	4.8%	4.9%	4.9%	5.3%	5.9%	5.1%	5.9%	5.9%	4.1%	3.7%	4.3%	4.7%	6.5%
70 to 79	3.3%	3.3%	3.1%	2.9%	2.9%	2.8%	3.0%	3.2%	3.2%	3.0%	3.4%	3.8%	3.6%	3.6%	2.7%	1.9%	2.1%	1.9%	2.0%
≥ 80	1.5%	1.5%	1.6%	1.8%	1.5%	1.3%	1.3%	1.4%	1.4%	1.7%	1.4%	1.5%	1.8%	1.8%	1.1%	1.6%	1.2%	1.1%	1.7%
<b>Total</b>	<b>8.2%</b>	<b>8.1%</b>	<b>7.4%</b>	<b>6.7%</b>	<b>6.6%</b>	<b>6.5%</b>	<b>6.6%</b>	<b>6.7%</b>	<b>6.4%</b>	<b>5.7%</b>	<b>5.6%</b>	<b>5.7%</b>	<b>5.7%</b>	<b>5.6%</b>	<b>5.2%</b>	<b>5.1%</b>	<b>4.5%</b>	<b>3.9%</b>	<b>4.4%</b>
<i>Smoking Intensity - 20 or More Cigarettes / Day</i>																			
12 to 19	1.7%	1.7%	1.5%	1.3%	1.1%	0.9%	0.9%	0.8%	0.8%	0.8%	0.8%	0.6%	0.9%	0.9%	0.5%	0.3%	0.1%	0.4%	0.2%
20 to 29	6.6%	6.6%	5.9%	5.1%	4.8%	4.6%	4.5%	4.3%	4.3%	4.0%	4.0%	3.2%	2.6%	2.6%	3.0%	2.2%	3.0%	1.9%	2.6%
30 to 39	9.6%	9.6%	8.6%	7.5%	6.5%	5.6%	5.3%	5.1%	5.1%	4.5%	4.3%	4.1%	4.0%	4.1%	5.3%	4.5%	3.7%	2.4%	3.1%
40 to 49	12.9%	12.9%	11.4%	9.9%	9.8%	9.6%	9.3%	8.9%	8.9%	7.9%	9.3%	7.8%	7.2%	7.2%	6.0%	3.6%	4.8%	4.8%	4.1%
50 to 59	10.5%	10.5%	9.4%	8.3%	8.3%	8.3%	8.2%	8.0%	8.0%	8.4%	9.0%	8.0%	8.8%	8.8%	6.7%	8.0%	5.7%	7.0%	6.1%
60 to 69	7.3%	7.3%	6.7%	6.2%	5.9%	5.6%	5.5%	5.4%	5.5%	5.3%	5.1%	5.2%	5.0%	4.9%	5.6%	5.2%	5.9%	5.1%	4.4%
70 to 79	3.4%	3.4%	2.9%	2.5%	2.5%	2.5%	2.3%	2.1%	2.1%	2.2%	2.4%	2.1%	2.1%	2.2%	2.4%	2.7%	2.8%	2.3%	1.9%
≥ 80	2.0%	2.0%	1.7%	1.3%	1.2%	1.0%	0.8%	0.7%	0.7%	0.5%	0.4%	0.8%	0.9%	0.9%	1.1%	0.4%	0.6%	1.2%	1.2%
<b>Total</b>	<b>8.0%</b>	<b>8.0%</b>	<b>7.1%</b>	<b>6.3%</b>	<b>6.0%</b>	<b>5.7%</b>	<b>5.6%</b>	<b>5.4%</b>	<b>5.2%</b>	<b>4.9%</b>	<b>5.3%</b>	<b>4.8%</b>	<b>4.6%</b>	<b>4.6%</b>	<b>4.4%</b>	<b>3.9%</b>	<b>3.8%</b>	<b>3.5%</b>	<b>3.3%</b>
<i>All Smoking Intensity Categories Combined</i>																			
12 to 19	16.0%	16.1%	14.9%	13.8%	12.2%	10.6%	10.0%	9.4%	9.5%	9.0%	9.5%	6.7%	7.2%	7.3%	6.5%	7.4%	5.6%	7.6%	4.9%
20 to 29	32.5%	32.6%	32.0%	31.4%	30.6%	29.8%	30.1%	30.3%	30.3%	25.9%	27.2%	25.7%	26.1%	26.2%	24.7%	22.1%	19.2%	19.2%	17.9%
30 to 39	29.6%	29.6%	27.7%	25.7%	25.3%	24.8%	24.1%	23.3%	23.3%	21.5%	20.6%	24.0%	22.0%	22.0%	20.7%	22.4%	21.5%	16.5%	19.5%
40 to 49	29.7%	29.7%	29.0%	28.3%	27.2%	26.2%	25.8%	25.4%	25.4%	23.0%	23.8%	23.9%	22.6%	22.6%	20.8%	19.0%	16.6%	16.9%	18.5%
50 to 59	22.1%	22.1%	21.8%	21.4%	20.9%	20.5%	20.7%	20.9%	21.0%	22.0%	21.7%	22.7%	24.0%	23.9%	21.0%	24.6%	21.8%	20.4%	19.0%
60 to 69	17.4%	17.4%	16.1%	14.9%	15.3%	15.7%	15.5%	15.3%	15.3%	15.6%	16.4%	14.5%	14.7%	14.7%	14.8%	14.0%	15.3%	16.3%	15.9%
70 to 79	10.4%	10.4%	9.5%	8.6%	8.6%	8.6%	8.7%	8.9%	8.9%	8.8%	9.4%	9.4%	9.6%	9.6%	7.9%	7.2%	8.5%	7.6%	7.8%
≥ 80	5.4%	5.4%	5.6%	5.7%	5.7%	5.7%	4.7%	3.7%	3.7%	4.8%	5.0%	4.4%	5.8%	5.9%	4.0%	3.8%	3.4%	5.0%	4.0%
<b>Total Pop.</b>	<b>24.1%</b>	<b>24.0%</b>	<b>23.0%</b>	<b>22.3%</b>	<b>21.6%</b>	<b>20.9%</b>	<b>20.8%</b>	<b>20.8%</b>	<b>19.8%</b>	<b>18.5%</b>	<b>19.3%</b>	<b>19.3%</b>	<b>19.0%</b>	<b>18.1%</b>	<b>17.4%</b>	<b>17.4%</b>	<b>16.0%</b>	<b>15.4%</b>	<b>15.2%</b>

