GPI Atlantic

Genuine Progress Index for Atlantic Canada / Indice de progrès véritable - Atlantique

MEASURING SUSTAINABLE DEVELOPMENT

THE GENUINE PROGRESS INDEX

THE COST OF TOBACCO USE IN SASKATCHEWAN

Prepared for the Canadian Cancer Society by:
Janet Rhymes, MA and Ronald Colman, PhD
with assistance from Zhe Ren, MA
October 2009

EXECUTIVE SUMMARY

GPI*Atlantic* first reported the full economic and social costs of tobacco use in *Cost of Tobacco in Nova Scotia* (2000). This was followed by assessments of the cost of tobacco use and the economics of tobacco control in New Brunswick (2003), Newfoundland and Labrador (2003) and British Columbia (2004). Nova Scotia's cost report was updated in 2007 using the latest, most widely accepted research and analytical techniques. Using the 2007 Nova Scotia report as a model, this current report provides an analysis of tobacco use trends and calculates the economic and social costs of tobacco use for the province of Saskatchewan.

Conventionally, smoking has been counted as a benefit to the economy because economic growth and Gross Domestic Product (GDP)-based measures of progress count the sale of tobacco and tobacco cessation products and smoking-attributable health care costs as contributors to economic growth. As this report shows, there are substantial physical, emotional, economic and environmental costs to tobacco use that are not included in conventional accounting mechanisms. Costs of tobacco use include premature mortality and disability, direct hospital, physician and drug expenditures on smoking-attributable illnesses and indirect costs such as productivity losses to the economy.

In contrast, the Genuine Progress Index (GPI) considers the costs of tobacco use and tobacco-related illnesses as liabilities, rather than gains to the economy.

Smoking and exposure to ETS resulted in the death of an estimated 1,561 Saskatchewan residents in 2005, accounting for 18% of all deaths in the province. This clearly has significant emotional and social costs for victims, their families and loved ones.

Tobacco use also adds a significant burden to the Saskatchewan economy, costing $167.6 million in direct health care costs and an additional $535.2 million ($2008) in indirect costs (productivity losses due to long and short term disability and premature death). It cost Saskatchewan employers an estimated additional $373 million ($2008) more to employ a smoker rather than a non-smoker, largely due to on-the-job productivity losses. Additional costs due to smoking in Saskatchewan include $1.9 million for the cost of fires due to smoking, and prevention and research costs ranging from $2.4 to $3.9 million ($2008).

As a result, the full cost of tobacco use in Saskatchewan is estimated at $1,080 million ($2008), or $1,063 per-capita. Only 18% of these costs are offset through tobacco tax revenue. Thirty-four percent of the cost, ($373 million), is borne by Saskatchewan employers; 48% ($517 million) is borne by taxpayers, more than 76% of whom are non-smokers.

There are also enormous potential benefits to investing in tobacco reduction, including lives saved, better long-term health outcomes and cost savings. A decline of 25% in tobacco use prevalence from 20% to 15% would lead to an estimated savings to Saskatchewan of $69 per-capita ($2009), or a total of $70 million ($2008), not including employer cost-savings.

Trend analysis shows tobacco use prevalence rates to be of concern within Saskatchewan. According to 2008 Canadian Tobacco Use Monitoring Survey (CTUMS) results, 20% of Saskatchewan residents (aged 15 and over) were current smokers. 2008 Canadian Community Health Survey (CCHS) data—drawing from a significantly larger sample size—show 28.4% of males and 22% of females in Saskatchewan as daily or occasional smokers. These rates are higher than the Canadian average (2008) of 24.3% for males and 18.5% for females.

Saskatchewan also recorded the lowest percentage decline of youth smoking rates (aged 15 – 24) and adult smoking rates (aged 25 and over) between 1999 and 2007 of any Canadian province.

It is, however, important to keep in mind that the majority of Saskatchewan residents do not smoke. In 2005, 75% of Saskatchewan males and 77% of females did not smoke. This includes individuals who have never smoked and others who have quit smoking. Exposure of children to Environmental Tobacco Smoke (ETS) in the home has also declined considerably over time, from 31% in 2000 to 11.7% in 2008. Exposure to ETS in public places has also declined, from 23.7% in 2003 to 7.7% in 2008.

Regionally, smoking rates in Saskatchewan vary considerably by health region and over time. The lowest smoking rates in 2008 were found in Cypress (21.1%). The highest smoking rates were found in Mamawetan/Keewatin/Athabasca (41.3%), Sunrise (29.6%) and Sun Country (29.9%).

From a full-cost accounting perspective, the GPI also considers tobacco reduction strategies as public health investments. These have the potential to provide significant returns on investment in the form of savings in avoided health care costs and productivity losses. Investing in tobacco reduction therefore has the potential to reduce suffering and premature mortality, to improve the health and well-being of individuals and families, and to reduce the direct and indirect costs associated with tobacco use.

ACKNOWLEDGEMENTS

GPI*Atlantic* gratefully acknowledges funding for this project provided by the Canadian Cancer Society – Saskatchewan Division.

The authors would like to extend a special thanks to Donna Pasiechnik, Manager of Tobacco Control, Media and Government Relations, Canadian Cancer Society – Saskatchewan Division; Zhe Ren, PhD candidate, Dalhousie University; Ronalda Leibel, Information Services Corporation of Saskatchewan; and Cynthia Martin, editor.

Inspiration for the Nova Scotia Genuine Progress Index came from the ground breaking work of Redefining Progress, which produced the first GPI in the United States in 1995. Though **GPI***Atlantic*'s methods differ in many ways, particularly in not aggregating index components for a single bottom line, we share with the original GPI the attempt to build a more comprehensive and accurate measure of well-being than can be provided by market statistics alone. **GPI***Atlantic* also gratefully acknowledges the pioneers in the field of natural resource accounting and integrated environmental-economic accounting on whose work this study and the GPI natural resource accounts build.

Any errors or misinterpretations, and all viewpoints expressed, are the sole responsibility of the authors and **GPI***Atlantic.*

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

List of Acronyms

AB	Alberta
ACS	American Cancer Society
AR	Attributable Risk
BC	British Columbia
CCSA	Canadian Centre on Substance Abuse
CCHS	Canadian Community Health Survey
CTUMS	Canadian Tobacco Use Monitoring Survey
CPS	Cancer Prevention Study
COPD	Chronic Obstructive Pulmonary Disease
ETS	Environmental Tobacco Smoke
GDP	Gross Domestic Product
GPI	Genuine Progress Index
ICD	International Classification of Diseases
MB	Manitoba
NB	New Brunswick
NL	Newfoundland and Labrador
NRT	Nicotine Reduction Therapy
NS	Nova Scotia
ON	Ontario
P	Prevalence
PE	Prince Edward Island
QC	Quebec
RR	Relative Risk
SAF	Smoking-Attributable Fraction
SAM	Smoking-Attributable Mortality
SK	Saskatchewan
SOSIC	Survey on Smoking in Canada
US	United States
WHO	World Health Organization

PART I
INTRODUCTION

1. Introduction

Conventionally, smoking has been counted as a benefit to the economy because economic growth and Gross Domestic Product (GDP)-based measures of progress count the sale of tobacco and tobacco cessation products and smoking-attributable health care costs as contributors to economic growth. Yet there are substantial physical, emotional, economic and environmental costs to tobacco use that are not included in conventional accounting mechanisms. Costs of tobacco use include premature mortality and disability, direct hospital, physician and drug expenditures on smoking-attributable illnesses, and indirect costs such as productivity losses to the economy. In contrast, the Genuine Progress Index (GPI) counts the costs of tobacco use and tobacco-related illnesses as liabilities, rather than gains to the economy.

From this perspective, the GPI also considers tobacco reduction strategies as public health investments. These have the potential to provide significant returns on investment in the form of savings in avoided health care costs and productivity losses. A healthy population and workforce is a fundamental component of the human capital required to power a healthy economy. Investing in tobacco reduction therefore has the potential to reduce suffering and premature mortality, to improve the health and well-being of individuals and families in Saskatchewan, and to reduce the direct and indirect costs associated with tobacco use.

An analysis of tobacco use trends and estimates of the full cost of tobacco use are important criteria for investment in tobacco reduction. This information is provided in the two main sections of this report.

- An overview of trends in tobacco use in Canada, Saskatchewan and the Prairie provinces.

This includes consideration of trends in smoking rates, exposure to Environmental Tobacco Smoke (ETS), average daily cigarette consumption, and tobacco sales. Smoking rates by health region are also examined.

- The cost of tobacco use in Saskatchewan.

This includes an estimate of mortality due to tobacco use and ETS exposure using accepted and recent methodological approaches based on epidemiological meta-analysis of smoking - attributable risk. The direct, indirect and employer costs of tobacco use are also estimated.

PART II
TRENDS IN SMOKING, ENVIRONMENTAL TOBACCO SMOKE AND TOBACCO SALES

2. Trends in Smoking, Environmental Tobacco Smoke and Tobacco Sales

General Trends in Smoking

Statistics on smoking prevalence in Saskatchewan vary by year and age. According to the most recent Canadian Tobacco Use Monitoring Survey (CTUMS) results shown over time in Table 1, 20% of Saskatchewan residents (aged 15 and over) were current smokers in 2008, a decline from 26% in 1999. The 20% rate is on par with most Canadian provinces except Ontario (17%) and British Columbia (15%). Canadian Community Health Survey (CCHS) data, drawn from a significantly larger sample size, shows a rate of 25% for current daily and occasional smokers aged 12 and over.[1]

As shown in Table 1, smoking rates (aged 15 and over) in Saskatchewan in 1999 and 2000 are relatively high (26% and 28% respectively) but are in keeping with similarly high rates in every Canadian province except British Columbia (20%). Over time, however, smoking rates fell in most provinces, but remained stubbornly high in Saskatchewan. In 2006 and 2007, for example, the smoking rates of 24% were the highest among all Canadian provinces.

Table 1: **Current Smokers (aged 15 and over) by Province, 1999–2008**

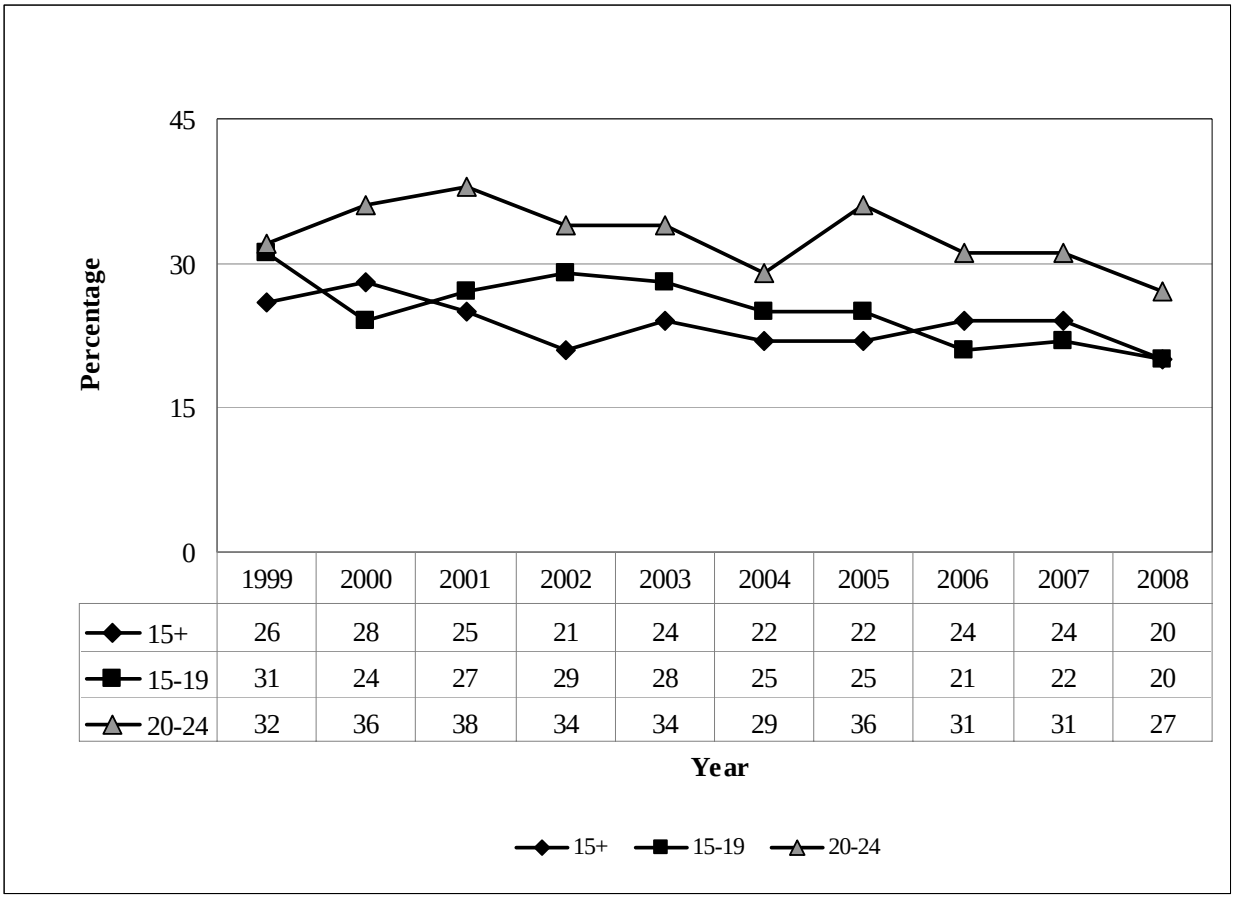
Age 15 and over	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Canada	25	24	22	21	21	20	19	19	19	18
British Columbia	20	20	17	16	16	15	15	16	14	15
Alberta	26	23	25	23	20	20	21	21	21	20
Saskatchewan	26	28	25	21	24	22	22	24	24	20
Manitoba	23	26	26	21	21	21	22	20	20	21
Ontario	23	23	20	20	20	19	16	17	18	17
Quebec	30	28	24	26	25	22	22	20	22	19
New Brunswick	26	27	25	21	24	24	22	23	21	20
Nova Scotia	29	30	25	25	22	20	21	22	20	20
Prince Edward Island	26	26	26	23	21	21	20	19	18	19
Newfoundland Labrador	28	28	26	24	23	22	21	22	21	20

Source: Health Canada, 2008, *CTUMS Supplementary Tables, Annual Results (2000, 2008)*. Available at: www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/_ctums-esutc_2008/ann-table2-eng.php. Accessed September 2008.

Source: Statistics Canada. Table 105-0501 - Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2007 boundaries) and peer groups, occasional, CANSIM (database). http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&CNSM-Fi=CII/CII_1-eng.htm (accessed: September 28, 2009)

Figure 1 (below) displays smoking rates over time by age group. Figure 1 shows a decline of 36% among Saskatchewan teens (aged 15-19), from 31% in 1999 to 20% in 2008. Among young adults (aged 20-24), smoking rates in this period fluctuated from 32% in 1999 to a high of 38% in 2001, to 29% in 2004, rising again to 36% in 2005 and estimated at 27% in 2008. Overall, this represents a 16% decline from 1999 to 2008.[2] Smoking rates among young adults aged 20-24 in Saskatchewan still remain unacceptably high at 27%.

