

The Costs of Substance Abuse in Canada 2002

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March 2006

ISBN 1-897321-10-4

Executive Summary

This study examined morbidity, mortality and economic costs attributable to the abuse of alcohol, illegal drugs and tobacco in Canada for the year 2002. Attributable fractions by age, gender and province for more than 80 causes of disease and death—partly or fully attributable to alcohol, illegal drugs or tobacco - were used to estimate the number of deaths, potential years of life lost, hospital days and diagnoses in acute care hospitals, psychiatric separations and hospital days in psychiatric hospitals, admissions in inpatient and outpatient centres, and days in treatment. .

Overall, it was estimated that there were 4,258 net deaths attributable to alcohol (8,103 deaths caused; 3,845 deaths prevented), 1,695 deaths attributable to illegal drugs, and 37,209 deaths attributable to tobacco in Canada in 2002. When combined, this represented 19.3% of the total mortality for that year. The number of days spent in acute care hospitals due to consumption of these substances represented 17.8% of the total days spent in these hospitals.

In 2002, 761,638 criminal offences were attributable to alcohol (corresponding to 30.4% of total of criminal offences in 2002 in Canada) and 554,131 (22.1%) criminal offences were attributable to illegal drugs. Furthermore, 206,594 criminal charges (35.8% of total of criminal charges in 2002) attributable to alcohol and 133,120 (23.1%) charges attributable to illegal drugs were brought before the courts in Canada in that year.

With regard to the economic costs due to morbidity, mortality and other problems associated with substance abuse, this study adopted a modified human capital approach, with sensitivity analyses being provided for two other approaches, which can be considered to result in lower

and upper bounds for social costs. Although this study contains more cost components than previous studies, data are lacking for some costs.

In the main scenario, it is estimated that cost of substance abuse totalled almost \$40 billion in Canada in 2002 or \$1,267 per capita. Alcohol accounted for approximately \$14.6 billion (36.6%), illegal drugs for approximately \$8.2 billion (20.7%), and tobacco for approximately \$17.0 billion (42.7%) of the total costs.

The highest contributor to total substance-attributable costs was the cost of productivity losses, which accounted for 61.0% (\$24.3 billion) of the overall costs. The second highest contributor to total substance-attributable costs was direct health care costs, accounting for 22.1% (\$8.8 billion). The third highest contributor in total substance-related costs was direct law enforcement costs at 13.6% (\$5.4 billion) of the overall costs.

The two sensitivity analyses resulted in \$54,797.3 billion as upper boundary and \$16,208.2 for the lower boundary.

Compared to the estimates of Single and colleagues for 1992, the social costs of substance abuse increased, but the exact level of increase is hard to quantify, as the overall figures are not comparable because different methodologies were used. However, the underlying epidemiological figures can be compared; when properly adjusted for general population trends, there has been an increase in morbidity and mortality attributable to illegal drugs and alcohol use, whereas the impact of tobacco use slightly decreased.

Estimates of the social costs of alcohol, illegal drugs and tobacco abuse were also calculated for each province. There was some variation with the per-capita costs of substance abuse

being highest in Nunavut and the other territories, and lowest in Quebec and Prince Edward Island.

There is a separate Highlights document entitled *The Costs of Substance Abuse in Canada 2002: Highlights* available in French and English from CCSA at www.ccsa.ca

Acknowledgments

This contribution is based on research within the framework of the Second Canadian Study on the Social Costs of Substance Abuse, which has received funding from various sources, under the umbrella of the Canadian Centre on Substance Abuse. The following institutions and representatives contributed to this study:

- Addictions Foundation of Manitoba - **John Borody**
- Alberta Alcohol and Drug Abuse Commission - **Ed Sawka**
- British Columbia Ministry of Health - **Perry Kendall**
- Canadian Centre on Substance Abuse - **Patricia Begin, Jacques LeCavalier**
- Canadian Institutes of Health Research, Institute of Neurosciences, Mental Health and Addiction - **Richard Brière**
- Centre for Addiction and Mental Health (Ontario) - **Louis Glikzman**
- Health Canada - **Louise Déry**
- Ministère de la Santé et des Services sociaux (Québec) - **Dominique Bouchard**
- New Brunswick Department of Health and Wellness - **Gordon Skead**
- Nova Scotia Health Promotion and Protection - **Carolyn Davison**
- Public Safety and Emergency Preparedness Canada - **Rachel Huggins**

The authors are grateful to these organizations for their generous support and contributions.

They also would like to thank David Collins, Helen Lapsley and Eric Single for thorough reviews of and helpful comments on an earlier version of this study. However, any errors or omissions in this report are the sole responsibility of the authors.

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CHAPTER I: INTRODUCTION

Background: current state of knowledge

The burden and cost of substance abuse¹ in all established market economies is enormous, with Canada being no exception. In the World Health Report 2002, the World Health Organization undertook comparable estimates of the impact of risk factors on burden of disease. The results showed that substance-attributable burden of disease was very high, with tobacco accounting for 12.2% of all disease burden in the year 2000 in established market economies (highest burden of all 26 risk factors examined), with alcohol accounting for 9.2% (third most important risk factor) and illegal drugs accounting for 1.8% (eighth) (Ezzati et al., 2002; WHO, 2002). For Canada, the last systematic estimate of the comparable burden of substance abuse was undertaken for the year 1992 and the results are summarized in Table 1 below.