## Trend in the Prevalence of Tobacco Smoking in Ontario

### By Sex, Age Group and Smoking Intensity

2000 to 2018

Age Group	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Males</b>																			
<i>Smoking Intensity - Less than 10 Cigarettes / Day</i>																			
12 to 19	7.8%	7.8%	8.3%	8.8%	8.2%	7.6%	7.1%	6.5%	6.5%	6.5%	7.5%	5.6%	5.4%	6.3%	7.4%	4.5%	5.6%	5.6%	4.9%
20 to 29	13.3%	13.3%	16.5%	19.7%	18.3%	16.9%	17.9%	18.9%	18.6%	15.2%	17.8%	19.0%	18.2%	14.3%	19.8%	20.9%	13.9%	18.3%	13.8%
30 to 39	9.7%	9.7%	10.4%	11.1%	11.6%	12.1%	11.5%	11.0%	10.9%	12.6%	11.7%	14.3%	11.1%	12.0%	11.1%	12.7%	15.2%	10.4%	12.8%
40 to 49	8.7%	8.7%	9.5%	10.4%	9.3%	8.1%	8.9%	9.7%	9.5%	8.4%	8.2%	11.7%	9.1%	10.6%	9.5%	9.8%	7.5%	9.5%	12.5%
50 to 59	4.7%	4.7%	5.7%	6.8%	5.8%	4.9%	5.4%	6.0%	5.9%	6.7%	6.2%	5.9%	6.2%	6.3%	6.3%	8.3%	9.5%	7.3%	7.0%
60 to 69	3.3%	3.3%	3.5%	3.8%	4.4%	5.0%	5.4%	5.7%	5.6%	5.0%	5.3%	3.7%	3.5%	6.1%	6.4%	4.4%	6.2%	7.1%	6.5%
70 to 79	3.1%	3.1%	2.8%	2.5%	2.7%	3.0%	3.3%	3.6%	3.6%	2.9%	2.7%	3.3%	3.7%	2.6%	2.8%	2.2%	2.9%	3.3%	3.7%
≥ 80	3.0%	3.0%	2.5%	2.1%	2.8%	3.5%	2.4%	1.3%	1.3%	1.4%	1.6%	2.4%	3.4%	3.0%	1.0%	0.5%	2.3%	1.6%	1.3%
<b>Total</b>	<b>8.0%</b>	<b>8.0%</b>	<b>9.0%</b>	<b>10.0%</b>	<b>9.5%</b>	<b>8.9%</b>	<b>9.1%</b>	<b>9.3%</b>	<b>9.2%</b>	<b>8.7%</b>	<b>9.0%</b>	<b>9.8%</b>	<b>8.7%</b>	<b>8.8%</b>	<b>9.5%</b>	<b>9.6%</b>	<b>9.1%</b>	<b>9.2%</b>	<b>9.1%</b>
<i>Smoking Intensity - 10 to 19 Cigarettes / Day</i>																			
12 to 19	5.7%	5.8%	4.6%	3.4%	2.9%	2.4%	2.6%	2.8%	2.8%	2.1%	2.0%	1.5%	1.4%	1.5%	2.7%	0.5%	0.7%	0.8%	
20 to 29	13.1%	13.1%	11.5%	10.0%	11.1%	12.1%	11.5%	11.0%	10.8%	8.5%	8.8%	7.1%	8.3%	9.5%	7.0%	4.4%	5.1%	4.0%	4.4%
30 to 39	10.9%	10.9%	9.9%	9.0%	9.2%	9.3%	9.6%	9.9%	9.8%	7.5%	8.3%	8.8%	6.3%	9.1%	6.9%	8.6%	7.2%	5.0%	6.9%
40 to 49	9.0%	9.0%	8.9%	8.9%	8.4%	7.8%	8.2%	8.7%	8.6%	7.9%	8.2%	7.8%	7.2%	6.3%	6.6%	6.9%	4.8%	4.8%	6.7%
50 to 59	5.9%	5.9%	6.2%	6.4%	6.3%	6.2%	6.0%	5.9%	5.9%	6.9%	6.3%	9.3%	9.2%	8.3%	9.4%	9.9%	7.9%	6.1%	6.4%
60 to 69	6.4%	6.5%	5.5%	4.6%	4.9%	5.1%	4.8%	4.5%	4.4%	5.3%	5.7%	5.9%	6.5%	4.9%	3.4%	4.5%	4.2%	6.4%	6.8%
70 to 79	3.2%	3.2%	2.9%	2.6%	2.6%	2.5%	2.8%	3.0%	2.9%	2.9%	3.7%	4.8%	3.5%	3.0%	2.9%	1.9%	2.3%	1.9%	1.7%
≥ 80	0.8%	0.8%	1.4%	2.1%	1.4%	0.8%	1.2%	1.7%	1.6%	2.1%	0.7%	2.2%	2.8%	1.3%	0.7%	0.5%	0.3%	1.4%	3.8%
<b>Total</b>	<b>8.4%</b>	<b>8.4%</b>	<b>7.7%</b>	<b>7.1%</b>	<b>7.0%</b>	<b>7.0%</b>	<b>7.0%</b>	<b>7.0%</b>	<b>6.9%</b>	<b>6.2%</b>	<b>6.4%</b>	<b>6.8%</b>	<b>6.4%</b>	<b>6.4%</b>	<b>5.7%</b>	<b>5.9%</b>	<b>4.8%</b>	<b>4.3%</b>	<b>5.1%</b>
<i>Smoking Intensity - 20 or More Cigarettes / Day</i>																			
12 to 19	2.2%	2.2%	1.9%	1.7%	1.4%	1.1%	1.1%	1.1%	1.1%	1.2%	1.1%	0.9%	1.3%	0.3%	0.7%	0.4%	0.2%	0.7%	0.3%
20 to 29	9.4%	9.4%	8.5%	7.6%	7.2%	6.8%	6.6%	6.5%	6.4%	5.8%	6.1%	5.3%	4.5%	3.0%	4.1%	2.8%	3.8%	2.5%	3.7%
30 to 39	13.0%	13.0%	11.5%	10.0%	9.0%	8.0%	7.6%	7.3%	7.2%	6.8%	6.9%	6.6%	6.2%	5.4%	8.8%	7.0%	5.2%	3.5%	4.7%
40 to 49	16.9%	16.9%	14.5%	12.1%	12.3%	12.5%	12.5%	12.6%	12.4%	11.1%	14.4%	11.8%	10.3%	9.3%	9.5%	5.2%	6.9%	7.0%	6.5%
50 to 59	13.0%	13.0%	11.6%	10.1%	10.2%	10.3%	10.6%	11.0%	10.8%	10.8%	12.1%	11.7%	13.0%	11.0%	9.1%	9.2%	7.5%	9.9%	7.5%
60 to 69	8.9%	8.8%	8.1%	7.4%	7.5%	7.5%	7.2%	6.9%	6.8%	6.8%	7.3%	7.4%	6.7%	7.3%	7.5%	6.0%	9.0%	6.6%	5.6%
70 to 79	4.0%	4.0%	3.0%	2.0%	2.4%	2.8%	2.5%	2.3%	2.3%	2.6%	2.9%	2.3%	2.0%	3.9%	3.5%	3.5%	3.0%	3.6%	2.3%
≥ 80	2.6%	2.6%	2.0%	1.5%	1.3%	1.1%	0.8%	0.6%	0.6%	0.5%	0.3%	0.9%	0.6%	1.5%	1.3%	0.4%	0.5%	2.2%	1.2%
<b>Total</b>	<b>10.5%</b>	<b>10.5%</b>	<b>9.2%</b>	<b>8.0%</b>	<b>7.7%</b>	<b>7.6%</b>	<b>7.5%</b>	<b>7.4%</b>	<b>7.3%</b>	<b>6.9%</b>	<b>7.8%</b>	<b>7.1%</b>	<b>6.8%</b>	<b>6.0%</b>	<b>6.4%</b>	<b>5.0%</b>	<b>5.2%</b>	<b>5.0%</b>	<b>4.6%</b>
<i>All Smoking Intensity Categories Combined</i>																			
12 to 19	15.7%	15.7%	14.8%	14.0%	12.5%	11.1%	10.8%	10.4%	10.3%	9.9%	10.7%	8.5%	8.2%	7.9%	11.3%	7.9%	7.9%	6.9%	6.0%
20 to 29	35.8%	35.8%	36.5%	37.4%	36.6%	35.8%	36.0%	36.3%	35.9%	29.4%	32.7%	31.4%	31.0%	26.8%	32.0%	29.4%	29.4%	24.7%	21.9%
30 to 39	33.6%	33.6%	31.8%	30.1%	29.7%	29.4%	28.8%	28.2%	27.9%	26.8%	26.9%	29.6%	23.6%	26.5%	30.3%	28.6%	28.6%	18.9%	24.5%
40 to 49	34.6%	34.6%	33.0%	31.4%	29.9%	28.5%	29.6%	30.9%	30.5%	27.4%	30.7%	31.3%	26.6%	26.1%	25.5%	25.8%	25.8%	21.3%	25.7%
50 to 59	23.7%	23.7%	23.4%	23.3%	22.3%	21.4%	22.1%	22.9%	22.6%	24.4%	24.6%	27.0%	28.4%	25.6%	28.8%	25.6%	25.6%	23.3%	21.0%
60 to 69	18.6%	18.6%	17.2%	15.8%	16.7%	17.7%	17.4%	17.1%	16.9%	17.1%	18.3%	17.1%	16.7%	18.3%	19.5%	19.5%	19.5%	20.1%	18.9%
70 to 79	10.3%	10.3%	8.7%	7.1%	7.7%	8.3%	8.6%	8.9%	8.7%	8.3%	9.2%	10.4%	9.1%	9.5%	9.9%	11.0%	11.0%	8.8%	7.7%
≥ 80	6.4%	6.4%	6.0%	5.7%	5.5%	5.3%	4.4%	3.5%	3.5%	4.1%	2.7%	5.6%	6.8%	5.8%	7.8%	5.1%	5.1%	5.1%	6.3%
<b>Total Males</b>	<b>27.0%</b>	<b>26.9%</b>	<b>25.9%</b>	<b>25.0%</b>	<b>24.3%</b>	<b>23.5%</b>	<b>23.7%</b>	<b>23.8%</b>	<b>23.4%</b>	<b>21.8%</b>	<b>23.2%</b>	<b>23.6%</b>	<b>21.9%</b>	<b>21.2%</b>	<b>21.6%</b>	<b>20.5%</b>	<b>19.2%</b>	<b>18.5%</b>	<b>18.8%</b>