Figure 1: Current Smokers by Age, Saskatchewan, 1999-2008



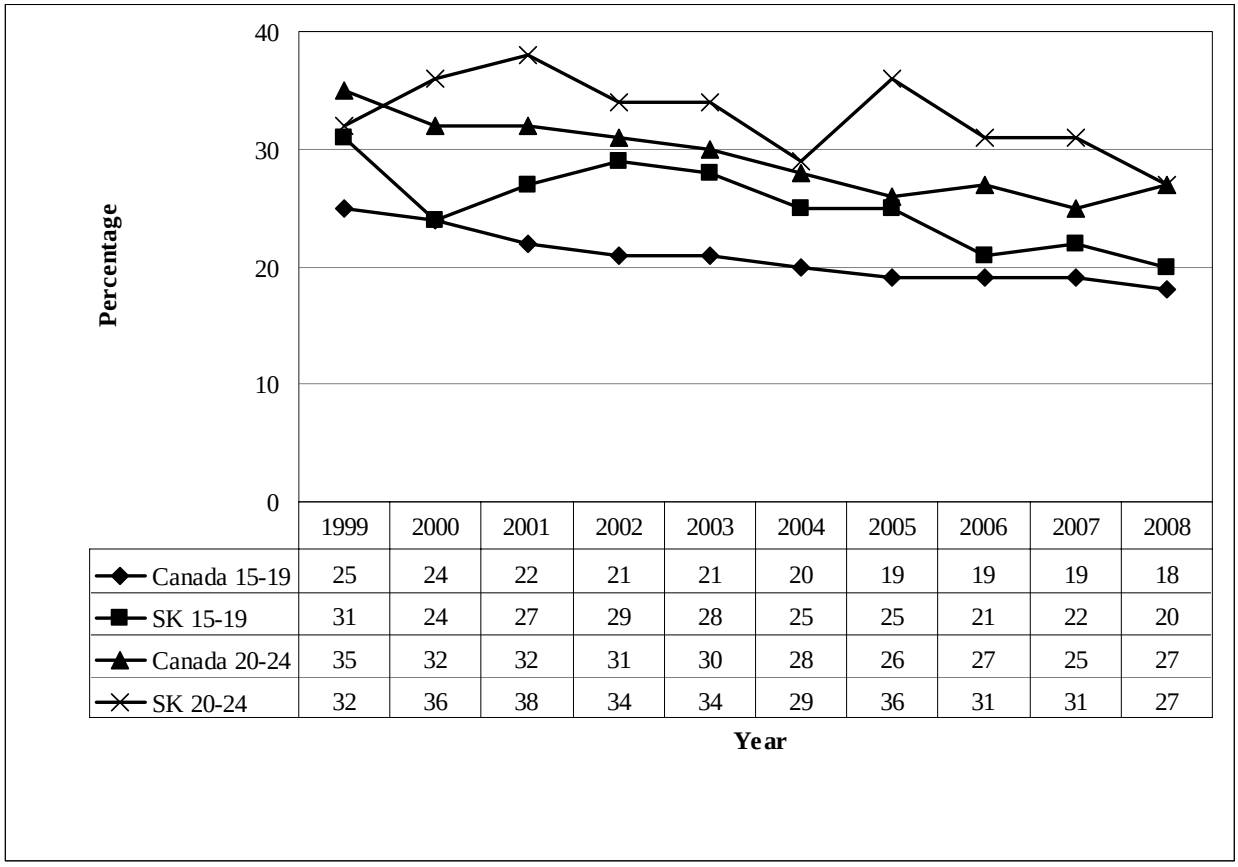
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
15+	26	28	25	21	24	22	22	24	24	20
15-19	31	24	27	29	28	25	25	21	22	20
20-24	32	36	38	34	34	29	36	31	31	27

Source: Health Canada, 2008, *CTUMS Annual Results 1999-2008* Available at: www.hc-sc.gc.ca/hl-vs/tobac-tabac/research-recherche/stat/_ctums-esutc_prevalence/prevalence-eng.php. Accessed September 2009.

[2] The 2005 outlier for 20-24 year olds, like other results, may be the result of statistical inconsistencies and limited sample sizes.

Figure 2 compares Canadian and Saskatchewan smoking rates for teens (aged 15–19) and youth (aged 20-24). For both age groups, Saskatchewan smoking rates are, for most years, higher than the Canadian average. In some years, these differences are substantial. For example, 2001 – 2005 rates in Saskatchewan for teen smoking are much higher than the canadian average. Rates among young adults are highly variable, with a high of 36% in 2005, 28% higher than the Canadian average. Rates for both age groups do, however, show an overall downward trend since 1999.

Figure 2: Current Teen and Youth Smokers, Canada and Saskatchewan, 1999-2008



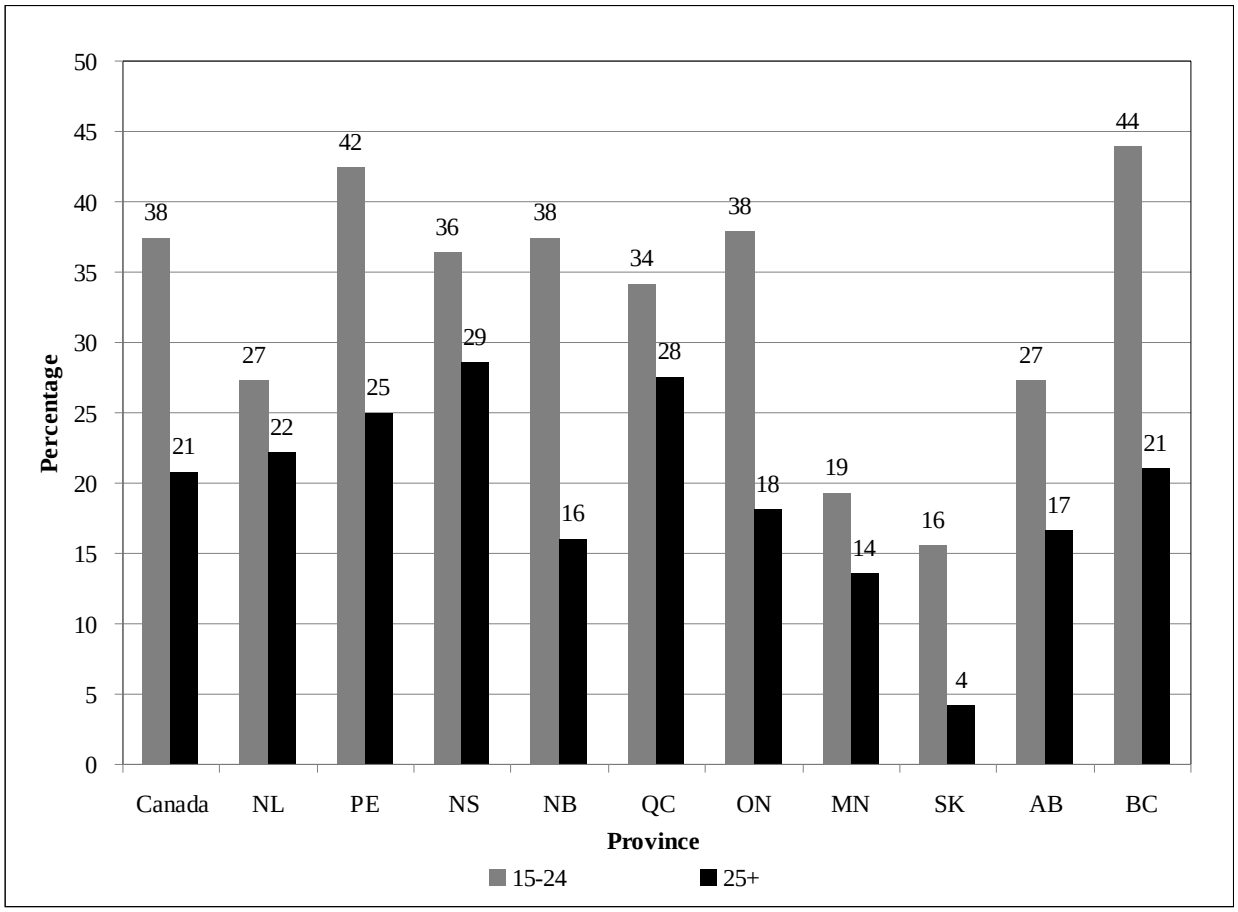
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Canada 15-19	25	24	22	21	21	20	19	19	19	18
SK 15-19	31	24	27	29	28	25	25	21	22	20
Canada 20-24	35	32	32	31	30	28	26	27	25	27
SK 20-24	32	36	38	34	34	29	36	31	31	27

Source: Health Canada, 2008, *CTUMS, Annual Results, 1999-2008.* Available at: www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/_ctums-esutc_2008/ann-histo-eng.php#tab2. Accessed September 2009.

Figure 3 highlights the percentage decline in smoking rates in Canada and all provinces from 1999 to 2007 for youth (aged 15-24) and adults (aged 25 and over).[3] Compared with all Canadian provinces, Saskatchewan saw the lowest percentage decline in smoking prevalence among youth and adults in the country for this period.

As shown in Table 1, declines in smoking prevalence within the Prairie provinces are among the lowest in the country in the 1999 to 2007 period. With targeted tobacco control efforts, smoking rates in provinces such as Nova Scotia declined by 29% between 1999 and 2007. In 1999, smoking rates in Nova Scotia were the second-highest in the country. This should be a source of some optimism for a province such as Saskatchewan, showing the tremendous potential for tobacco reduction if a comprehensive provincial tobacco reduction strategy is implemented.

Figure 3: Percentage Decline in Smoking Rates in Canadian Provinces, 1999-2007



Source: As calculated by the authors, based on Health Canada, 2007, *CTUMS Annual Results 1999-2007.* Available at: www.hc-sc.gc.ca/hl-vs/tobac-tabac/research-recherche/stat/_ctums-esutc_prevalence/prevalence-eng.php.

[3] This comparison is also possible for 1999 to 2008. However, as it appears 2008 CTUMS smoking rates are not as consistent with trends for the previous 5-year period, 2007 has been used as a comparative year.

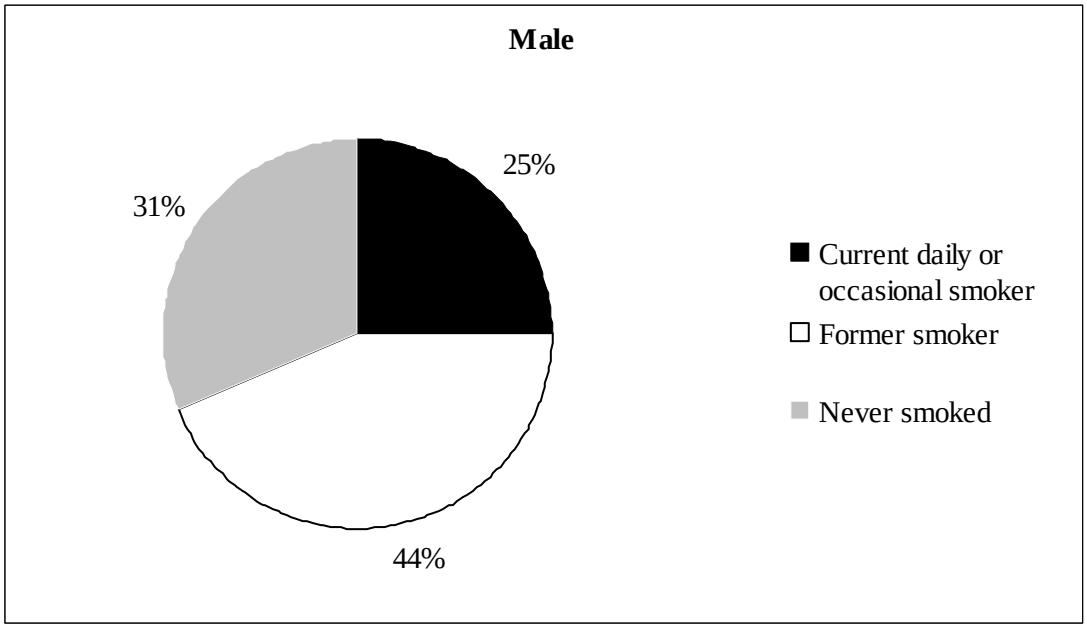
Smoking Status by Age and Sex

The most current 2008 Canadian Community Health Survey (CCHS) results show that 28.4% of Saskatchewan males and 22% of females indicated they were current daily or occasional smokers.[4] These rates are higher than the Canadian averages of 24.3% for males and 18.5% for females in the same year.

2005 CCHS results provide include data on daily/occasional smokers, never smoker and former smokers. These results show 25% of Saskatchewan males (Figure 4) and 23% of females (Figure 5) indicated they were current daily or occasional[5] smokers. In the same year, 44% of Saskatchewan males and 35% of females indicated they were former smokers. Thirty-one percent of males and 42% of females reported they had never smoked.

When never-smokers are added to those who have already quit, 75% of Saskatchewan males and 77% of females reported that they did not smoke in 2005. It is important to remember, then, that the majority of Saskatchewan residents were smoke-free in 2005.

Figure 4: Male Smoking Status, Saskatchewan, 2005

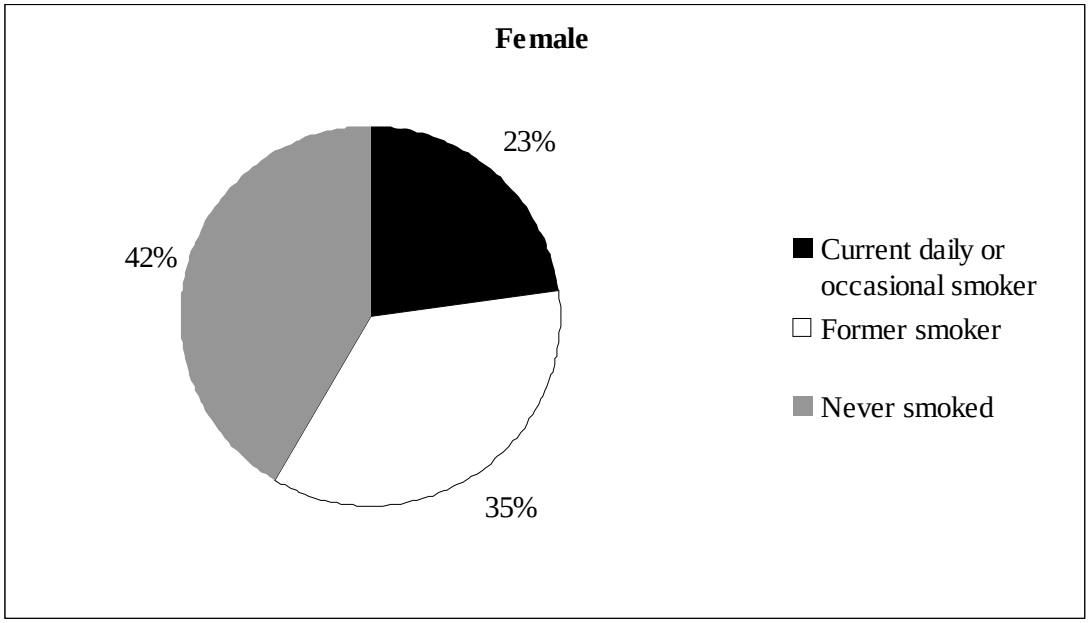


Source: Statistics Canada, 2005, *CCHS (Cycle 3.1) CANSIM Table no. 105-0427.* Available at: cansim2.statcan.ca/cgi-win/cnsmcgi.pgm. Accessed January 2009.

[4] Statistics Canada (2008). Table 105-0501 - *Health indicator profile, annual estimates, by age group and sex, Canada, provinces, territories, health regions (2007 boundaries) and peer groups, occasional,* CANSIM (database). http://cansim2.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&CNSM-Fi=CII/CII_1-eng.htm: Accessed: September 2009.

[5] An individual who smokes less than daily is considered an occasional smoker.

Figure 5: Female Smoking Status, Saskatchewan, 2005



Source: Statistics Canada, 2005, *CCHS (Cycle 3.1) CANSIM Table no. 105-0427.* Available at: cansim2.statcan.ca/cgi-win/cnsmcgi.pgm. Accessed January 2009.