## Trend in the Prevalence of Tobacco Smoking in Ontario

### By Sex, Age Group and Smoking Intensity

2000 to 2018

Age Group	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
<b>Females</b>																			
<i>Smoking Intensity - Less than 10 Cigarettes / Day</i>																			
12 to 19	10.6%	10.7%	10.3%	10.0%	8.5%	7.1%	6.8%	6.5%	6.1%	5.6%	5.6%	3.7%	4.8%	4.7%	2.2%	6.3%	4.5%	8.0%	3.1%
20 to 29	14.0%	14.0%	14.0%	14.3%	14.4%	14.5%	15.0%	15.5%	14.2%	14.1%	14.8%	14.2%	16.0%	10.8%	11.6%	11.5%	10.2%	9.1%	9.1%
30 to 39	8.6%	8.6%	8.8%	9.1%	9.5%	9.9%	9.5%	9.0%	8.3%	7.7%	8.0%	11.0%	12.5%	9.5%	7.5%	8.5%	8.0%	8.2%	9.3%
40 to 49	6.6%	6.6%	7.8%	9.1%	9.1%	9.0%	8.5%	8.0%	7.3%	6.7%	7.2%	7.7%	8.6%	7.7%	6.7%	8.1%	5.2%	5.7%	5.8%
50 to 59	5.4%	5.4%	5.9%	6.5%	6.6%	6.7%	6.7%	6.6%	6.0%	7.0%	7.6%	8.1%	8.2%	8.0%	6.3%	7.6%	8.5%	7.2%	6.8%
60 to 69	5.0%	5.0%	4.7%	4.5%	5.1%	5.7%	5.1%	4.6%	4.2%	5.0%	5.7%	4.7%	4.1%	4.2%	3.8%	5.9%	4.0%	6.0%	3.5%
70 to 79	4.1%	4.1%	4.0%	4.0%	3.8%	3.5%	3.7%	3.8%	3.5%	4.3%	4.4%	3.8%	4.1%	3.1%	2.8%	3.0%	4.4%	3.4%	4.0%
≥ 80	1.4%	1.4%	2.1%	2.8%	3.2%	3.5%	2.7%	1.9%	1.7%	3.2%	4.1%	2.0%	3.1%	1.3%	2.2%	2.7%	1.1%	3.5%	1.0%
<b>Total</b>	<b>7.9%</b>	<b>7.9%</b>	<b>8.1%</b>	<b>8.5%</b>	<b>8.5%</b>	<b>8.4%</b>	<b>8.2%</b>	<b>7.9%</b>	<b>7.3%</b>	<b>7.3%</b>	<b>7.8%</b>	<b>7.9%</b>	<b>8.7%</b>	<b>7.1%</b>	<b>6.1%</b>	<b>7.4%</b>	<b>6.4%</b>	<b>6.8%</b>	<b>6.0%</b>
<i>Smoking Intensity - 10 to 19 Cigarettes / Day</i>																			
12 to 19	4.7%	4.7%	3.7%	2.8%	2.6%	2.4%	2.3%	2.1%	1.9%	1.8%	2.2%	1.0%	1.0%	0.8%	0.7%	0.9%	0.2%	0.2%	0.5%
20 to 29	11.4%	11.4%	10.2%	9.1%	8.3%	7.5%	8.0%	8.5%	7.8%	5.6%	5.6%	5.4%	4.9%	7.3%	4.8%	2.8%	3.1%	2.8%	3.2%
30 to 39	10.7%	10.7%	9.0%	7.5%	7.5%	7.6%	7.7%	7.7%	7.1%	5.9%	5.1%	6.4%	6.1%	5.2%	5.5%	6.0%	5.5%	4.8%	3.8%
40 to 49	9.2%	9.2%	8.9%	8.7%	8.6%	8.5%	8.2%	8.0%	7.3%	6.9%	5.8%	5.8%	5.9%	4.8%	6.8%	6.0%	6.2%	4.4%	3.9%
50 to 59	7.2%	7.2%	7.0%	6.9%	6.8%	6.7%	7.5%	8.3%	7.6%	6.3%	5.5%	6.5%	7.0%	7.4%	6.6%	7.3%	6.4%	6.1%	5.5%
60 to 69	5.4%	5.4%	5.0%	4.7%	4.6%	4.5%	5.1%	5.7%	5.2%	5.2%	6.2%	4.4%	5.4%	4.5%	4.8%	3.0%	4.5%	3.2%	6.3%
70 to 79	3.4%	3.4%	3.3%	3.3%	3.2%	3.1%	3.3%	3.5%	3.2%	3.1%	3.3%	3.0%	3.7%	2.7%	2.5%	1.9%	2.0%	2.0%	2.4%
≥ 80	1.8%	1.8%	1.7%	1.7%	1.6%	1.6%	1.5%	1.3%	1.2%	1.4%	1.8%	1.1%	1.2%	1.2%	1.4%	2.2%	1.9%	1.0%	0.3%
<b>Total</b>	<b>7.9%</b>	<b>7.9%</b>	<b>7.1%</b>	<b>6.4%</b>	<b>6.2%</b>	<b>6.1%</b>	<b>6.2%</b>	<b>6.5%</b>	<b>5.9%</b>	<b>5.1%</b>	<b>4.8%</b>	<b>4.8%</b>	<b>4.9%</b>	<b>4.9%</b>	<b>4.7%</b>	<b>4.3%</b>	<b>4.2%</b>	<b>3.5%</b>	<b>3.7%</b>
<i>Smoking Intensity - 20 or More Cigarettes / Day</i>																			
12 to 19	1.1%	1.1%	1.0%	1.0%	0.9%	0.8%	0.6%	0.5%	0.5%	0.4%	0.6%	0.4%	0.5%	0.2%	0.2%	0.1%	0.0%	0.0%	0.2%
20 to 29	3.8%	3.8%	3.2%	2.6%	2.5%	2.4%	2.4%	2.4%	2.2%	2.0%	1.9%	1.3%	0.7%	2.3%	2.0%	1.5%	2.1%	1.3%	1.3%
30 to 39	6.2%	6.2%	5.7%	5.2%	4.2%	3.2%	3.2%	3.2%	3.0%	2.2%	1.9%	2.0%	2.1%	4.3%	2.1%	2.2%	2.2%	1.3%	1.5%
40 to 49	8.9%	8.9%	8.3%	7.9%	7.4%	7.0%	6.3%	5.6%	5.2%	4.4%	4.3%	4.2%	4.2%	4.7%	2.7%	2.0%	2.7%	2.6%	1.8%
50 to 59	8.0%	8.0%	7.3%	6.7%	6.7%	6.6%	6.1%	5.7%	5.2%	5.8%	6.1%	4.8%	4.7%	4.4%	4.5%	6.9%	4.0%	4.1%	4.8%
60 to 69	5.8%	5.8%	5.4%	5.2%	4.6%	3.9%	4.2%	4.4%	4.1%	3.7%	3.1%	3.4%	3.4%	3.9%	3.9%	4.4%	3.0%	3.6%	3.4%
70 to 79	2.9%	2.9%	2.9%	2.9%	2.6%	2.3%	2.2%	2.2%	2.0%	1.7%	2.0%	2.1%	2.3%	1.9%	1.5%	2.1%	2.5%	1.2%	1.5%
≥ 80	1.8%	1.8%	1.5%	1.3%	1.1%	1.0%	0.9%	0.7%	0.7%	0.5%	0.5%	0.7%	1.0%	0.7%	0.9%	0.4%	0.6%	0.5%	1.2%
<b>Total</b>	<b>5.5%</b>	<b>5.5%</b>	<b>5.0%</b>	<b>4.6%</b>	<b>4.3%</b>	<b>3.9%</b>	<b>3.7%</b>	<b>3.5%</b>	<b>3.2%</b>	<b>3.0%</b>	<b>2.9%</b>	<b>2.6%</b>	<b>2.6%</b>	<b>3.2%</b>	<b>2.5%</b>	<b>2.8%</b>	<b>2.4%</b>	<b>2.1%</b>	<b>2.1%</b>
<i>All Smoking Intensity Categories Combined</i>																			
12 to 19	16.4%	16.5%	15.1%	13.9%	12.1%	10.3%	9.7%	9.1%	8.5%	7.8%	8.4%	5.1%	6.2%	5.7%	8.5%	8.6%	8.6%	8.3%	3.8%
20 to 29	29.2%	29.2%	27.4%	25.9%	25.1%	24.3%	25.3%	26.3%	24.1%	21.7%	22.3%	21.0%	21.6%	20.5%	22.7%	24.4%	24.4%	13.2%	13.5%
30 to 39	25.6%	25.6%	23.5%	21.7%	21.3%	20.8%	20.4%	20.0%	18.3%	15.8%	15.0%	19.5%	20.7%	19.0%	21.6%	21.9%	21.9%	14.2%	14.5%
40 to 49	24.8%	24.8%	25.0%	25.7%	25.1%	24.5%	23.1%	21.6%	19.8%	18.0%	17.4%	17.7%	18.8%	17.2%	24.6%	20.9%	20.9%	12.7%	11.6%
50 to 59	20.5%	20.5%	20.1%	20.0%	20.1%	20.0%	20.3%	20.6%	18.9%	19.1%	19.2%	19.4%	19.9%	19.8%	24.5%	23.6%	23.6%	17.5%	17.0%
60 to 69	16.2%	16.2%	15.1%	14.3%	14.2%	14.2%	14.4%	14.7%	13.4%	13.9%	15.0%	12.5%	12.9%	12.6%	15.4%	15.4%	15.4%	12.8%	13.2%
70 to 79	10.4%	10.4%	10.2%	10.1%	9.6%	9.0%	9.2%	9.5%	8.7%	9.1%	9.7%	8.9%	10.1%	7.7%	10.6%	10.0%	10.0%	6.6%	7.8%
≥ 80	5.0%	5.0%	5.3%	5.8%	5.9%	6.1%	5.0%	4.0%	3.6%	5.1%	6.4%	3.8%	5.3%	3.1%	4.1%	4.2%	4.2%	5.0%	2.5%
<b>Total Females</b>	<b>21.4%</b>	<b>21.2%</b>	<b>20.2%</b>	<b>19.6%</b>	<b>19.0%</b>	<b>18.4%</b>	<b>18.2%</b>	<b>17.9%</b>	<b>16.4%</b>	<b>15.4%</b>	<b>15.6%</b>	<b>15.3%</b>	<b>16.2%</b>	<b>15.1%</b>	<b>13.3%</b>	<b>14.5%</b>	<b>13.0%</b>	<b>12.4%</b>	<b>11.8%</b>