The distinction between former and current smokers is important because the health costs of smoking and the benefits of quitting add up over time, with risks of illness and premature death gradually diminishing with the length of time since quitting. A detailed overview of the changes in smoking-attributable risks among former smokers for lung cancer, heart disease and chronic obstructive pulmonary disease (COPD) are provided in *The Cost of Tobacco in Nova Scotia (2000).* Assessing the economic costs of tobacco use must therefore consider the percentage of former and current smokers: in 2005, 69% of Saskatchewan males and 58% of females (aged 15 and over) were either current or former smokers.

It is also important to emphasize that the burden of death lags behind the smoking rate by as much as 30 to 60 years.[6] As with other provinces, there is a large backlog of smokers and former smokers in Saskatchewan who will require extensive health system use in the next 20 years, even if smoking rates fall in the province. Gradually, as rates decline, mortality and illness attributable to smoking and the associated costs will also decline.

[6] Thun, M. & da Costa e Silva, V. (2003). Introduction and Overview of Global Tobacco Surveillance in Shafey, O., Dolwick, S. and Guindon, G. (eds) *Tobacco Control Country Profiles*, 2nd ed, pp.7–8. Available at: www.who.int/tobacco/global_data/country_profiles/Introduction.pdf.

Daily Average Cigarette Consumption

Table 2 shows that Saskatchewan daily smokers aged 15 and over consumed an average of 15.3 cigarettes daily in 2000, slightly lower than the Canadian average of 16.8 cigarettes daily. This average declined slightly by 2008 to 14.8 cigarettes, almost identical to the Canadian average of 14.9 cigarettes.

Average figures conceal considerable differences by age and sex. In Saskatchewan, adult males (aged 25 and over) have the highest rate of daily cigarette consumption, smoking an average of 17.7 cigarettes a day in 2008, close to the Canadian average of 17. Youth (aged 15-19) generally smoke fewer cigarettes daily than other age groups. Negligible declines in daily consumption can be seen among young adults (aged 20-24), from 12.6 cigarettes in 2000 to 12.4 cigarettes in 2008. In Saskatchewan and Canada, adult females (aged 25 and over) smoke fewer cigarettes than men.

Table 2: Average Number of Cigarettes Smoked Daily by Daily Smokers, Canada and Saskatchewan, 2000 and 2008

	2000		2008	
Sex/age group	**SK**	**Canada**	**SK**	**Canada**
Total—all smokers aged 15+	15.3	16.8	14.8	14.9
Youth (aged 15-19)	11.6	12.7	11.4	12.2
Young adults (aged 20-24)	12.6	13.9	12.4	12.2
Adult males (aged 25+)	17.5	19.8	17.7	17.0
Adult females (aged 25+)	14.5	15.0	12.8	13.4

Source: Health Canada, 2008, *CTUMS Supplementary Tables, Annual Results (2000, 2008).* Available at: www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/_ctums-esutc_2008/ann-table2-eng.phpAccessed September 2008.

Trends in Smoking Prevalence: Saskatchewan Health Regions

Regional trends in smoking prevalence are important as provincial averages can mask important intra-provincial disparities. Figure 6 uses CCHS data to illustrate smoking prevalence among daily and occasional smokers for 2003, 2005, 2007 and 2008 in Saskatchewan health regions.[7] In 2008, the lowest smoking rates for all health regions were found in Cypress (21.1%) and Heartland (18.6%). In the same year, the highest smoking rates among all health regions were

[7] To avoid suppression of data, the CCHS combines the three northern health regions into Mamawetan/Keewatin/ Athabasca. Due to sampling variation, results from Heartland (2005, 2008) in Figure 14 should be used with caution.

seen in the Mamawetan/Keewatin/Athabasca (41.3%) regions, Sunrise (29.6%) and Sun Country (29.9%). Thus, the Mamawetan/Keewatin/Athabasca regions in northern Saskatchewan—where aboriginal people make up 83.5% of the population—had a smoking rate more than double that in Cypress in the far southern part of the province, where non-aboriginal people make up 97.5% of the population.[8] Saskatchewan aboriginal people are generally seen to have much higher smoking rates than the non-aboriginal population, which may result in these differences.

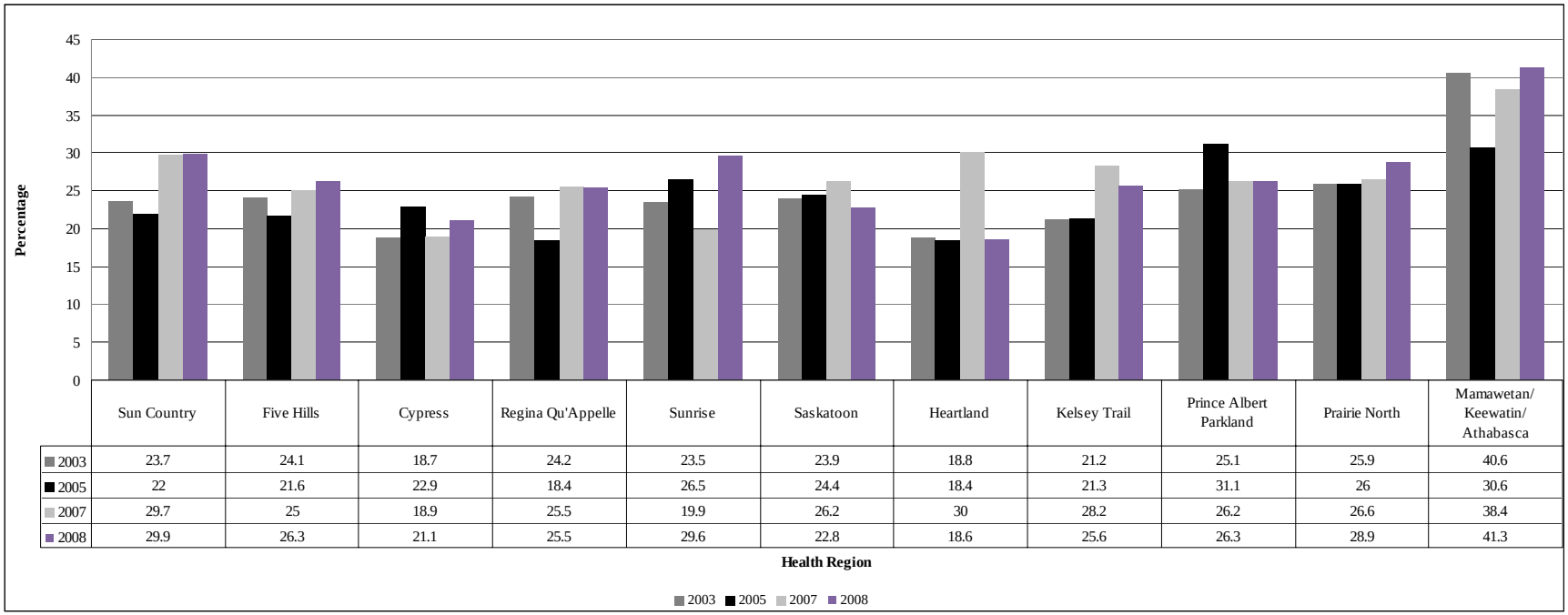
Trends in smoking prevalence throughout this period are highly variable and differ greatly by year and health region. Unfortunately, an overall decline in smoking rates from 2003 to 2008 is not seen in any health region.

Sun County, Five Hills, and Regina Qu'Appelle also saw smoking rates fall from 2003 to 2005, and then rise again in 2007/08. Other health regions, such as Cypress and Sunrise saw rates rise from 2003 to 2005, fall in 2007 then rise again in 2008. Smoking rates appeared to be slowly on the rise in the Saskatoon health region, with a recent decline. Smoking rates were fairly stable over time in Prairie North with a recent increase. Smoking rates were stable from 2003 to 2005 in Kelsey Trail (21.2% and 21.3%), rising to 28.2% in 2007 and then 25.6% in 2008.

As smoking rates vary so greatly by region, it is important to correlate this by region with a wide range of socio-demographic characteristics. Also, it is important to assess whether changes in tobacco use over time in particular health regions are correlated with community-based tobacco reduction initiatives initiated in those regions. Given the small sample sizes in some health regions, however, it is important to interpret these results with caution. While the very dramatic differences in smoking prevalence noted above, and their correlation with aboriginal status are statistically significant, some of the smaller apparent differences and changes seen in Figure 6 (below) are not.

[8] Statistics Canada, Community Highlights. Available at: www12.statcan.ca/english/Profil01/CP01/Details/Page.cfm?Lang=E&Geo1=HR&Code1=4714&Geo2=PR&Code2=47&Data=Count&SearchText=Mamawetan/Keewatin/Athabasca&SearchType=Begins&SearchPR=01&B1=All&Custom= and www12.statcan.ca/english/profil01/CP01/Details/Page.cfm?Lang=E&Geo1=HR&Code1=4703&Geo2=PR&Code2=47&Data=Count&SearchText=Cypress&SearchType=Begins&SearchPR=01&B1=Population&Custom=. Accessed June, 2009.

Figure 6: Daily or Occasional Smokers by Health Region (Aged 12+), Saskatchewan, 2003/2005/2007/2008



	Sun Country	Five Hills	Cypress	Regina Qu'Appelle	Sunrise	Saskatoon	Heartland	Kelsey Trail	Prince Albert Parkland	Prairie North	Mamawetan/ Keewatin/ Athabasca
2003	23.7	24.1	18.7	24.2	23.5	23.9	18.8	21.2	25.1	25.9	40.6
2005	22	21.6	22.9	18.4	26.5	24.4	18.4	21.3	31.1	26	30.6
2007	29.7	25	18.9	25.5	19.9	26.2	30	28.2	26.2	26.6	38.4
2008	29.9	26.3	21.1	25.5	29.6	22.8	18.6	25.6	26.3	28.9	41.3

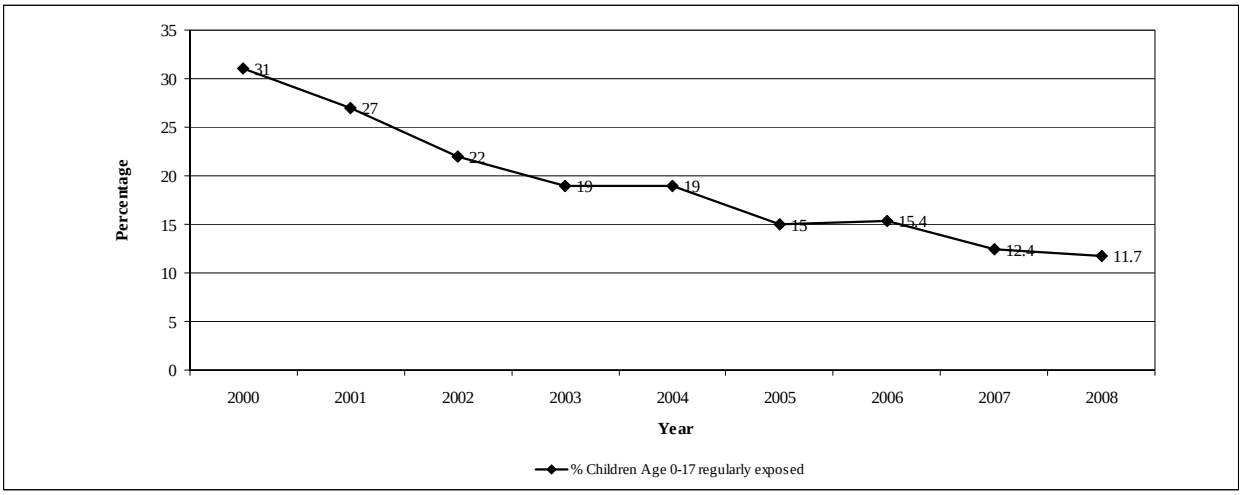
Sources: Statistics Canada, 2003, *CCHS (Cycle 2.1) CANSIM Table no. 105-0227*; Statistics Canada, 2005, *CCHS (Cycle 3.1) CANSIM Table no. 105-0327*. Available at: cansim2.statcan.gc.ca/cgi-win/CNSMCGI.PGM; Statistics Canada, 2007, *CCHS indicator profile, by age group and sex, Canada, provinces, territories, health regions (2007 boundaries) and peer groups, annual, CANSIM Table 105-0501*. Available at: www.statcan.gc.ca/pub/82-221-x/2008001/5202308-eng.htm.

Note: According to Statistics Canada, data from Heartland (2005, 2008) should be used with caution.

Trends in Exposure to Environmental Tobacco Smoke

Exposure to Environmental Tobacco Smoke (ETS) in all settings varies by province, depending on the dates with which smoke-free legislation has been in place. In Figure 7, Canadian Tobacco Use Monitoring Survey (CTUMS) results show a steady decline in ETS exposure of children (aged 0-17) in the home in Saskatchewan, from 31% in 2000 to 11.7% in 2008, a total decline of 62%. Although significant, this rate is the second-highest ETS exposure rate for children within Canadian provinces, behind Quebec at 14.5%. It is also above the Canadian average of 8%.[9]

Figure 7: Regular Exposure to ETS in the Home (Children Aged 0-17), Saskatchewan, 2000-2008



Source: Health Canada, 2008, *CTUMS Annual Results 2000 -2008, Supplementary Tables*. Available at: www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/_ctums-esutc_2008/ann-table9-eng.php. Accessed September 2009.

[9] Health Canada, 2008. *Canadian Tobacco Use Monitoring Survey, Supplementary Tables, Table 9. Exposure of children at home to Environmental Tobacco Smoke (ETS), by province and age group, Canada 2008.* Available at: www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/stat/_ctums-esutc_2008/ann-table9-eng.php. Accessed September 2009.

Between 2003 and 2008, an increasing number of households in all provinces and territories restricted smoking in the home (see Table 3). Almost 67% of Saskatchewan households reported that smokers were asked to refrain from smoking in the home in 2008. This is an increase of 17% from 55.2% in 2003. But, this also means that more than one third of Saskatchewan households still do not restrict household smoking. This is the second-lowest rate of ETS protection in the home of all provinces and territories.

Table 3: Smokers Asked to Refrain from Smoking in the Home, Canada by Province and Territory, 2003/2005/2007/2008

	2003 (%)	2005 (%)	2007 (%)	2008 (%)
Canada	*55.8*	*63.5*	*67.0*	*69.3*
British Columbia	71.3	76.1	75.8	77.3
Nunavut (10 largest communities)	54.1	67.8	75.7	73.6
Alberta	64.8	71.0	73.7	73.6
Ontario	n/a	69.6	72.5	74.2
Manitoba	57.7	66.9	70.7	71.9
Prince Edward Island	57.1	63.6	70.5	72.6
Nova Scotia	57.8	65.9	69.5	70.5
Newfoundland and Labrador	53.8	63.6	69.3	71.8
Northwest Territories	55.8	63.2	68.5	74.1
Yukon	61.9	61.6	68.1	69.8
Saskatchewan	55.2	63.9	66.8	66.9
New Brunswick	53.6	61.1	66.8	68.9
Quebec	32.5	42.9	49.1	54.4

Source: Statistics Canada, *CCHS indicator profile, by age group and sex, Canada, provinces, territories, health regions (2007 boundaries) and peer groups, annual, CANSIM Tables 105-0502 and Table 105-0501.* Available at: cansim2.statcan.gc.ca/cgi-win/cnsmcgi.exe. Accessed September 2009.

Exposure to ETS in vehicles and public places in Canadian provinces declined between 2003 and 2008 (see Table 4). In Saskatchewan, the greatest declines have been in ETS exposure in public places, from a high of 23.7% in 2003 to 7.5% in 2008, a decline of 16 percentage points, or 68%.