## Appendix B: Direct Costs by Disease Category

### Quebec Males

<b>Estimated Direct Costs of Comorbidities</b>								
Quebec Males, 2018 (\$' 000,000)								
ICD-10	Hospitals	Physicians	Other Health Professionals	Drugs	Health Research	Other	Total	
<b>Neoplasms</b>								
Lip, oral cavity, pharynx, larynx	C00-14, 30-32	\$29.25	\$6.99	\$2.53	\$0.44	\$0.83	\$6.60	<b>\$46.65</b>
Esophagus	C15	\$12.81	\$3.41	\$1.12	\$0.00	\$0.37	\$2.92	<b>\$20.63</b>
Stomach	C16	\$21.86	\$1.76	\$1.63	\$0.00	\$0.54	\$4.25	<b>\$30.03</b>
Colo-rectal	C18-20	\$92.84	\$16.85	\$7.82	\$3.66	\$2.58	\$20.39	<b>\$144.14</b>
Liver	C22	\$7.04	\$1.53	\$0.59	\$0.00	\$0.19	\$1.54	<b>\$10.90</b>
Pancreas	C25	\$15.68	\$2.39	\$1.25	\$0.00	\$0.41	\$3.25	<b>\$22.98</b>
Trachea, bronchus, lung	C33-34	\$85.89	\$14.04	\$7.62	\$10.50	\$2.51	\$19.87	<b>\$140.42</b>
Breast	C50	\$0.40	\$0.32	\$0.05	\$0.00	\$0.02	\$0.13	<b>\$0.91</b>
Kidney	C64	\$17.18	\$3.87	\$1.45	\$0.00	\$0.48	\$3.79	<b>\$26.76</b>
Urinary bladder	C67	\$26.21	\$10.53	\$2.53	\$0.00	\$0.83	\$6.61	<b>\$46.71</b>
<b>Endocrine, nutritional and metabolic diseases</b>								
Type 2 diabetes	E11-14	\$57.74	\$141.47	\$72.67	\$853.93	\$23.92	\$189.45	<b>\$1,339.19</b>
<b>Diseases of the circulatory system</b>								
Ischaemic heart diseases	I20-25	\$486.75	\$99.96	\$48.89	\$121.81	\$16.10	\$127.46	<b>\$900.97</b>
Pulmonary embolism	I26	\$20.82	\$5.87	\$2.13	\$4.13	\$0.70	\$5.54	<b>\$39.19</b>
Venous thromboembolism	I80-82	\$10.22	\$3.47	\$1.80	\$12.40	\$0.59	\$4.69	<b>\$33.17</b>
Cerebrovascular disease	I60-69	\$91.36	\$29.38	\$10.52	\$31.72	\$3.46	\$27.43	<b>\$193.88</b>
Aortic aneurysm	I71	\$39.39	\$13.36	\$6.94	\$47.83	\$2.28	\$18.09	<b>\$127.89</b>
<b>Diseases of the respiratory system</b>								
Pneumonia	J12-18	\$129.87	\$27.15	\$11.82	\$14.22	\$3.89	\$30.80	<b>\$217.75</b>
Chronic lung disease	J40-44	\$116.74	\$0.47	\$8.09	\$0.10	\$2.66	\$21.10	<b>\$149.16</b>
<b>Diseases of the digestive system</b>								
Intestinal Ischemia	K55	\$14.26	\$4.20	\$1.88	\$8.83	\$0.62	\$4.91	<b>\$34.72</b>
Cirrhosis of liver	K70,74	\$39.22	\$11.82	\$3.83	\$4.53	\$1.26	\$10.00	<b>\$70.66</b>
<b>Total</b>		<b>\$1,315.5</b>	<b>\$398.8</b>	<b>\$195.2</b>	<b>\$1,114.1</b>	<b>\$64.3</b>	<b>\$508.8</b>	<b>\$3,596.7</b>
% of Total		36.58%	11.09%	5.43%	30.98%	1.79%	14.15%	100.00%

## Quebec Females

### Estimated Direct Costs of Comorbidities

Quebec Females, 2018 (\$' 000,000 )

	ICD-10	Other Health						Total
		Hospitals	Physicians	Professionals	Drugs	Research	Other	
<b>Neoplasms</b>								
Lip, oral cavity, pharynx, larynx	C00-14, 30-32	\$7.38	\$1.96	\$0.92	\$0.30	\$0.30	\$2.39	<b>\$13.24</b>
Esophagus	C15	\$2.01	\$0.67	\$0.25	\$0.00	\$0.08	\$0.66	<b>\$3.69</b>
Stomach	C16	\$7.17	\$0.81	\$0.76	\$0.00	\$0.25	\$1.98	<b>\$10.97</b>
Colo-rectal	C18-20	\$49.39	\$8.88	\$5.66	\$1.34	\$1.87	\$14.77	<b>\$81.91</b>
Liver	C22	\$1.27	\$0.62	\$0.18	\$0.00	\$0.06	\$0.47	<b>\$2.60</b>
Pancreas	C25	\$10.06	\$1.56	\$1.10	\$0.00	\$0.36	\$2.88	<b>\$15.96</b>
Trachea, bronchus, lung	C33-34	\$50.69	\$8.38	\$6.37	\$8.00	\$2.10	\$16.61	<b>\$92.14</b>
Breast	C50	\$38.41	\$21.64	\$5.71	\$0.00	\$1.88	\$14.88	<b>\$82.52</b>
Kidney	C64	\$6.88	\$1.53	\$0.81	\$0.17	\$0.27	\$2.12	<b>\$11.77</b>
Urinary bladder	C67	\$6.10	\$2.41	\$0.81	\$0.00	\$0.27	\$2.11	<b>\$11.69</b>
<b>Endocrine, nutritional and metabolic diseases</b>								
Type 2 diabetes	E11-14	\$30.40	\$99.24	\$41.97	\$312.05	\$13.82	\$109.43	<b>\$606.91</b>
<b>Diseases of the circulatory system</b>								
Ischaemic heart diseases	I20-25	\$138.97	\$31.86	\$18.72	\$26.14	\$6.16	\$48.80	<b>\$270.65</b>
Pulmonary embolism	I26	\$21.96	\$2.57	\$2.76	\$4.56	\$0.91	\$7.21	<b>\$39.96</b>
Venous thromboembolism	I80-82	\$7.42	\$2.81	\$1.67	\$7.39	\$0.55	\$4.37	<b>\$24.21</b>
Cerebrovascular disease	I60-69	\$64.60	\$17.53	\$8.04	\$2.51	\$2.65	\$20.97	<b>\$116.31</b>
Aortic aneurysm	I71	\$7.48	\$2.83	\$1.69	\$7.45	\$0.56	\$4.40	<b>\$24.40</b>
<b>Diseases of the respiratory system</b>								
Pneumonia	J12-18	\$82.99	\$15.52	\$10.67	\$13.74	\$3.51	\$27.81	<b>\$154.25</b>
Chronic lung disease	J40-44	\$91.17	\$0.56	\$8.81	\$1.01	\$2.90	\$22.98	<b>\$127.43</b>
<b>Diseases of the digestive system</b>								
Intestinal Ischemia	K55	\$17.95	\$5.00	\$3.27	\$11.50	\$1.08	\$8.54	<b>\$47.34</b>
Cirrhosis of liver	K70,74	\$18.17	\$5.41	\$2.97	\$7.73	\$0.98	\$7.75	<b>\$43.01</b>
<b>Total</b>		<b>\$660.5</b>	<b>\$231.8</b>	<b>\$123.2</b>	<b>\$403.9</b>	<b>\$40.6</b>	<b>\$321.1</b>	<b>\$1,781.0</b>
% of Total		37.08%	13.01%	6.92%	22.68%	2.28%	18.03%	100.00%

## Ontario Males

### Estimated Direct Costs of Comorbidities

Ontario Males, 2018 (\$' 000,000 )

	ICD-10	Other Health						Total
		Hospitals	Physicians	Professionals	Drugs	Research	Other	
<b>Neoplasms</b>								
Lip, oral cavity, pharynx, larynx	C00-14, 30-32	\$39.68	\$12.65	\$3.65	\$3.91	\$1.32	\$13.58	\$74.79
Esophagus	C15	\$19.35	\$6.17	\$1.66	\$0.00	\$0.60	\$6.16	\$33.93
Stomach	C16	\$28.65	\$3.17	\$2.07	\$0.00	\$0.74	\$7.68	\$42.32
Colo-rectal	C18-20	\$119.14	\$30.48	\$9.77	\$0.83	\$3.52	\$36.33	\$200.07
Liver	C22	\$11.45	\$2.77	\$0.92	\$0.00	\$0.33	\$3.43	\$18.91
Pancreas	C25	\$15.79	\$4.32	\$1.31	\$0.00	\$0.47	\$4.86	\$26.75
Trachea, bronchus, lung	C33-34	\$72.52	\$25.38	\$7.06	\$10.80	\$2.54	\$26.25	\$144.55
Breast	C50	\$0.76	\$0.57	\$0.09	\$0.00	\$0.03	\$0.32	\$1.78
Kidney	C64	\$24.85	\$6.99	\$2.16	\$1.39	\$0.78	\$8.02	\$44.19
Urinary bladder	C67	\$50.32	\$19.04	\$4.50	\$0.00	\$1.62	\$16.75	\$92.23
<b>Endocrine, nutritional and metabolic diseases</b>								
Type 2 diabetes	E11-14	\$157.17	\$255.83	\$122.40	\$1,472.39	\$44.13	\$455.27	\$2,507.19
<b>Diseases of the circulatory system</b>								
Ischaemic heart diseases	I20-25	\$893.84	\$180.77	\$74.94	\$79.75	\$27.02	\$278.75	\$1,535.07
Pulmonary embolism	I26	\$31.10	\$10.61	\$2.97	\$4.09	\$1.07	\$11.06	\$60.90
Venous thromboembolism	I80-82	\$17.20	\$6.27	\$2.62	\$16.96	\$0.95	\$9.76	\$53.77
Cerebrovascular disease	I60-69	\$139.33	\$53.14	\$14.77	\$35.04	\$5.33	\$54.94	\$302.55
Aortic aneurysm	I71	\$66.33	\$24.17	\$10.12	\$65.38	\$3.65	\$37.64	\$207.29
<b>Diseases of the respiratory system</b>								
Pneumonia	J12-18	\$169.47	\$49.09	\$15.89	\$26.14	\$5.73	\$59.09	\$325.41
Chronic lung disease	J40-44	\$197.17	\$0.84	\$12.99	\$2.04	\$4.68	\$48.31	\$266.03
<b>Diseases of the digestive system</b>								
Intestinal Ischemia	K55	\$27.26	\$7.60	\$3.06	\$12.23	\$1.10	\$11.37	\$62.62
Cirrhosis of liver	K70,74	\$82.09	\$21.37	\$6.88	\$2.50	\$2.48	\$25.59	\$140.90
<b>Total</b>		<b>\$2,163.5</b>	<b>\$721.2</b>	<b>\$299.8</b>	<b>\$1,733.5</b>	<b>\$108.1</b>	<b>\$1,115.2</b>	<b>\$6,141.3</b>
% of Total		35.23%	11.74%	4.88%	28.23%	1.76%	18.16%	100.00%