Rates of exposure to ETS in vehicles have declined less dramatically in Saskatchewan, from 11.2% in 2003 to 8.7% in 2008. However, these declines are in keeping with those of other provinces. By far the lowest rates of ETS exposure in vehicles is in British Columbia, with rates of only 5.4%.

Table 4: Exposure to Second-Hand Smoke in the Past Month in Vehicles and in Public Places, Canada by Province, 2003/2005/2008

	2003 (%)		2005 (%)		2008 (%)	
	Vehicles	**Public Places**	**Vehicles**	**Public Places**	**Vehicles**	**Public Places**
Canada	10.1	19.6	8.1	14.7	7.3	9.9
British Columbia	6.8	12.2	5.7	10.5	5.4	10.6
Alberta	10.1	21.2	9.2	18.1	8.6	10.5
Ontario	9.6	17.7	7.8	13.0	6.9	11.3
Manitoba	10.7	19.5	8.6	6.0	8.5	8.3
Prince Edward Island	13.4	13.1	11.8	5.6	9.0	6.0
Nova Scotia	13.3	15.6	9.1	9.2	10.6	8.1
Newfoundland & Labrador	14.5	13.8	10.4	10.1	10.4	6.0
Saskatchewan	11.2	23.7	9.4	9.8	8.7	7.5
New Brunswick	12.4	19.0	10.5	6.8	10.0	7.2
Quebec	11.5	27.0	8.8	22.8	7.5	8.4

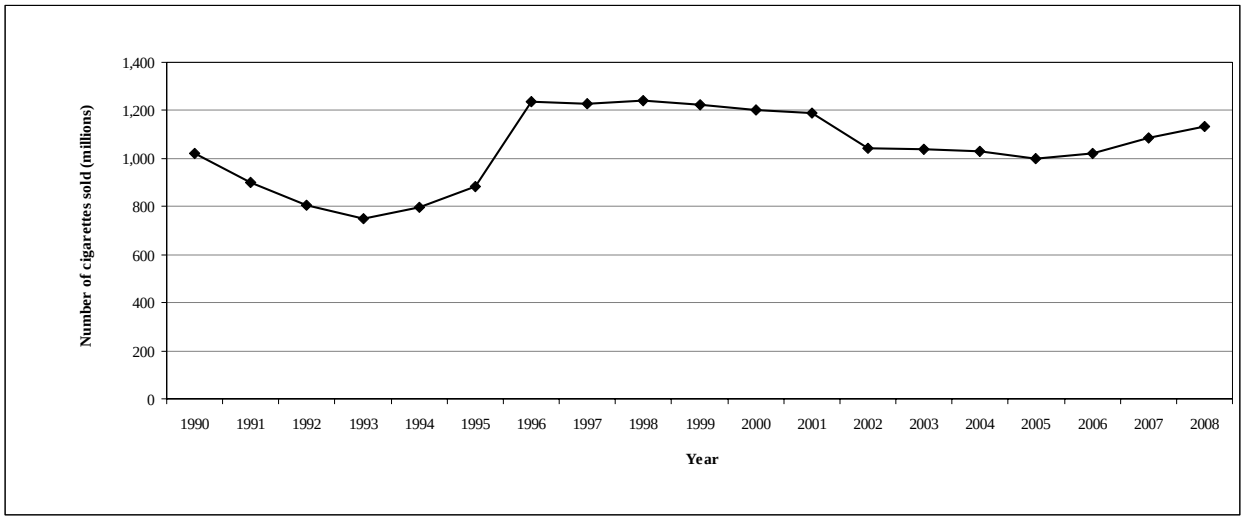
Source: Statistics Canada, 2009, *CCHS indicator profile, by age group and sex, Canada, provinces, territories, health regions (2007 boundaries) and peer groups, annual, CANSIM Table 05-0502.* Available at: www.statcan.gc.ca/pub/82-221-x/2008001/5202308-eng.htm. Accessed May 2009. Note: Data for public places in PEI (2008) must be interpreted with caution due to sampling variation.

Trends in Cigarette Sales

As shown in Figure 8, legal cigarette sales in Saskatchewan declined steadily from 1 billion cigarettes in 1989 to an all-time low of 750 million cigarettes in 1993 (a drop of 25%).[10] Sales then rose dramatically over the 1994 to 1996 period in response to the government's sharp cut in tobacco taxes. Sales reached a high of 1.2 billion cigarettes in 1996. Sales were relatively stable within the 1996 to 2001 period as tobacco taxes remained low and did not even keep pace with inflation. The number of cigarettes sold then declined to 998 million in 2005 in direct response to tobacco tax increases in March 2002, and April 2004, which doubled taxes on cigarettes from $2.15 in 1999 to $4.00 per pack of 25 in 2002 and $4.375 in 2004. However, sales then crept slowly higher to 1.13 billion in 2008 as tobacco tax rates again failed to keep pace with inflation, thus lowering the real price of cigarettes.[11]

From a high of 1.2 billion cigarettes in 1996 to 1.13 billion in 2007 represents a decline of only 8%, and sales today remain 51% higher than in 1993. Because epidemiological and clinical evidence confirms a direct dose-response relationship between number of cigarettes consumed and disease risk, the continued high level of cigarette sales in Saskatchewan is a major health concern and constitutes a continuing burden to the province's health care system. On the positive side, the trends in cigarette sales illustrate the powerful role played by tobacco taxes on cigarette sales—with sales rising and falling sharply in direct response to cuts and increases in tobacco taxes. A 1999 World Bank report confirms that finding, stating that tobacco taxes are the most cost effective tobacco reduction intervention.[12]

Figure 8: Units of Cigarettes Sold, Saskatchewan, 1990-2008



Source: Health Canada, 2008, *Wholesale Sales Data, Tobacco Control Program.* Available at: www.hc-sc.gc.ca/hc-ps/tobac-tabac/research-recherche/indust/_sales-ventes/sk-eng.php

[10] For data table, see Appendix A.
[11] Government of Saskatchewan, *Tobacco Tax Programs*, available at: www.finance.gov.sk.ca/taxes/tob/. Accessed June 2009.
[12] World Bank (1999). Curbing the epidemic: Governments and the economics of tobacco control as cited by World Health Organization (2004). *European Strategy for Smoking Cessation Policy*. Available at: www.euro.who.int/Document/E80056.pdf.

Summary of Key Observations

- According to Canadian Tobacco Use Monitoring Survey (CTUMS) results, 20% of Saskatchewan residents (aged 15 and over) were current smokers.

- The most current 2008 Canadian Community Health Survey (CCHS) results show that 28.4% of Saskatchewan males and 22% of females indicated they were current daily or occasional smokers. These rates are higher than the Canadian averages of 24.3% for males and 18.5% for females in the same year.

- Saskatchewan recorded the lowest percent decline of youth smoking rates (aged 15-24) and adult smoking rates (aged 25 and over) between 1999 and 2007 of any Canadian province.

- The vast majority of Saskatchewan residents don't smoke. In 2005, 75% of Saskatchewan males and 77% of females did not smoke. In the same year, 31% of males and 42% of females reported they had never smoked, while 44% of males and 35% of females reported having quit.

- Daily cigarette consumption (smokers aged 15 and over) declined slightly in Saskatchewan from an average of 15.3 cigarettes smoked in 2000 to 14.8 cigarettes smoked in 2008. The current provincial average is on par with the Canadian average of 14.9 cigarettes smoked daily.

- Regionally, smoking rates vary significantly by year and health region. The lowest smoking rates in 2008 were found in Cypress (21.1%). The highest smoking rates were found in Mamawetan/Keewatin/Athabasca (41.3%), Sunrise (29.6%) and Sun Country (29.9%). Further data and information would be beneficial to appropriately analyse this region-level data.

- Exposure of children to ETS in the home has declined steadily in Saskatchewan, from 31% in 2000 to 11.7% in 2008.

- Sixty-seven percent of Saskatchewan households asked smokers to refrain from smoking in the home in 2008. Although an improvement from 55% in 2003, this rate is still one of the lowest in the country.

- In 2008, 8.7% of individuals surveyed indicated exposure to ETS in vehicles in Saskatchewan versus 7.7% in public places. Exposure to ETS in public places has declined greatly since the rate of 23.7% in 2003.

- Legal cigarette sales in Saskatchewan declined from 1 billion cigarette units sold in 1989 to a low of 750 million in 1993 (a drop of 25%), then rose to a high of 1.2 billion in 1996. Sales were relatively stable in the 1997 to 2001 period, declined to 998 million in 2005, and rose to 1.13 billion in 2008.

PART III
COST OF TOBACCO USE IN SASKATCHEWAN

3. Cost of Tobacco Use in Saskatchewan

Introduction

There are many costs associated with tobacco use, including premature death and a wide range of illnesses including certain types of cancer (especially lung, lip/oral cavity, larynx and oesophagus), cardiovascular disease and COPD among others. Negative health effects exist due to exposure to ETS including cancer, infections, complication during pregnancy and higher risk of Sudden Infant Death Syndrome (SIDS). These health effects are physically and emotionally devastating to individuals, their families and loved ones.

Recent (2009) Canadian Cancer Society statistics show lung cancer to be the leading cause of cancer death for men and women in Canada. Forty percent of Canadian women and 45% of Canadian men are expected to develop cancer in their lifetimes. One in every four Canadians is expected to die of that diagnosis.[13]

A 2007 report from the Saskatchewan Cancer Agency profiles changes in cancer prevalence rates between 1984 and 2003. According to this report, the 10-year cancer prevalence of the trachea, bronchus and lung cancer among males in Saskatchewan increased 15% from 1984 to 2003 (423 to 486). The five-year cancer prevalence increased 6% from 1984 to 2003 (354 to 376) and the one-year cancer prevalence decreased by 10% from 1984 to 2003 (185 to 167). Among females, prevalence rate increases are much greater for cancer of the trachea, bronchus and lung in the same period. Over the 10-year period, prevalence increased 135% from 1984 to 2003 (196 to 463). The five-year cancer prevalence increased 122% from 1984 to 2003 (72 to 138) and the one-year cancer prevalence increased by 92% from 1984 to 2003 (72 to 138).[14]

There are significant economic costs that come from unnecessary disease and premature death. These include costs to health care systems, such as hospitalization, medications and physician fees. These include costs to employers, the economy and society in the form of productivity losses due to smoking-related disability and death.

This section of the report estimates the number of deaths in Saskatchewan that can be attributed to tobacco use and exposure to ETS. As well, this report estimates the economic costs of tobacco use in Saskatchewan in these five categories:

1. Direct Health Care Costs (acute care hospitalization, physician fees and visits, prescription drug costs)
2. Direct Prevention and Research Costs
3. Other Direct Costs: Fires Due to Smoking
4. Indirect Costs (short and long term disability and morbidity)

[13] Canadian Cancer Society, 2009. *Canadian Cancer Statistics 2009*. Available at: www.cancer.ca/Saskatchewan/About%20cancer/Cancer%20statistics. Accessed September 2009.
[14] Alvi R and Tonita J., 2008. *Saskatchewan Cancer Control Report: Profiling Cancer Prevalence 1984-2003*. Saskatoon: Saskatchewan Cancer Agency. Available at: www.saskcancer.ca. Accessed September 2009.

5. Employer Costs (absenteeism, reduced productivity and insurance costs)

Also included is information on the limitations of cost estimation and a summary of findings of similar Canadian cost of tobacco use studies.

Mortality Due to Smoking in Saskatchewan

How Smoking-Attributable Mortality (SAM) is Calculated

In this report, deaths due to smoking in Saskatchewan are estimated using the Smoking-Attributable Mortality (SAM) approach.[15] SAM estimates the number of deaths that could theoretically be avoided for each disease category if smoking were eliminated. SAM thus estimates the number of deaths due to smoking.

In this report, SAM was calculated by multiplying the Smoking-Attributable Fraction (SAF) of a disease by mortality rates for smoking-related diseases in Saskatchewan (SAM = SAF x mortality rates for specific diseases).[16]

Mortality rates for smoking-related diseases in Saskatchewan were obtained from Statistics Canada (2005), *Mortality, Summary List of Causes*, and by special order from the Information Services Corporation of Saskatchewan. This data is included as Appendix B.[17] The smoking-related diseases used in this report are those identified by the US Centers for Disease Control, International Classification of Disease (ICD) list of smoking-related diseases, included as Appendix C.

SAF essentially estimates the effects of smoking on a given disease and the extent to which each disease is attributable to smoking.[18] In theory, the SAF of a disease is, therefore, the proportion of each disease that could be prevented if smoking was eliminated. The SAF of 19 smoking-related diseases was calculated by multiplying Saskatchewan sex-specific smoking prevalence rates[19] by Relative Risk (RR) measures for current and former adult (aged 35 and over) smokers (see formula below).

RR measures provide epidemiological evidence that links smoking with various illnesses. Essentially, RR values express the relative risk to the smoker of developing a disease as compared with someone who does not smoke. Age-adjusted RR factors for adults 35 and over

[15] See work by Levin (1953) or Lilienfield & Lilienfield (1980).
[16] Limitations of the SAM and SAF estimation approaches are discussed in detail in Appendix D.
[17] Statistics Canada, 2005. *Mortality, Summary List of Causes, Catalogue Number 84F0209X, Table 1-9 Deaths by selected grouped causes, sex and geography—Saskatchewan.* Available at: www.statcan.gc.ca/pub/84f0209x/2005000/t004-eng.htm. Accessed May 2009.
[18] This method is originally described by Levin (1953). See also Lilienfield & Lilienfield (1980) or Makomaski Illing E. & Kaiserman, M., 2004. Mortality attributable to tobacco use in Canada and its regions. *Canadian Journal of Public Health*, Vol. 95 (1). This work includes Canada-wide data and Prairie data, but not data for Saskatchewan alone.
[19] Percentages of current, former and never-smokers in Saskatchewan were obtained from Statistics Canada, 2005. *Canadian Community Health Survey (CCHS 3.1)*, as shown in Figures 4 and 5.

were obtained from the second wave of the American Cancer Society's *Cancer Prevention Study (CPS II*), six year follow–up.[20] RR estimates from this source are based on a four-year study with 1.2 million participants. Although American in origin, consensus is that Canadian and American populations are similar enough with respect to overall health, longevity and disease that the American RR measures can reasonably be applied to Canada. These RR values for select tobacco-related diseases for males and females are included as Appendix D.

SAFs for each disease and sex were derived in this report using the following formula:

$$\text{SAF} = \frac{[P_n + P_c(RR_c) + P_f(RR_f)] - 1}{[P_n + P_c(RR_c) + P_f(RR_f)]}$$

Where

Measure	Defined
P_n	Percentage of adult never-smokers in study group
P_c	Percentage of adult current smokers in study group
P_f	Percentage of adult former smokers in study group
RR_c	Relative risk of death for adult current smokers relative to adult never-smokers
RR_f	Relative risk of death for adult former smokers relative to adult never-smokers

This formula is derived from the standard attributable risk (AR) formula: AR = P (RR - 1) / [P(RR - 1) + 1], where RR is the relative risk for smoker and P is the fraction of the relevant population categorized as smokers (may include former smokers or those exposed to smokers). According to Harrison *et al*, many Canadian studies reply on this approach, including Choi and Pak (1996), Kaiserman (1997), and Xie *et al*. (1999).[21]

[20] US CDC Relative Risk Data, CPS–II (82-88). Unpublished estimates provided by American Cancer Society (ACS). See Thun, M. *et al*. Trends in tobacco smoking and mortality from cigarette use in Cancer Prevention Studies I (1959 through 1965) and II (1982 through 1988). In *Changes in cigarette-related disease risks and their implication for prevention and control*. Smoking and Tobacco Control Monograph 8. Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute 1997; 305–382. NIH Publication no. 97–1213.