## Ontario Females

Estimated Direct Costs of Comorbidities								
Ontario Females, 2018 (\$' 000,000 )								
	ICD-10	Hospitals	Physicians	Other Health Professionals	Drugs	Health Research	Other	Total
<b>Neoplasms</b>								
Lip, oral cavity, pharynx, larynx	C00-14, 30-32	\$7.53	\$3.54	\$1.30	\$2.48	\$0.47	\$4.84	<b>\$20.16</b>
Esophagus	C15	\$3.94	\$1.21	\$0.50	\$0.00	\$0.18	\$1.84	<b>\$7.67</b>
Stomach	C16	\$9.42	\$1.46	\$1.04	\$0.00	\$0.38	\$3.88	<b>\$16.18</b>
Colo-rectal	C18-20	\$60.11	\$16.06	\$7.51	\$2.06	\$2.71	\$27.94	<b>\$116.40</b>
Liver	C22	\$1.61	\$1.13	\$0.26	\$0.00	\$0.09	\$0.98	<b>\$4.08</b>
Pancreas	C25	\$10.61	\$2.82	\$1.29	\$0.00	\$0.46	\$4.80	<b>\$19.98</b>
Trachea, bronchus, lung	C33-34	\$42.92	\$15.15	\$6.34	\$8.01	\$2.29	\$23.60	<b>\$98.30</b>
Breast	C50	\$57.85	\$39.14	\$9.31	\$0.00	\$3.36	\$34.64	<b>\$144.30</b>
Kidney	C64	\$8.67	\$2.76	\$1.10	\$0.00	\$0.40	\$4.08	<b>\$17.01</b>
Urinary bladder	C67	\$10.85	\$4.35	\$1.46	\$0.00	\$0.53	\$5.43	<b>\$22.62</b>
<b>Endocrine, nutritional and metabolic diseases</b>								
Type 2 diabetes	E11-14	\$72.56	\$179.46	\$76.33	\$542.93	\$27.52	\$283.92	<b>\$1,182.73</b>
<b>Diseases of the circulatory system</b>								
Ischaemic heart diseases	I20-25	\$245.10	\$57.62	\$30.30	\$12.82	\$10.92	\$112.70	<b>\$469.46</b>
Pulmonary embolism	I26	\$28.60	\$4.65	\$3.29	\$1.03	\$1.19	\$12.24	<b>\$51.01</b>
Venous thromboembolism	I80-82	\$11.39	\$5.08	\$2.64	\$11.07	\$0.95	\$9.84	<b>\$40.98</b>
Cerebrovascular disease	I60-69	\$87.91	\$31.71	\$12.33	\$8.78	\$4.45	\$45.86	<b>\$191.03</b>
Aortic aneurysm	I71	\$11.48	\$5.12	\$2.67	\$11.16	\$0.96	\$9.91	<b>\$41.30</b>
<b>Diseases of the respiratory system</b>								
Pneumonia	J12-18	\$102.68	\$28.07	\$14.02	\$15.22	\$5.05	\$52.14	<b>\$217.18</b>
Chronic lung disease	J40-44	\$121.46	\$1.01	\$12.02	\$2.68	\$4.33	\$44.70	<b>\$186.20</b>
<b>Diseases of the digestive system</b>								
Intestinal Ischemia	K55	\$31.87	\$9.04	\$5.53	\$16.70	\$1.99	\$20.58	<b>\$85.72</b>
Cirrhosis of liver	K70,74	\$35.53	\$9.77	\$4.53	\$1.89	\$1.63	\$16.86	<b>\$70.21</b>
<b>Total</b>		<b>\$962.1</b>	<b>\$419.2</b>	<b>\$193.8</b>	<b>\$636.8</b>	<b>\$69.9</b>	<b>\$720.8</b>	<b>\$3,002.5</b>
% of Total		32.04%	13.96%	6.45%	21.21%	2.33%	24.01%	100.00%

## Appendix C: Direct Cost Attributable to Smoking by Sex and Diseases Category

Quebec

### Estimated Direct Cost of Smoking in Quebec, Total and Per Smoker By Sex and Disease Category, 2018

Number of Smokers in 2018		Male	Female	Total			
		715,770	562,652	1,278,421			
		\$ Millions			Per Smoker		
	ICD-10	Male	Female	Total	Male	Female	Total
Lip, oral cavity, pharynx, larynx	C00-14, 30-32	\$15.12	\$4.37	\$19.48	\$21.12	\$7.76	\$15.24
Esophagus	C15	\$4.22	\$0.81	\$5.02	\$5.89	\$1.44	\$3.93
Stomach	C16	\$2.71	\$1.35	\$4.06	\$3.78	\$2.39	\$3.17
Colo-rectal	C18-20	\$6.87	\$2.88	\$9.75	\$9.60	\$5.13	\$7.63
Liver	C22	\$0.32	\$0.18	\$0.50	\$0.45	\$0.32	\$0.39
Pancreas	C25	\$2.82	\$2.42	\$5.24	\$3.94	\$4.30	\$4.10
Trachea, bronchus, lung	C33-34	\$111.02	\$67.11	\$178.13	\$155.11	\$119.28	\$139.34
Breast	C50	\$0.00	\$1.10	\$1.10	\$0.00	\$1.95	\$0.86
Kidney	C64	\$2.35	\$1.39	\$3.74	\$3.29	\$2.47	\$2.93
Urinary bladder	C67	\$9.07	\$2.81	\$11.88	\$12.67	\$5.00	\$9.30
<b>All smoking-related Cancers</b>		<b>\$154.49</b>	<b>\$84.42</b>	<b>\$238.91</b>	<b>\$215.84</b>	<b>\$150.04</b>	<b>\$186.88</b>
Aortic aneurysm	I71	\$48.39	\$10.07	\$58.46	\$67.60	\$17.90	\$45.73
Pulmonary embolism	I26	\$0.99	\$2.46	\$3.45	\$1.38	\$4.37	\$2.70
Venous Thromboembolism	I80-82	\$0.84	\$1.49	\$2.33	\$1.17	\$2.65	\$1.82
<b>Vascular Disease</b>		<b>\$50.22</b>	<b>\$14.02</b>	<b>\$64.24</b>	<b>\$70.16</b>	<b>\$24.92</b>	<b>\$50.25</b>
Ischaemic heart diseases	I20-25	\$277.48	\$86.47	\$363.95	\$387.67	\$153.68	\$284.68
<b>Coronary Heart Disease</b>		<b>\$277.48</b>	<b>\$86.47</b>	<b>\$363.95</b>	<b>\$387.67</b>	<b>\$153.68</b>	<b>\$284.68</b>
Cerebrovascular disease	I60-69	\$38.20	\$25.39	\$63.59	\$53.37	\$45.13	\$49.74
<b>Cerebrovascular Disease</b>		<b>\$38.20</b>	<b>\$25.39</b>	<b>\$63.59</b>	<b>\$53.37</b>	<b>\$45.13</b>	<b>\$49.74</b>
Chronic lung disease	J40-44	\$124.52	\$105.38	\$229.91	\$173.97	\$187.30	\$179.84
Pneumonia	J12-18	\$42.71	\$32.81	\$75.52	\$59.67	\$58.32	\$59.08
<b>Respiratory Disease</b>		<b>\$167.23</b>	<b>\$138.20</b>	<b>\$305.43</b>	<b>\$233.64</b>	<b>\$245.62</b>	<b>\$238.91</b>
Type 2 diabetes	E11-14	\$66.22	\$39.93	\$106.15	\$92.51	\$70.97	\$83.03
Intestinal Ischemia	K55	\$13.33	\$18.30	\$31.63	\$18.62	\$32.52	\$24.74
Cirrhosis of alcoholic liver	K70,74	\$15.91	\$10.56	\$26.47	\$22.23	\$18.76	\$20.71
<b>Other</b>		<b>\$95.46</b>	<b>\$68.79</b>	<b>\$164.25</b>	<b>\$133.37</b>	<b>\$122.26</b>	<b>\$128.48</b>
<b>Total</b>		<b>\$783.09</b>	<b>\$417.29</b>	<b>\$1,200.37</b>	<b>\$1,094.05</b>	<b>\$741.64</b>	<b>\$938.95</b>
<b>Total excluding "other"</b>		\$687.63	\$348.50	\$1,036.12	\$960.68	\$619.39	\$810.47