[21] Harrison, G., Feehan J., Edwards, A. & Segovia, J. (2003). Cigarette Smoking and the Cost of Hospital and Physician Care. In *Canadian Public Policy*. University of Toronto Press. March, Vol. 29 (1), pp. 1-19. Available at: ideas.repec.org/a/cpp/issued/v29y2003i1p1-19.html. Accessed June 2008.

Estimate of Smoking-Attributable Mortality (SAM) in Saskatchewan

SAM estimates for 2005 are summarized in Table 5. These figures do not include deaths from diseases attributable to ETS. Table 5 shows an estimate of 910 male deaths and 624 female deaths from cancer, cardiovascular disease and respiratory disease as a direct result of smoking in Saskatchewan in 2005. The total number of deaths in Saskatchewan in 2005 attributable to smoking was thus estimated at 1,534.

As shown in Table 5, cancers of the trachea, bronchus and lung resulted in the highest cancer mortality in Saskatchewan, with 2005 mortality estimates of 199 females (32% of total deaths) and 269 males (30% of total deaths). Ischaemic heart disease in those over aged 65 generated the highest cardiovascular mortality due to smoking, resulting in the death of 99 females (16% of total deaths) and 269 males (13% of total deaths) in Saskatchewan in 2005. Chronic airway obstruction was the highest cause of mortality due to respiratory disease, resulting in the death of 104 females (17% of deaths) and 144 males (16% of deaths) in Saskatchewan in 2005.

For both males and females, death due to cancer represented the greatest morbidity from smoking as compared with cardiovascular and respiratory diseases in Saskatchewan, resulting in 247 female deaths (40% of total deaths) and 372 male deaths (41% of total deaths) in 2005.

Table 5: Smoking-Attributable Mortality (Male and Female Aged 35+), Saskatchewan, 2005

Diseases (Adults Aged 35+)		
Disease Category	**SAM Female**	**SAM Male**
Malignant neoplasms		
Lip, oral cavity, pharynx	5	12
Esophagus	6	19
Stomach	3	10
Pancreas	22	14
Larynx	2	11
Trachea, bronchus, lung	199	269
Cervix uteri	1	n/a
Kidney and renal pelvis	2	12
Bladder	5	23
Acute myeloid leukemia	2	2
Total cancer deaths	*247*	*372*
Percent of total deaths	*39.6%*	*40.9%*
Cardiovascular diseases		
Ischaemic heart disease		
Persons aged 35–64	10	66
Persons aged 65+	99	121
Other heart diseases	52	68
Cerebrovascular disease		
Persons aged 35–64	6	10
Persons aged 65+	31	37
Atherosclerosis	2	8
Aortic aneurysm	17	23
Other arterial diseases	5	5
Total cardiovascular disease deaths	*222*	*338*
Percent of total deaths	*35.6%*	*37.1%*
Respiratory Diseases		
Pneumonia and influenza	32	34
Bronchitis and emphysema	19	22
Chronic airway obstruction	104	144
Total respiratory disease deaths	*155*	*200*
Percent of total deaths	*24.8%*	*22%*
Total	**624**	**910**

Source: As calculated by the authors.

Estimate of Mortality Due to Environmental Tobacco Smoke

Mortality estimates due to ETS in Saskatchewan are summarized in Table 6 from the *Cost of Substance Abuse in Canada 2002,* Canadian Centre on Substance Abuse (2006). The CCSA includes only lung cancer and ischemic heart disease in passive smoking calculations; causal links with other diseases are suspected, but controversial.[22] According to CCSA calculations, 11 female deaths and 16 male deaths were attributed to ETS in Saskatchewan in 2002, a total of 27 individuals.

Table 6: Mortality Due to ETS Exposure (Males and Females Aged 35+), Saskatchewan, 2002

Disease Category	Females	Males
Lung cancer	3	5
Ischemic Heart Disease	8	11
Total	**11**	**16**

Source: Rehm, J. *et al*, 2006, *The Cost of Substance Abuse in Canada 2002*. Canadian Centre on Substance Abuse (CCSA). Table 1-S-4.

[22] The CCSD derives passive smoking-attributable morbidity by applying age- and sex-specific relative risk and rates of morbidity from lung cancer and ischemic heart disease (IHD) to the population of Canadians who have never smoked, but are exposed to ETS from spouses and other sources inside the home. Relative risk estimates were obtained from the most comprehensive meta-analyses applicable to Canada. See Rehm, J. *et al.* (2006). *The Cost of Substance Abuse in Canada 2002*. Canadian Centre on Substance Abuse, pp. 20-21. In the *Economic Impact of Smoke-Free Places* (2002), Colman estimates deaths due to passive smoking based on epidemiological evidence showing one death due to ETS for every eight direct smoking-related deaths. More recent SAF-based approaches to passive smoking calculations were not available at time of writing.

Total Deaths Due to Tobacco Use

As summarized in Table 7, in 2005, 1,561 Saskatchewan deaths were estimated to be attributable to smoking and ETS exposure.[23] Given the total of 8,850 deaths in Saskatchewan in 2005, this means 18% of all deaths in Saskatchewan can be directly attributed to tobacco use—approximately one in every five deaths in the province.

Table 7: Deaths Due to Tobacco Use (Males and Females Aged 35+), Saskatchewan, 2005

	Male	Female
Deaths due to tobacco use in Saskatchewan (2005)	910	624
Deaths due to ETS in Saskatchewan (2002)[24]	16	11
Total estimated deaths by sex (M/F)	926 (59% of total)	635 (41% of total)
Total estimated deaths due to tobacco use[25]	1,561	
Total deaths in Saskatchewan (2005)[26]	8,850	
Percentage of all Saskatchewan deaths attributable to tobacco use	*18%*	

Source: As summarized by the authors.

Discussion of Mortality Estimates

Smoking attributable mortality (SAM) estimates and mortality due to environmental tobacco smoke (ETS) are highly dependent on prevalence and exposure rates, which vary yearly by age and sex. They also vary dramatically over time for ETS. In addition, Relative Risk (RR) data vary by study, also impacting results.

Two main studies have generated mortality estimates due to smoking and ETS exposure—*The Cost of Substance Abuse in Canada 2002* (CCSA, 2006)[27] and *Mortality attributable to tobacco*

[23] ETS calculations are based on 2002 data, as explained previously.
[24] Rehm, J. *et al.* (2006). *The Cost of Substance Abuse in Canada 2002*. Canadian Centre on Substance Abuse, Table I-S-4.
[25] Deaths due to tobacco use are for 2005, ETS deaths are for 2002.
[26] Statistics Canada, 2005. *Mortality, Summary List of Causes, Catalogue Number 84F0209X, Table 1-9 Deaths by selected grouped causes, sex and geography—Saskatchewan.* Available at: www.statcan.gc.ca/pub/84f0209x/2005000/t009-eng.htm. Accessed May 2008.
[27] Rehm, J. *et al.* (2006). *The Cost of Substance Abuse in Canada 2002*. Canadian Centre on Substance Abuse (CCSA).

use in Canada and its regions (Makomaski Illing & Kaiserman, 2004).[28] Mortality results from these sources are discussed below.

The Canadian Centre on Substance Abuse (CCSA) estimated tobacco-related mortality in 2002 for Saskatchewan at 798 males and 427 females—yielding a total estimate of 1,225 deaths due to tobacco use.[29] This estimate is slightly lower than the 1,561 deaths estimated in this report. There are several reasons which may account for the difference. It may partially be due to the fact that the RR values used in the CCSA report are generated from multiple sources[30] and not from the source used here.[31] A review of comparable studies included in the *Cost of Tobacco in Nova Scotia* (2000) indicated that CCSA estimates tend to be conservative, and may underestimate mortality by at least 20%—which is in line with the disparity observed here. Indeed, Health Canada SAM estimates at the time were found to be 24% higher than comparable CCSA estimates.

Makomaski Illing & Kaiserman (2004) provide SAM estimates for all Prairie Provinces (but not Saskatchewan alone) for males and females in 1994 and 1996. This estimate uses the ICD-9 disease codes and calculates adult (aged 35 and over) mortality for tobacco-related diseases, as well as tobacco-related paediatric diseases and fire deaths, as well as deaths due to passive smoking. Using this approach, the authors attribute 4,535 male deaths and 2,492 female deaths to smoking in 1996. In 1996, Saskatchewan represented approximately 20% of the Prairie population. This provides us with a rough estimate of 907 male deaths and 498 female deaths—which would yield a total of 1,405 deaths in Saskatchewan due to smoking in 1996, based on the Makomaski Illing & Kaiserman study, if smoking rates are assumed to be comparable in all the Prairie provinces.

This result is somewhat lower than the SAM estimates calculated in this report for Saskatchewan, although the RR estimates used by the authors are from the same source used in this report—namely the Cancer Prevention Study (CPS) II from the American Cancer Society. The disparity may therefore be at least partially explained by the fact that Saskatchewan in 1996, had a higher rate of daily smoking (24.5%) than the other Prairie provinces (Manitoba – 22.1%, Alberta – 23.3%), so an extrapolation for Saskatchewan by population alone based on the

[28] Makomaski Illing, E. and Kaiserman, M. (2004). Mortality attributable to tobacco use in Canada and its regions. *Canadian Journal of Public Health.* Vol. 95 (1).
[29] See Table I-S-4, CCSA (2006).
[30] The CCSA carries out a detailed process to estimate RR values. To identify malignant and non-malignant health conditions caused by smoking, the *Health Consequences of Smoking: A Report from the Surgeon General, US Department of Health and Human Services* (2004) was used. A comprehensive search of current meta-analyses was performed by disease category. If RRs for dose-responses were not available from the studies, current/former/never or ever/never categories were used where available. Analyses that included age- and sex-stratified estimates of relative risk were preferred over more crude estimates. In cases where a more current meta-analysis did not exist, analyses from English *et al* were used. When a meta-analysis was published later than 1995, there was usually only one that presented data on smoking dose, so it was used as the source of relative risk. If there was more than one, all were examined and the most comprehensive one based on age and smoking dose categories was chosen.
[31] As noted above, age-adjusted RR factors for adults 35 and over for this study were obtained from the second wave of the American Cancer Society's *Cancer Prevention Study (CPS II*), six year follow–up, and were favoured here due to the very large sample size of this study. RR estimates from this source are based on a four-year study with 1.2 million participants.

Makomaski Illing and Kaiserman estimate for all Prairie provinces is likely to yield a lower estimate than if Saskatchewan's higher smoking rate is taken into account.[32]

As explained by Makomaski Illing & Kaiserman (2004), the smoking behaviour of the population two decades earlier is now reflected in the present mortality trends and SAM estimates. Women's smoking peaked in the late 1970s, and deaths from lung cancer among women are therefore now nearly four times as high as 1969 rates. Smoking rates for men, by contrast, peaked in the mid-1960s and lung cancer deaths therefore peaked in the late 1980s, falling slightly since then. Trends in mortality are also influenced by the growth and aging of the population. According to the authors, "As baby boomers age, it can be expected that large numbers of Canadians will continue to die from smoking-related causes, in particular from lung cancer, heart disease, and cerebrovascular disease."[33] Because of the time lag between tobacco use and disease onset, the authors predict female mortality due to smoking will continue to rise and may even exceed male levels, while male mortality will decline.

[32] 1996/97 smoking rates are from the 1996/97 National Population Health Survey. See Statistics Canada, *Smoking status, by sex, household population aged 12 and over*, Canada and provinces, 1994/95-1998/99. Available at: www.statcan.gc.ca/pub/82-221-x/2004002/t/th/4063003-eng.htm. Accessed June 2009.

[33] Thun *et al*, cited by Makomaski Illing, M. & Kaiserman, M. (2004). Mortality attributable to tobacco use in Canada and its regions. *Canadian Journal of Public Health*, Vol. 95 (1), p. 39.

Economic Costs Due to Tobacco Use in Saskatchewan

1. Direct Health Care Costs

Direct health care costs due to tobacco use include the cost of hospitalization, medications and physician services (ambulatory and family physician visits).

These estimates are taken from the *Cost of Substance Abuse in Canada* (CCSA 2006) and are based on 2002 data. Results are summarized in Table 8. As shown, by far the greatest burden of direct health care cost due to tobacco use in Saskatchewan is hospitalization, valued at $104.2 million, followed by the cost of medications at $40.2 million. Added to this is the cost of all physician services (ambulatory care and family physician visits). This totals $154,859,735 ($2002). Converted to 2008 dollars,[34] the total direct annual health care costs attributed to tobacco use in Saskatchewan is estimated at $167,558,233.

Table 8: Direct Health Care Costs Attributable to Tobacco Use, Saskatchewan ($2002/$2008)

Cost category	CCSA Table Number	Cost ($2002)
Acute care hospitalizations	D-HC-1	$104,200,223
Ambulatory care (physician fees)	D-HC-5	$1,690,812
Family physician visits	D-HC-6	$8,736,073
Prescription drugs	D-HC-7	$40,232,627
Total cost ($2002)		**$154,859,735**
Total cost ($2008)		**$167,558,233**

Source: Rehm, J. *et al.*, 2006, *The Cost of Substance Abuse in Canada 2002*. Canadian Centre on Substance Abuse.

Note: Acute care hospitalizations include those due to active smoking and ETS exposure.

2. Direct Prevention and Research Costs

There are many organizations, agencies, and individuals working on tobacco-related prevention and research in Saskatchewan. These include Saskatchewan Health, Health Canada, First Nations and Inuit Health, Canadian Cancer Society-Saskatchewan Division, Saskatchewan Coalition for

[34] Conversion to $2008 completed using the Consumer Price Index (CPI) for health care (only), Statistics Canada (2009) *Consumer price index, health and personal care (Saskatchewan)*, 2002 base year to 2008, an inflator of 1.082. Available at: www40.statcan.ca/l01/cst01/econ161a-eng.htm.

Tobacco Reduction, Saskatchewan Public Health Association, Heart and Stroke Foundation of Saskatchewan, Saskatchewan Prevention Institute, Lung Association of Saskatchewan, Saskatchewan Medical Association, individual health regions, school boards, university researchers, and so on. It would be complicated to quantify what portion of the spending of these agencies is solely used for tobacco reduction initiatives.

The Canadian Centre on Substance Abuse (2006) estimated the direct costs of prevention and research for tobacco use in Canada at $78.1 million ($2002). The Quebec Coalition for Tobacco Control (2004) based their prevention and research costs on the annual cost of Health Canada's Federal Tobacco Control Strategy, valued at $112 million for 2002. Given Saskatchewan makes up 3% of the population of Canada, this extrapolates to prevention and research costs estimates ranging from $2.1 million to $3.4 million ($2002).[35] In 2008 dollars, this yields a range of $2.4 million to $3.9 million in prevention and research costs for Saskatchewan.[36]

3. Other Direct Costs: Cost of Fires Due to Smoking

The cost of fires due to tobacco use in Saskatchewan was extrapolated from Council of Canadian Fire Marshals and Fire Commissioners data from 2000. This source estimates the value of losses due to fires in Canada caused by smoking as $56,720,971 ($2000),[37] adjusted to $64,718,628 ($2008).[38] Given that Saskatchewan comprises 3% of the Canadian population, the annual value of losses due to fires caused by smoking can be estimated at $1,941,559 ($2008).

4. Indirect Costs

Indirect costs are those that do not tax the health care budget of the province directly, but add to society's cost of tobacco use due to lost economic output. These, in turn, reduce GDP and tax revenues. For example, deaths due to tobacco use mean individuals prematurely leave the workforce, depriving society and the family of income. Economic costs to society are also incurred for active work days lost as a result of short and long term disability.