Ontario

**Estimated Direct Cost of Smoking in Ontario, Total and Per Smoker**  
By Sex and Disease Category, 2018

Number of Smokers in 2018		Male	Female	Total			
		1,156,030	751,755	1,907,785			
		\$ Millions			Per Smoker		
ICD-10		Male	Female	Total	Male	Female	Total
Lip, oral cavity, pharynx, larynx	C00-14, 30-32	\$23.42	\$5.63	\$29.05	\$20.26	\$7.48	\$15.23
Esophagus	C15	\$6.64	\$1.39	\$8.03	\$5.75	\$1.84	\$4.21
Stomach	C16	\$3.67	\$1.59	\$5.26	\$3.18	\$2.11	\$2.76
Colo-rectal	C18-20	\$9.04	\$3.21	\$12.26	\$7.82	\$4.28	\$6.42
Liver	C22	\$0.55	\$0.22	\$0.77	\$0.47	\$0.29	\$0.40
Pancreas	C25	\$3.16	\$2.44	\$5.60	\$2.73	\$3.25	\$2.93
Trachea, bronchus, lung	C33-34	\$112.97	\$66.70	\$179.67	\$97.72	\$88.72	\$94.18
Breast	C50	\$0.00	\$1.55	\$1.55	\$0.00	\$2.06	\$0.81
Kidney	C64	\$3.75	\$1.62	\$5.37	\$3.24	\$2.16	\$2.81
Urinary bladder	C67	\$17.45	\$4.47	\$21.92	\$15.10	\$5.95	\$11.49
<b>All smoking-related Cancers</b>		<b>\$180.65</b>	<b>\$88.81</b>	<b>\$269.47</b>	<b>\$156.27</b>	<b>\$118.14</b>	<b>\$141.25</b>
Aortic aneurysm	I71	\$76.86	\$14.66	\$91.52	\$66.48	\$19.51	\$47.97
Pulmonary embolism	I26	\$1.45	\$2.48	\$3.93	\$1.26	\$3.30	\$2.06
Venous Thromboembolism	I80-82	\$1.28	\$1.99	\$3.28	\$1.11	\$2.65	\$1.72
<b>Vascular Disease</b>		<b>\$79.59</b>	<b>\$19.14</b>	<b>\$98.73</b>	<b>\$68.85</b>	<b>\$25.46</b>	<b>\$51.75</b>
Ischaemic heart diseases	I20-25	\$457.29	\$125.99	\$583.27	\$395.57	\$167.59	\$305.73
<b>Coronary Heart Disease</b>		<b>\$457.29</b>	<b>\$125.99</b>	<b>\$583.27</b>	<b>\$395.57</b>	<b>\$167.59</b>	<b>\$305.73</b>
Cerebrovascular disease	I60-69	\$57.47	\$34.22	\$91.69	\$49.72	\$45.51	\$48.06
<b>Cerebrovascular Disease</b>		<b>\$57.47</b>	<b>\$34.22</b>	<b>\$91.69</b>	<b>\$49.72</b>	<b>\$45.51</b>	<b>\$48.06</b>
Chronic lung disease	J40-44	\$220.06	\$146.94	\$367.00	\$190.36	\$195.47	\$192.37
Pneumonia	J12-18	\$61.24	\$38.04	\$99.27	\$52.97	\$50.60	\$52.04
<b>Respiratory Disease</b>		<b>\$281.29</b>	<b>\$184.98</b>	<b>\$466.28</b>	<b>\$243.33</b>	<b>\$246.07</b>	<b>\$244.41</b>
Type 2 diabetes	E11-14	\$119.35	\$63.40	\$182.75	\$103.24	\$84.34	\$95.79
Intestinal Ischemia	K55	\$23.27	\$28.30	\$51.57	\$20.13	\$37.64	\$27.03
Cirrhosis of alcoholic liver	K70,74	\$30.61	\$14.18	\$44.79	\$26.48	\$18.86	\$23.48
<b>Other</b>		<b>\$173.22</b>	<b>\$105.88</b>	<b>\$279.11</b>	<b>\$149.84</b>	<b>\$140.85</b>	<b>\$146.30</b>
<b>Total</b>		<b>\$1,229.52</b>	<b>\$559.03</b>	<b>\$1,788.55</b>	<b>\$1,063.57</b>	<b>\$743.63</b>	<b>\$937.50</b>
<b>Total excluding "other"</b>		\$1,056.30	\$453.14	\$1,509.44	\$913.73	\$602.78	\$791.20