The indirect costs calculated in this study are the smoking-attributable productivity losses due to long-term disability, short-term disability (days in bed and days with reduced activity) and losses due to premature mortality, based on a modified human capital approach. All estimates in this report are extrapolated from indirect cost estimates found in the *Cost of Substance Abuse in*

[35] Using 2008 population figures from Statistics Canada, 2009, *Population by year, by province and territory*. Available at: www40.statcan.gc.ca/l01. Conversion: 1,016/33,311.4 = 0.031.
[36] Conversion to $2008 completed using the Consumer Price Index (CPI), Statistics Canada, 2009, *Consumer price index, by province (Saskatchewan)*, 2002 base year to 2008 yielding an inflator of 1.159. Available at: www40.statcan.ca/l01/cst01/econ09i-eng.htm. Accessed May 2009.
[37] Council of Canadian Fire Marshals and Fire Commissioners, 2000, *Annual Reports of Fire Losses in Canada (1986-2002).* Available at: www.ccfmfc.ca/stats/stats_e.html. Accessed May 2008.This approach was used by Groupe D'Analyse (2004) in *Update on Smoking Costs to Society.*
[38] Conversion to $2008 completed using the Consumer Price Index (CPI), Statistics Canada, 2009, *Consumer price index, by province (Canada)*, 2002 base year to 2008, yielding an inflator of 1.141. Available at: www40.statcan.ca/l01/cst01/econ09a-eng.htm. Accessed May 2009.

Canada 2002 (Rehm *et al* 2006, CCSA), which has been assessed as the most reliable estimate currently available for the country.[39] Unfortunately, indirect costs by province are not provided by the CCSA. For the purposes of this study, the indirect-to-direct cost ratio for the Canada-wide figures was calculated and used to estimate total indirect costs based on the direct cost figures for Saskatchewan. It was assumed that this ratio will not vary greatly by jurisdiction since diseases, once incurred, have similar effects. Indirect costs by category were then calculated as a percent of total indirect costs and converted to $2008.[40]

As shown in Table 9, the greatest annual indirect cost of tobacco use in Saskatchewan is productivity losses due to long-term disability, estimated at $452 million ($2008). This is followed by losses due to premature mortality, valued at $80 million ($2008) and total losses due to short-term disability, totaling $1.6 million ($2008). Thus the total annual indirect cost of tobacco use in Saskatchewan is estimated at $535.2 million ($2008).

Table 9: Indirect Productivity Losses Due to Tobacco Use, Saskatchewan ($2002/$2008)

	Canada ($2002, millions)	Saskatchewan ($2002, millions)	Saskatchewan ($2008, millions)
Total Direct Costs (Tobacco)	$4,525.30	$167.56	$194.20
Indirect/direct ratio (12470.9/4525.3)	2.756	2.756	
Total Indirect Costs (Tobacco)	$12,470.90	$461.80	$535.23
Long-term disability Source: Table I-PR-6 Hybrid calculation	$10,536.80 (84.5%)	$390.22	$452.27
Short-term disability (days in bed) Source: Table I-PR-2	$24.40 (0.2%)	$0.92	$1.07
Short-term disability (days of reduced activity) Source: Table I-PR-4	$36.20 (0.3%)	$1.39	$1.61
Premature mortality Source: Table I-PR-7 Hybrid calculation	$1,873.50 (15%)	$69.27	$80.28

Source: Rehm *et al*, 2006, CCSA, Table 16, page 101.

Notes: Indirect/direct cost ratio of 2.756 used to estimate indirect cost total in Saskatchewan based on direct cost estimate from this report. Individual indirect costs then calculated as a percentage of the total.

[39] See Rehm, J. *et al.*, 2006, *Cost of Substance Abuse in Canada 2002*, CCSA.
[40] Conversion to $2008 completed using the Consumer Price Index (CPI), Statistics Canada, 2009, *Consumer price index, by province (Saskatchewan)*, 2002 base year to 2008, yielding an inflator of 1.159. Available at: www40.statcan.ca/l01/cst01/econ09i-eng.htm. Accessed May 2009.

5. Employer Costs

A variety of studies estimate the cost of tobacco use to employers.[41] These studies consider four main cost areas: absenteeism, productivity, insurance and the cost of smoking facilities. The Conference Board of Canada updated these costs in *Smoking and the Bottom Line: Updating the Cost of Smoking in the Workplace* (2006), to integrate changes such as new workplace smoking restrictions that affect costs. So, for example, although more workplaces are now smoke-free, employees must leave the premises for a smoke break, adding time away from work a reduction in productivity. The Conference Board approach for calculating each of these costs is used in this report, with adjustments made for Saskatchewan as outlined. A summary of the per-employee annual cost of employing a smoker in Saskatchewan is included as Table 10.

Up until May 2009, smoking was still allowed in some Saskatchewan workplaces (rather than in designated smoking areas). However, a newly implemented workplace smoking ban (May 2009) prohibits smoking in all enclosed places of employment, including buildings, vehicles, other enclosed structures and underground mines, with the following exceptions:

- Traditional First Nations and Métis spiritual and/or cultural ceremonies;
- Smoking rooms for residents and visitors of long-term care facilities designated by tobacco control legislation, Ministry of Health;
- Areas of underground mines located more than 10 metres from other workers; and,
- Some self-employed businesses, vehicles and camp living accommodations with permission and when others are not present.

Based on experience from other jurisdictions, this new ban can be expected to lower exposure to ETS and reduce opportunities for smoking in public places and de-normalize tobacco use, thereby strengthening tobacco reduction efforts especially when used in combination as part of a comprehensive tobacco control strategy.

Increased Employee Absenteeism

Abundant research shows that smokers are absent from work due to illness more frequently than non-smokers, although the actual rates of absenteeism vary.[42] The Conference Board of Canada (2006) cites data from the *Canadian Community Health Survey*, estimating that smokers miss, on average, two additional days as compared with non-smokers. The cost of absenteeism is then calculated as these days lost, multiplied by the average daily per-employee payroll cost.[43] This is a conservative estimate, since it is lower than the value of lost economic output, which could be assessed in a GDP per-employee per-day basis.

---

[41] See Colman, R., 2001, *The Economic Impact of Smokefree Workplaces: an Assessment for Nova Scotia*. GPI Atlantic for Tobacco Control Unit, Nova Scotia Department of Health; also Conference Board of Canada, 2006. *Smoking and the Bottom Line: Updating the Costs of Smoking in the Workplace;* and Quebec Coalition for Tobacco Control, 2004, *Update on Smoking Costs to Society*.

[42] For example, the US CDC, 2004, *Surgeon General's Report on Tobacco* reviewed 320 studies on employee absenteeism.

[43] See Conference Board of Canada, 2006, *Smoking and the Bottom Line: Updating the Costs of Smoking in the Workplace*, p. 4. As well, this payroll cost includes the daily wage plus payroll taxes and benefits paid by the employer.

In 2008, the average daily wage for a Saskatchewan worker was estimated at $157.[44] Payroll taxes and benefit payments are estimated by the Conference Board of Canada to be 12.5% of payroll.[45] Combining wages with taxes and benefits provides an average daily per-employee payroll cost for a Saskatchewan employee of $176.63 ($2008). Given that smokers are absent from work, on average, two additional days than non-smokers, the annual employer absenteeism cost for employing each staff member who smokes is $353.26 in Saskatchewan ($2008).

Reduced Employee Productivity

The Conference Board of Canada (2006) updated earlier estimates of the cost of cigarette breaks taken by smoking employees in considering legislative changes that restrict workplace smoking. Based on an examination of research in the field, the Conference Board assumes smokers take an average of two unsanctioned smoking breaks each day. It was also assumed an employee takes 10 minutes to consume a cigarette. However, given legislative bans on smoking in public places/workplaces, the time to reach an acceptable smoking site (generally outside the building) was increased to 10 minutes per break. Thus in total, an employee who smokes spends an additional 40 minutes each day on cigarette breaks, outside of sanctioned rest and meal time.

As estimated above, combining wages with taxes and benefits provides an average daily per-employee payroll cost for a Saskatchewan employee of $176.63 ($2008). If, as assumed, each employee who smokes spends an average of 40 minutes of that 8-hour day consuming cigarettes (8.3% of the day), the estimated daily cost to a Saskatchewan employer of lost productivity due to smoking is $14.66 ($2008). Assuming 227 work days in a year,[46] the annual cost of lost productivity for each employee who smokes in Saskatchewan is $3,327.82.[47]

Increased Insurance Costs

Although there is solid evidence showing that smokers use health services more often than non-smokers and thus incur higher medical costs[48] it is difficult to substantiate calculations on the impact of smoking on employer-sponsored insurance premiums. As recommended by the Conference Board (2006), these are not included in this estimation.

---

[44] Calculation based on data from Statistics Canada, 2005, *Average hourly wages of employees by selected characteristics and profession, unadjusted data,* (monthly, Saskatchewan) *CANSIM tables 282-0069 and 282-0073.* Hourly wage ($2008) of $19.99 x 8 hr average workday = $159.92 as average daily wage. A slightly lower estimate is obtained by using the average weekly wage in Saskatchewan of $785.71/5 day work week = $157.14 ($2008). Source of average weekly wage data, Statistics Canada, 2008. *Earnings, average weekly, by province and territory (Saskatchewan).* Available at: www40.statcan.gc.ca/l01/cst01/labr79-eng.htm. The lower of these two estimates is used in this study.

[45] See Conference Board of Canada. (2006). *Smoking and the Bottom Line: Updating the Costs of Smoking in the Workplace*, p. 5.

[46] Ibid, p. 6, which calculates 365 days minus 104 for weekends, 10 for holidays, 15 for vacation time and nine for sick days, totalling 227 working days.

[47] The Conference Board (p.7) points out that this assumes an employee on a smoking break is not engaged in work-related tasks. This may or may not be true (i.e., they may be discussing work while on a cigarette break). Also, given smoking rates are declining, these estimates will decline if smokers consume fewer than 12 cigarettes per day.

[48] US CDC, 2002. Annual Smoking-Attributable Mortality, Years of Potential Life Lost and Economic Costs—United States 1995–99. *Morbidity and Mortality Weekly Report, Vol.* 51 (14) as cited by Conference Board of Canada.

Total Annual Cost of Tobacco Use to Employers in Saskatchewan

The total cost to an employer of employing a smoker in Saskatchewan, as summarized in Table 10, is estimated at $3,694.69 ($2008) per year more than the cost of employing a non-smoker.

Table 10: Per Employee Annual Cost of Employing a Smoker, Saskatchewan ($2008)

Category	Cost ($2008)
Employee absenteeism	$353.26
Employee productivity	$3,327.80
Insurance	n/a
Total annual per employee cost	*$3,681.06*

Source: As summarized by the authors.

Multiplying the number of employees who smoke by the annual per-employee cost of smoking was used to estimate the total annual cost of tobacco use to employers in Saskatchewan. Statistics Canada estimated 421,100 full-time and 91,700 part-time employees in Saskatchewan in 2008.[49] Using the 2007 smoking rate of 24%, this means 101,064 full-time employees and 22,008 part-time employees are smokers. Multiplying the total annual per-employee cost ($3,681.06) by the total number of full-time Saskatchewan employees who smoke (101,064) results in a total employer cost estimate of $372 million ($2008).

The greatest proportion of cost to employers is for lost productivity, a calculation based on the length of time for cigarette breaks in an 8-hour workday. Using this calculation for part-time workers then, is not entirely accurate. For the purpose of this study, we'll assume the annual per-employee cost is half that of the full-time worker, at $1,840.53. Multiplying that by 22,008 part-time workers who smoke means a total employer cost estimate for part-time workers of $41 million.

This results in a total cost estimate to Saskatchewan employers for employing workers who smoke, at $413 million ($2008) per-year.

[49] Statistics Canada, 2009, *Labour force survey estimates (LFS), by sex and detailed age group, annual, CANSIM Table 282-0002*. Available at: cansim2.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&CNSM-Fi=CII/CII_1-eng.htm. Accessed May 2009.

Summary of Economic Costs of Tobacco Use in Saskatchewan

The total economic costs of tobacco use in Saskatchewan, summarized in Table 11, amount to $1,080 million ($2008). Indirect costs, valued at $535.23 million ($2008) accounted for the greatest proportion of total costs (50%), followed by $373 million ($2008) for employing a smoker (34% of the total cost), and $167.6 million in direct health care costs ($2008) (16% of the total cost). The total cost of smoking in Saskatchewan is estimated at $1,063 per-capita per-year.

The indirect costs of tobacco use, reflecting productivity losses to the economy, constitute the greatest economic burden of tobacco use in Saskatchewan, as they do elsewhere in the country. These costs are generally invisible in conventional accounting mechanisms as receive considerably less attention than taxpayer-funded health care expenditures.

Table 11: Total Costs of Tobacco Use in Saskatchewan ($2008)

Cost items	Cost (millions $2008)	Percent of total cost
1. Direct health care costs	$167.56	16.00%
2. Direct prevention and research costs	$2.40	00.22%
3. Other direct costs: fire damage	$1.94	00.18%
4. Indirect costs	$535.23	50%
5. Employer costs	$373.00	34%
Total cost of smoking in Saskatchewan	***$1,080.13***	***100%***
Total per-capita		$1,063
Total deaths due to tobacco use (2005)		1,561

Source: As summarized by the authors.

Notes: Employer costs include employee productivity and smoking facilities only. Absenteeism is counted previously as an indirect cost. Total per-capita cost calculation is based on the 2008 population of Saskatchewan, 1,016,000. Source: Statistics Canada, 2009, *Population by year, by province and territory.* Available at: www40.statcan.ca/l01/cst01/demo02a-eng.htm. Accessed May 2009.

Who Pays for Tobacco Use in Saskatchewan?

The proportion of total smoking costs borne by employers, smokers and society is summarized in Table 12 using estimates generated in this report. As previously estimated, the annual cost of tobacco use in Saskatchewan is $1,080 million ($2008). Employer-borne costs were estimated at $373 million ($2008). The remaining cost ($707 million) is thus borne by society and by government.

However, government redeems a portion of this cost in the form of tobacco tax revenue. Total federal and provincial tax revenue generated from tobacco use in Saskatchewan in 2007/2008 was estimated at $190.4 million.[50] It is important to note this cost is for the tax portion of cigarettes, not the full cost paid by the smoker. It also does not consider private health and caregiving costs that may be incurred by smokers.

Subtracting the revenue from tobacco taxes from the societal and government cost burden leaves a shortfall of $516.6 million ($2008). This amount, which constitutes 48% of the total economic cost of tobacco use in Saskatchewan, is carried by the Saskatchewan taxpayer, more than 76% of whom are non-smokers.

Table 12: Percentage of Total Cost of Tobacco Use Attributable to Smokers, Employers and Society, Saskatchewan ($2008)

	Source	Estimate (Millions, $2008)	% of Total
Cost to employers	Table 11	$373.00	34%
Cost to smokers	Tobacco tax revenue	$190.40	18%
Cost to society	Remainder of total cost	$516.60	48%
Total cost		*$1,080.00*	*100%*

Source: As estimated by the authors.

Potential Savings from Tobacco Reduction

Significant evidence exists to support the use of interventions for tobacco reduction. Generally-speaking, such interventions achieve three broad goals: increased tobacco cessation: helping smokers quit, reducing tobacco use and preventing relapse; protecting people from Environmental Tobacco Smoke (ETS); and, reducing smoking initiation, especially among youth.

Tobacco-reduction interventions commonly used to achieve these goals can include:
- Smoke-free policies and programs
- Increased tobacco taxes

[50] Physicians for a Smoke-Free Canada, 2006. *Tax Revenue from Tobacco Sales.* Available at: www.smoke-free.ca/factsheets/pdf/totaltax.pdf. Accessed May 2009.

- Marketing bans
- Mass media and public awareness campaigns
- Cessation assistance
- School-based programs
- Community-based programs and education

Comprehensive, funded tobacco reduction programs have shown success in many jurisdictions in Canada and the United States. For example, in the 1990s, comprehensive, funded programs in Arizona, California, Massachusetts and Oregon resulted in more than twice the decline in cigarette sales as compared with the country as a whole.

This report estimates tremendous economic and social costs to society of tobacco use. Reducing use, through interventions such as those listed above, has the potential to save lives and reduce suffering, as well as generating future cost savings. This section calculates the potential cost-savings from a hypothetical 25% reduction in Saskatchewan smoking rates, from the current CTUMS rate of 20% to 15%, comparable to the tobacco use prevalence rate of British Columbia (BC).

This extrapolation is based on 2002 data from the Canadian Centre on Substance Abuse (CCSA). The CCSA estimates the total cost of tobacco use at $563 per-capita in BC and $593 per-capita in Saskatchewan.[51] The CCSA provides conservative estimates of direct health care, prevention and research and indirect productivity costs, but not employer costs.

Productivity losses must also be factored in, because the cost of labour is higher in BC than Saskatchewan. According to Statistics Canada, average annual weekly earnings in Saskatchewan were 94% of those in British Columbia[52] ($656 versus $699). Adjusting BC per-capita cost of use ($563) downward by 6% to account for earning differences results in a per-capita cost estimate of $529.22.

Per-capita cost savings can then be calculated by subtracting the per-capita Saskatchewan cost of use from the adjusted per-capita BC cost of use ($593 - $529.22). This would result in a per-capita savings of $63.78 ($2002) and $69 per-capita ($2008).[53]

This implies a potential cost savings of $70,104,000 ($2008) using the previously cited population estimate of 1,016,000 for Saskatchewan.

Calculating anticipated cost savings in this manner has limitations. Former smokers have increased risk of tobacco-related illness and mortality as compared to never-smokers. This calculation does not take into consideration the lower percentage of former smokers in BC as

[51] Rehm, J. et al. (2006). *The Cost of Substance Abuse in Canada 2002. Canadian Centre on Substance Abuse.* See Table 20: Total costs of substance abuse in Canadian provinces 2002, page 107.
[52] Statistics Canada, 2004. *Earnings, average weekly, by province and territory*: 2004–2008. Available at: www40.statcan.gc.ca/l01/cst01/labr79-eng.htm. Accessed September 2009. 2004 data used in calculation (2002 not available).
[53] Conversion to $2008 completed using the Consumer Price Index (CPI) for health care (only), Statistics Canada (2009) *Consumer price index, health and personal care (Saskatchewan),* 2002 base year to 2008, an inflator of 1.082. Available at: www40.statcan.ca/l01/cst01/econ161a-eng.htm.

compared with Saskatchewan. Given that Saskatchewan's smoking rates have been higher over time than those in BC, Saskatchewan has a higher percentage of costs associated with former smokers. In addition, all calculations are limited by availability and accuracy of numerical cost estimates.

Discussion of Cost Estimates

Tobacco-related costs can be estimated using a number of different approaches and methods. For example, a 2003 study by Harrison *et al* uses an econometric approach to calculate SAF, not the RR approach used in this report. Econometric studies express SAF as the "relative difference between two predictors of health care expenditure or use: (i) predicted based on actual behaviour and (ii) predicted use based on the assumption that no one has ever smoked, but their other characteristics remain the same."[54]

Smoking-attributable health care utilization can be estimated using regression analysis, which, however, requires a large data set. Thus, the *Newfoundland Adult Health Survey* (1995), covering thousands of individuals and linking to respondents' medical utilization records, makes this calculation possible using regression analysis. Results from this research estimate that more than 12% of hospital use and 7% of physician visits are attributable to smoking, resulting in annual costs of $100 to $140 per-capita in Newfoundland for these two smoking-attributable health care costs.

A study for the Quebec Coalition for Tobacco Control, *Update on Smoking Costs to Society* (2004) estimates six categories of Canadian tobacco-attributable costs: direct health care costs (hospital care, medical care and drug expenses), costs incurred by employers (absenteeism, decreased productivity, increased life insurance premiums and cost of smoking areas), prevention and research costs, cost of fires, costs linked to premature death and costs specific to ETS. This resulted in an estimated cost attributable to smoking in Canada (2002) of $15,847 million. Adjusting for inflation this amounts to $18,066 million in $2008.[55]

Extrapolating from this Quebec study on a per-capita basis—with Saskatchewan comprising approximately 3% of the Canadian population—would result in an estimated cost attributable to smoking of $542 million, amounting to just under half the cost estimate of $1.08 billion estimated here. This is a considerably more modest estimate of total smoking-attributable costs than in this report. This is primarily because the Quebec Coalition for Tobacco Control study excludes most of the costs of productivity losses due to long-term and short-term disability, which together account for a significant portion of costs estimated in this report. Only a small proportion of disability costs appear in the Quebec report, as part of absenteeism costs incurred by employers. As well, an extrapolation to Saskatchewan from Canadian data based on

[54] See Harrison, G. *et al*, 2003. Cigarette smoking and the cost of hospital and physician care. *Canadian Public Policy*. University of Toronto Press, March, Vol. 29 (1), p. 4. Available at: ideas.repec.org/a/cpp/issued/v29y2003i1p1-19.html. Accessed June 2008.

[55] CPI from Statistics Canada, 2009. *Consumer Price Index, by Province* (Canada). Available at: www40.statcan.gc.ca/l01/cst01/econ09a-eng.htm. Accessed May 2009. 114/100 = 1.14, CPI conversion $15,847 x 1.14 = $18,066

population alone, as done here, will yield lower results than if Saskatchewan's current higher rate of smoking (23% versus 19%) is taken into account.

These few examples are provided here simply to illustrate the range of estimates that result from using different costing methods and approaches, and the difficulties and challenges inherent in cost estimation altogether depending on assumptions made, and on the inclusion or exclusion of particular cost categories.

It should be noted that the $1.08 billion total smoking-attributable cost estimate for Saskatchewan in this study can also be considered conservative in so far as some significant indirect costs are excluded from this estimate. For example, the burden of physical pain and suffering resulting from premature death and illness is an intangible cost not included here.

Globally, there have also been significant documented environmental costs to growing tobacco and producing and using tobacco products, which are also excluded from cost estimates. For example, tobacco production requires high levels of fertilizer, herbicides, and pesticides as well as abundant cleared land. Pesticides seep into the soil, pollute waterways, and poison fish, livestock and food crops. The large areas of land needed to grow tobacco have resulted in deforestation, soil erosion, nutrient depletion, changes in microclimates and land degradation, particularly in developing nations. According to one estimate, the tobacco industry burns as much as one acre of forest for every acre of tobacco cured, using nearly 12% of all timber felled in the world, while a cigarette manufacturing machine uses four miles of paper per-hour to roll and package cigarettes.[56] Forest fires have also caused by careless disposal of cigarette butts.

Tobacco use also generates substantial amount of garbage, including cigarette butts, empty packages and foil wrappers, which frequently litter public places. Cigarette butts degrade very slowly, taking an average of 25 years to decompose entirely. The industry itself also generates considerable quantities of dangerous solid and liquid chemical wastes.[57] None of these significant environmental costs were incorporated into the cost estimates in this study. Again, this brief discussion simply illustrates the challenges and wide range of assumptions, exclusions and methodological considerations inherent in risk factor cost analyses, and helps explain the wide range of estimates possible. These caveats notwithstanding, the authors are confident that the $1.08 billion smoking-attributable cost estimate for Saskatchewan in this study is a reasonable one based on the widely accepted methodologies and reliable data sources used.

[56] City of Berkeley, 2007. *Tobacco and the Environment.* Available at: www.ci.berkeley.ca.us/publichealth/tobacco/environ.html. Accessed May 2008.
[57] Novotny, T. & F. Zhao, 1999. Consumption and production waste: another externality of tobacco use, *Tobacco Control,* August; 8: pp. 75 – 80. Available at: tobaccocontrol.bmj.com/cgi/content/full/8/1/75. Accessed May 2008.

Summary of Key Observations

- The total number of deaths in Saskatchewan (2005) attributable to active smoking was estimated at 1,534, with 910 males and 624 females dying from cancer and cardiovascular and respiratory diseases as a result.

- ETS was estimated to be responsible for an additional 27 deaths in 2005 due to lung cancer and ischemic heart disease.

- Deaths due to smoking in Saskatchewan thus totaled 1,561 in 2005. This means 18% of a total 8,850 deaths in Saskatchewan in 2005 can be attributed to tobacco use--approximately one in every five deaths in the province.

- The total direct annual health care cost attributable to smoking in Saskatchewan is estimated at $167.6 million ($2008).

- Annual indirect cost due to tobacco use is estimated at $535.23 million ($2008), reflecting productivity losses due to long-term and short-term disability and premature death.

- The value of losses due to fires due to smoking is estimated at $1.9 million ($2008).

- Prevention and research costs ranged from $2.4 to $3.9 million ($2008).

- The total annual cost to employers of hiring smokers is estimated at $413 million ($2008). This includes absentee costs and on-the-job productivity losses due to unauthorized smoke breaks.

- The total cost of tobacco use in Saskatchewan is estimated at $1,080 million ($2008), or $1,063 per-capita. Indirect costs accounted for the greatest proportion of the total at $535.2 million (50%), followed by employer costs of $373 million (34%), direct health care costs $167.6 million (16%), direct prevention and research costs of $2.4 million (0.22%), and cost of damage due to fires of $1.9 million (0.18%).

- $516.6 million ($2008) or 48% of the total cost of tobacco use in Saskatchewan is paid for by society, more than 76% of whom are non-smokers.

- There are enormous potential benefits to investing in tobacco reduction, including lives saved, better long-term health outcomes and cost savings. A decline of 25% in tobacco use prevalence from 20% to 15% was estimated to save Saskatchewan approximately $69 per-capita ($2009), or a total savings of $70 million ($2008) not including employer cost-savings.

References

Council of Canadian Fire Marshals and Fire Commissioners (2000). *Annual Reports of Fire Losses in Canada* (1986-2002). Available at: www.ccfmfc.ca/stats/stats_e.html. Accessed May 2009.

Colman, R. (2000). *The Cost of Tobacco in Nova Scotia.* GPI Atlantic, prepared for Cancer Care Nova Scotia.

Colman, R. (2001). *The Economic Impact of Smokefree Workplaces: an Assessment for Nova Scotia*. GPI Atlantic for Tobacco Control Unit, Nova Scotia Department of Health, Committee for the National Strategy to Reduce Tobacco Use in Canada (NSTRTU). (1999). Available at: www.hc-sc.gc.ca/hl-vs/pubs/tobac-tabac/ns-sn/index_e.html. Accessed May 2007.

Conference Board of Canada (2006). S*moking and the Bottom Line: Updating the Costs of Smoking in the Workplace.* Available at: www.conferenceboard.ca/documents.asp?rnext=1754. Accessed May 2007.

Groupe D'Analyse (2004). *Update on Smoking Costs to Society.* Available at: www.cqct.qc.ca/Documents_docs/DOCU_2004/ETUD_04_01_15_GroupeDAnalyseCoutTabac ENG.PDF. Accessed May 2007.

Harrison, G., Feehan, J., Edwards, A. & Segovia, J. (2003). Cigarette Smoking and the Cost of Hospital and Physician Care. *Canadian Public Policy*. University of Toronto Press. March, Vol. 29 (1). Available at: ideas.repec.org/a/cpp/issued/v29y2003i1p1-19.html. Accessed May 2007.

Health Canada (2007). *Canadian Tobacco Use Monitoring Survey (CTUMS) Annual Results 1985 - 2007.* Available at: www.hc-sc.gc.ca/hl-vs/tobac-tabac/research-recherche/stat/ctums-esutc_2007-eng.php. Accessed January 2009.

Health Canada (2007). *Canadian Tobacco Use Monitoring Survey (CTUMS), Annual Results 1999 - 2007.* Available at: www.hc-sc.gc.ca/hl-vs/tobac-tabac/research-recherche/stat/_ctums-esutc_prevalence/prevalence-eng.php. Accessed January 2009.

Health Canada (2007). *Canadian Tobacco Use Monitoring Survey (CTUMS), Supplementary tables,* (2000, 2007). Available at: www.hc-sc.gc.ca/hl-vs/tobac-tabac/research-recherche/stat/index-eng.php. Accessed January 2009.

Kaiserman, M. (1997). The Cost of Smoking in Canada, 1991. *Chronic Diseases in Canada*, 18 (1).

Levin, M. (1953). The occurrence of lung cancer in man. *Acta Unio Internationalis Contra Cancrum*. Vol. 19, p. 531–541.

Lilienfield A. & Lilienfield, D. (1980). *Foundations of epidemiology.* 2nd ed. Nueva York: Oxford University Press.

Makomaski Illing E. & Kaiserman, M. (2004). Mortality attributable to tobacco use in Canada and its regions. *Canadian Journal of Public Health*, Vol. 95(1), p. 39.

Rehm, J. *et al* (2004). *The Costs of Substance Abuse in Canada: 2002 Highlights*. Canadian Centre on Substance Abuse. Available at: www.ccsa.ca/CCSA/EN/Publications. Accessed April 2007.

Rehm, J. *et al* (2006). *The Cost of Substance Abuse in Canada 2002*. Canadian Centre on Substance Abuse.

Statistics Canada (2003). *Canadian Community Health Survey (Cycle 2.1) CANSIM Table no. 105-0227.* Available at: cansim2.statcan.gc.ca/cgi-win/CNSMCGI.PGM. Accessed January 2009.

Statistics Canada (2005). *Mortality, Summary List of Causes, Catalogue Number 84F0209X, Table 1-9 Deaths by selected grouped causes, sex and geography—Saskatchewan.* Available at: www.statcan.gc.ca/pub/84f0209x/2005000/t004-eng.htm. Accessed January 2009.

Statistics Canada (2005). *Canadian Community Health Survey (Cycle 3.1) CANSIM Table no. 105-0327.* Available at: cansim2.statcan.gc.ca/cgi-win/CNSMCGI.PGM. Accessed January 2009.

Statistics Canada. (2005). *Canadian Community Health Survey (Cycle 3.1). CANSIM Table no. 105-0427.* Available at: cansim2.statcan.ca/cgi-win/cnsmcgi.pgm. Accessed January 2009.

Statistics Canada (2007). *Canadian Community Health Survey (CCHS)* Table 105-0501 *indicator profile, by age group and sex, Canada, provinces, territories, health regions (2007 boundaries) and peer groups, annual, CANSIM (database).* Available at: www.statcan.gc.ca/pub/82-221-x/2008001/5202308-eng.htm.Accessed January 2009.

Statistics Canada (2007). *Canadian Community Health Survey (CCHS) Table 05-0502, indicator profile, by age group and sex, Canada, provinces, territories, health regions (2007 boundaries) and peer groups, annual, CANSIM (database).* Available at: www.statcan.gc.ca/pub/82-221-x/2008001/5202308-eng.htm. Accessed January 2009.

Statistics Canada (2008). *Earnings, average weekly, by province and territory (Saskatchewan).* Available at: www40.statcan.gc.ca/l01/cst01/labr79-eng.htm. Accessed May 2009.

Statistics Canada (2009). *Consumer price index, health and personal care (Canada) 2002 base year to 2008.* Available at: www40.statcan.ca/l01/cst01/econ161a-eng.htm. Accessed May 2009.

Statistics Canada (2009). *Table 282-0002 - Labour force survey estimates (LFS), by sex and detailed age group, annual (persons unless otherwise noted), CANSIM (database).*

Available at: cansim2.statcan.gc.ca/cgi-win/cnsmcgi.exe?Lang=E&CNSM-Fi=CII/CII_1-eng.htm. Accessed May 2009.

Statistics Canada (2009). *Population by year, by province and territory.* Available at: www40.statcan.gc.ca/l01. Accessed May 2009.

Thun, M. & da Costa e Silva, V. (2003). Introduction and Overview of Global Tobacco Surveillance in Shafey, O., Dolwick, S. and Guindon, G. (eds) *Tobacco Control Country Profiles,* 2nd ed, pp.7–8. Available at: www.who.int/tobacco/global_data/country_profiles/Introduction.pdf. Accessed May 2008.

Thun M., Day-Lally, C. & Myers, D. *et al*. (1997). Trends in tobacco smoking and mortality from cigarette use in Cancer Prevention Studies I (1959 through 1965) and II (1982 through 1988). In *Changes in cigarette-related disease risks and their implication for prevention and control.* Smoking and Tobacco Control Monograph 8. Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute 1997; 305-382. NIH Publication no. 97-1213.

US Centers for Disease Control (CDC), 2008, *International Classification of Diseases, Tenth Revision (ICD-10).* Available at: www.cdc.gov/nchs/about/major/dvs/icd10des.htm.

World Bank (1999). Curbing the epidemic: Governments and the economics of tobacco control as cited by World Health Organization (2004). *European Strategy for Smoking Cessation Policy* Available at: www.euro.who.int/Document/E80056.pdf. Accessed June 2007.

APPENDICES

APPENDIX A
CIGARETTE SALES IN SASKATCHEWAN, 1989-2008

Year	Units of Cigarettes
1989	1,037,895,000
1990	1,019,360,000
1991	899,544,000
1992	805,117,000
1993	751,380,000
1994	797,190,000
1995	883,435,000
1996	1,234,957,000
1997	1,227,789,000
1998	1,241,564,000
1999	1,222,244,000
2000	1,200,144,725
2001	1,190,410,275
2002	1,042,594,110
2003	1,036,957,265
2004	1,030,252,450
2005	997,806,005
2006	1,023,063,805
2007	1,083,646,605
2008	1,132,169,720

Source: Health Canada, 2008. *Wholesale Sales Data, Tobacco Control Program*. Available at: www.hc-sc.gc.ca/hl-vs/tobac-tabac/research-recherche/indust/_sales-ventes/sk-eng.php. Accessed September 2009.

APPENDIX B
MORTALITY DATA FOR SASKATCHEWAN (2005)

Cause of Death	Male		Female
Malignant neoplasms		**Malignant neoplasms**	
Lip, oral cavity, and pharynx (C00-C14)	15	Lip, oral cavity, and pharynx (C00-C14)	9
Oesophagus (C15)	25	Oesophagus (C15)	9
Stomach (C16)	32	Stomach (C16)	19
Pancreas (C25)	49	Pancreas (C25)	69
Larynx (C32)	13	Larynx (C32)	2
Trachea, bronchus, and lung (C33-34)	299	Trachea, bronchus, and lung (C33-34)	250
Cervix uteri (C53)	n/a	Cervix uteri (C53)	9
Kidney and renal pelvis (C64-65)	28	Kidney and renal pelvis (C64-65)	22
Bladder (C67)	45	Bladder (C67)	13
Acute myeloid leukemia (C92.0)	9	Acute myeloid leukemia (C92.0)	12
Cardiovascular Diseases		**Cardiovascular Diseases**	
Ischaemic heart disease (I20-I25)		Ischaemic heart disease (I20-I25)	
Aged 35-64	156	Aged 35 -64	27
Aged 65+	671	Aged 65+	575
Other heart disease (I00-I09, I26-I51)	303	Other heart disease (I00-I09, I26-I51)	373
Cerebrovascular disease (I60-I69)		Cerebrovascular disease (I60-I69)	
Aged 35-64	26	Aged 35-64	14
Aged 65+	248	Aged 65+	287
Atherosclerosis (I70)	24	Atherosclerosis (I70)	14
Aortic aneurysm (I71)	34	Aortic aneurysm (I71)	27
Other arterial disease (I72-I78)	22	Other arterial disease (I72-I78)	21
Respiratory Diseases		**Respiratory Diseases**	
Pneumonia, influenza (J10-18)	131	Pneumonia, influenza (J10-18)	139
Bronchitis, emphysema (J40-J43)	24	Bronchitis, emphysema (J40-J43)	22
Chronic airway obstruction (J44)	173	Chronic airway obstruction (J44)	126

Source: Selected from Statistics Canada, 2005, *Mortality, Summary List of Causes, Catalogue Number 84F0209X, Table 1-9 Deaths by selected grouped causes, sex and geography—Saskatchewan.* Available at: www.statcan.gc.ca/pub/84f0209x/2005000/t009-eng.htm. Accessed May 2009. Acute myeloid leukemia, cerebrovascular disease, chronic airway obstruction and ischemic heart disease data obtained as a special order from the Information Services Corporation of Saskatchewan.

APPENDIX C
US CDC INTERNATIONAL CLASSIFICATION OF DISEASES: SMOKING-RELATED

Disease Category	ICD-10	ICD-9	Comparability Ratio
Malignant Neoplasm			
Lip, Oral Cavity, Pharynx	C00-C14	140-149	0.960
Oesophagus	C15	150	0.997
Stomach	C16	151	1.006
Pancreas	C25	157	0.998
Larynx	C32	161	1.005
Trachea, Lung, Bronchus	C33-C34	162	0.984
Cervix Uteri	C53	180	0.987
Kidney and Renal Pelvis	C64-C65	189	1.000
Urinary Bladder	C67	188	0.997
Acute Myeloid Leukemia	C92.0	205	1.012
Cardiovascular Diseases			
Ischemic Heart Disease	I20-I25	410-414, 429.2	0.999
Other Heart Disease	I00-I09, I26-I51	390–398, 415-417, 420-429.1, 429.3-429.9	0.969
Cerebrovascular Disease	I60-I69	430-438	1.059
Atherosclerosis	I70	440	0.964
Aortic Aneurysm	I71	441	1.001
Other Arterial Disease	I72-I78	442-448	0.850
Respiratory Diseases			
Pneumonia, Influenza	J10-J18	4800487	0.698
Bronchitis, Emphysema	J40-J42, J43	490-492	0.894
Chronic Airway Obstruction	J44	496	1.097

Source: US CDC, 2008, *International Classification of Diseases, Tenth Revision (ICD-10).* Available at: www.cdc.gov/nchs/about/major/dvs/icd10des.htm. Accessed May 2008.

Note: This table provides a list of diseases known to be attributable to smoking. The ICD is revised periodically to incorporate medical advances. To date, there have been 10 revisions of the ICD. The information included in the table above are the 9th and 10th revisions, which reflect changes from 1979–1998 and 1999–present, respectively. The comparability ratios between the two sets of data are similar and included above.

This 2009 update of the *International Classification of Diseases*, 10th revision, Clinical Modification (ICD-10-CM) is being published by the United States Government in recognition of its responsibility to promulgate this classification throughout the United States for morbidity coding. The International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10), published by the World Health Organization (WHO), is the foundation of ICD-10-CM. ICD-10 continues to be the classification used in cause-of-death coding in the United States; the ICD-10-CM is comparable with the ICD-10. The WHO Collaborating Center for the Family of International Classifications in North America, housed at the National Center for Health Statistics (NCHS), has responsibility for the implementation of ICD and other WHO-FIC classifications and serves as a liaison with the WHO, fulfilling international obligations for comparable classifications and the national health data needs of the United States. The historical background of ICD and ICD-10 can be found in the Introduction to the *International Classification of Diseases and Related Health Problems (ICD-10), Second Edition,* World Health Organization, Geneva, Switzerland, 2005.

ICD-10-CM is the United States' clinical modification of the World Health Organization's ICD-10. The word clinical is used to emphasize the modification's intent: to serve as a useful tool in the area of classification of morbidity data for indexing of medical records, medical care review, and ambulatory and other medical care programs, as well as for basic health statistics. To describe the clinical picture of the patient the codes must be more precise than those needed only for statistical groupings and trend analysis.

Characteristics of ICD-10-CM
ICD-10-CM far exceeds its predecessors in the number of concepts and codes provided. The clinical modification represents a significant improvement over ICD-9-CM and ICD-10. Specific improvements include: the addition of information relevant to ambulatory and managed care encounters; expanded injury codes; the creation of combination diagnosis/symptom codes to reduce the number of codes needed to fully describe a condition; the addition of sixth and seventh characters; incorporation of common fourth and fifth digit sub-classifications; laterality; and greater specificity in code assignment. The new structure will allow further expansion than was possible with ICD-9-CM.

An updated 2009 version of ICD-10-CM is now available for public viewing. However, the codes in ICD-10-CM are not currently valid for any official purpose or use. There is now an anticipated implementation date for the ICD-10-CM of October 1, 2013. Implementation will be based on the process for adoption of standards under the Health Insurance Portability and Accountability Act of 1996.

APPENDIX D
RELATIVE RISK VALUES FOR SELECTED DISEASES

Female Disease Category	Current Smoker	Former Smoker
Malignant Neoplasm		
Lip, Oral Cavity, Pharynx	5.08	2.29
Esophagus	7.75	2.79
Stomach	1.36	1.32
Pancreas	2.25	1.55
Larynx	13.02	5.16
Trachea, Lung, Bronchus	12.69	4.53
Cervix Uteri	1.59	1.14
Kidney and Renal Pelvis	1.29	1.05
Urinary Bladder	2.22	1.89
Acute Myeloid Leukemia	1.13	1.38
Cardiovascular Diseases		
Ischemic Heart Disease		
Persons Aged 35-64	3.08	1.32
Persons Aged 65+	1.60	1.20
Other Heart Disease	1.49	1.14
Cerebrovascular Disease		
Persons Aged 35-64	4.00	1.30
Persons Aged 65+	1.49	1.03
Atherosclerosis	1.83	1.00
Aortic Aneurysm	7.07	2.07
Other Arterial Disease	2.17	1.12
Respiratory Diseases		
Pneumonia, Influenza	2.17	1.10
Bronchitis, Emphysema	12.04	11.77
Chronic Airway Obstruction	13.08	6.78

Sources: US CDC Relative Risk Data, CPS–II (82-88). Unpublished estimates provided by American Cancer Society (ACS). See Thun, M. *et al.* Trends in tobacco smoking and mortality from cigarette use in Cancer Prevention Studies I (1959 through 1965) and II (1982 through 1988). In: *Changes in cigarette-related disease risks and their implication for prevention and control*. Smoking and Tobacco Control Monograph 8. Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute 1997; 305-382. NIH Publication no. 97-1213.

Male Disease Category	Current Smoker	Former Smoker
Malignant Neoplasms		
Lip, Oral Cavity, Pharynx	10.89	3.40
Esophagus	6.76	4.46
Stomach	1.96	1.47
Pancreas	2.31	1.15
Larynx	14.6	6.34
Trachea, Lung, Bronchus	23.26	8.70
Kidney and Renal Pelvis	2.72	1.73
Urinary Bladder	3.27	2.09
Acute Myeloid Leukemia	1.86	1.33
Cardiovascular Diseases		
Ischemic Heart Disease		
Persons Aged 35-64	2.80	1.64
Persons Aged 65+	1.51	1.21
Other Heart Disease	1.78	1.22
Cerebrovascular Disease		
Persons Aged 35-64	3.27	1.04
Persons Aged 65+	1.63	1.04
Atherosclerosis	2.44	1.33
Aortic Aneurysm	6.21	3.07
Other Arterial Disease	2.07	1.01
Respiratory Diseases		
Pneumonia, Influenza	1.75	1.36
Bronchitis, Emphysema	17.1	15.64
Chronic Airway Obstruction	10.58	6.8

Source: US CDC Relative Risk Data, CPS–II (82-88) Unpublished estimates provided by American Cancer Society (ACS). See Thun, M. *et al*. Trends in tobacco smoking and mortality from cigarette use in Cancer Prevention Studies I (1959 through 1965) and II (1982 through 1988). In: *Changes in cigarette-related disease risks and their implication for prevention and control*. Smoking and Tobacco Control Monograph 8. Bethesda, MD: US Department of Health and Human Services, Public Health Service, National Institutes of Health, National Cancer Institute 1997; 305-382. NIH Publication no. 97-1213.

APPENDIX E
DATA LIMITATIONS

The methodology used to calculate smoking-attributable deaths has limitations. The attributable-fraction (AF) methodology calculates smoking-attributable deaths using smoking prevalence and number of deaths for the given year. However, most smoking-attributable deaths are the result of smoking in previous decades, during which smoking rates may have been higher or lower. During periods where smoking prevalence is declining, the AF methodology will tend to understate the number of deaths caused by smoking. Conversely, when smoking prevalence is increasing, the AF formula may overstate the number of deaths caused by smoking. Provinces such as Nova Scotia and Saskatchewan currently find themselves in the former state. Therefore calculations done by studies over the next several years will continue to underestimate the true smoking-attributable deaths.

Certainly, a limiting factor for most diagnoses related to smoking is the fact that age-specific measures of relative risks (RR) are unavailable. However, for most diagnoses, the RRs associated with smoking remain stable across age categories. That is to say, for most diagnoses, tobacco users have a relatively constant increased rate of death regardless of age. Thus, for such diagnoses, applying a single SAF estimate to all age categories is not problematic. However, where this is not the case, separate RRs have been calculated by the ACS. For example, the RRs for death from ischemic heart disease and cerebrovascular disease decline substantially after the age of 65. In this work, as well as most of the major studies on the economic costs of tobacco and smoking, separate SAMs are calculated for the two age groups (before and after age 65).

The data for this report are as recent and reliable as possible. While current from this perspective, this in fact presents a significant challenge in this field of study. Since data are constantly forthcoming and are being obtained from different sources over slightly different time intervals, a certain amount of homogeneity is missing. As researchers and policy makers move forward and attempt to track progress, certain data sets are kept and others are modified. New surveys are taken and older ones are shelved. This can present significant problems for the statistician.

For instance, The Centers for Disease Control and Prevention has issued an updated disease classification system which is denoted ICD-10. For the most part, the disease categories match very closely to the “old” classification of ICD-9. The relative risk categories are those of ICD-9 while mortality is categorized via the ICD-10. The latest edition of the *Economic Burden of Illness in Canada* (EBIC) data used for this study are also ICD-9. Although these disease codes do not match exactly, comparability ratios of diseases would suggest the two systems are very similar and for the purposes of this study are very adequate. Appendix C provides the comparability ratios as calculated by the National Center for Health Statistics of the Centers for Disease Control and Prevention. This work was completed in 1999 after the release of the ICD-10 nearly doubled the diagnostic categories and made comparisons over time very challenging.

APPENDIX F
SMOKING-ATTRIBUTABLE FRACTIONS, SASKATCHEWAN 2005

Diseases (Adults 35+)		
Disease Category	**SAF Female**	**SAF Male**
Malignant Neoplasm		
Lip, Oral Cavity, Pharynx	0.582	0.779
Oesophagus	0.685	0.748
Stomach	0.163	0.309
Pancreas	0.324	0.282
Larynx	0.810	0.852
Trachea, Lung, Bronchus	0.797	0.900
Cervix Uteri	0.156	n.a.
Kidney and Renal Pelvis	0.078	0.429
Urinary Bladder	0.371	0.512
Acute Myeloid Leukemia	0.140	0.265
Cardiovascular Diseases		
Ischemic Heart Disease		
Persons Aged 35-64	0.371	0.423
Persons Aged 65+	0.172	0.180
Other Heart Disease	0.139	0.226
Cerebrovascular Disease		
Persons Aged 35-64	0.443	0.369
Persons Aged 65+	0.110	0.149
Atherosclerosis	0.160	0.336
Aortic Aneurysm	0.639	0.689
Other Arterial Disease	0.237	0.214
Respiratory Diseases		
Pneumonia, Influenza	0.233	0.257
Bronchitis, Emphysema	0.863	0.913
Chronic Airway Obstruction	0.828	0.832