Table 1: Morbidity and mortality due to alcohol, illegal drugs and tobacco, Canada 1992 (Single et al., 1996, 1999)

	Mortality N (% of total)	Years of life lost N (% of total)	Hospitalizations N (% of total)	Hospital days N (% of total)
Alcohol	6,701 (3%)	186,257 (6%)	86,076 (2%)	1,149,106 (3%)
Illegal drugs	732 (0.4%)	31,147 (1%)	7,095 (0.2%)	58,571 (0.1%)
Tobacco	33,498 (17%)	495,640 (16%)	208,095 (6%)	3,024,265 (7%)

The burden of disease is only one cost factor and, for some substances like illegal drugs, is not necessarily the factor associated with the highest cost. Other major cost factors are associated with law enforcement or property damage, among others. Unfortunately, the most recent cost

¹ Based on the economically orientated definition of Collins and Lapsley (1991), our study defines substance abuse as any substance use that involves a net social cost additional to the resource costs of the provision of that substance. Thus, the costs include the complete set of problems associated with the use of psychoactive substances, rather than just those costs associated with physical dependence or heavy use or with substance abuse in the psychiatric definition of DSM IV.

numbers, similar to the most recent comparable burden numbers for Canada, are outdated and of limited utility in health care and social planning, despite their importance to key stakeholders, policy makers, and the media. These numbers were presented in June 1996, when the Canadian Centre on Substance Abuse (CCSA), in partnership with a number of federal and provincial organizations, released the first-ever comprehensive estimate of the social and economic costs of substance abuse in Canada (Single et al., 1996). The study featured data collected for the year 1992 and presented cost estimates for alcohol, illegal drugs and tobacco, both nationally and by province.

The overall cost of substance abuse for 1992 was estimated at \$18.5 billion, which represented \$649 per capita, or about 2.7% of the Gross Domestic Product (GDP). Legal substances accounted for most of these costs. Alcohol accounted for \$7.5 billion in economic costs (\$265 per capita), with large portions of the total attributed to lost productivity due to morbidity and premature mortality (\$4.14 billion), law enforcement (\$1.36 billion), and direct health care costs (\$1.30 billion). Tobacco-related costs totalled more than \$9.6 billion (\$336 per capita), making it the highest contributor to overall substance-attributable costs. This number included \$6.7 billion due to lost productivity from premature mortality and \$2.7 billion in direct health care costs. Finally, the costs of illegal drugs were estimated to be \$1.4 billion (\$48 per capita). Lost productivity due to morbidity and premature death accounted for \$823 million and law enforcement accounted for another substantial portion (\$400 million) of the total economic costs for illegal drugs. There are no comprehensive data on social costs of substance abuse for Canada for the time after 1992.

To fill this gap, the current study was initiated in 2003. Again, CCSA spearheaded a partnership of various provincial and federal organizations to organize the Second Canadian Study on the Social Costs of Substance Abuse. The scientific implementation was appropriated to a

multidisciplinary working group of scholars from various institutions with Dr. J. Rehm from the Centre for Addiction and Mental Health acting as Principal Investigator. This study has been based on revised International Guidelines for Estimating the Costs of Substance Abuse (Single et al., 2001).

The following objectives were set for the current study:

- Computation of social costs of alcohol, illegal drug and tobacco² for Canada for 2002;
- Estimation of deaths and hospitalizations attributable to the use of alcohol, illegal drugs and tobacco in Canada in 2002 by sex and age;
- Estimation of crime and imprisonment attributable to the use of alcohol, illegal drugs and tobacco in Canada in 2002;
- Comparison of substance-attributable social costs for Canada between 1992 and 2002;
- Comparison of costs by substance categories;
- Comparison of substance-attributable costs by province.

In terms of the wider conceptual environment of the study, the notion of avoidable costs has gained more and more attention. Parallel to this study, an international working group has been developing guidelines for avoidable cost estimation (Collins et al., 2006). We hope that this study may serve as basis to pilot some of these new developments; however, estimation of avoidable costs is not part of the current study.

² This report uses the term “tobacco” for reason of consistency with other substance use categories. Note the measurement of actual tobacco consumption was limited to the smoking of cigarettes. For example, there were no measures of consumption of cigars, chewing tobacco or pipe tobacco.

CHAPTER II: METHODS FOR ESTIMATING DIRECT AND INDIRECT COSTS ATTRIBUTABLE TO SUBSTANCE USE

Determining the main approach of the study

This study of the social costs of substance abuse in Canada in 2002 was conducted within the framework of the revised International Guidelines for Estimating the Costs of Substance Abuse (Single et al., 2001) and can be characterized as a cost-of-illness study, in which the impact of psychoactive substance abuse on the material welfare of Canadian society is examined. We utilized a modified prevalence-based **human capital approach**, which is conceptually based on opportunity costs. Costs are resources spent on an activity that could have been spent otherwise, and thus are lost to other streams. For example, consider the costs of treatment for alcohol dependence incurred by Canadian society in 2002: if there had been no cases of alcohol dependence in Canada in 2002, the resources invested in this treatment could have been used for other interventions or services.

We included only **social costs** according to the definition of Single et al. (2001), i.e., the concept often labelled as external costs or externalities in mainstream economic textbooks. This excluded so-called private costs, i.e., costs incurred by people engaged in the activity of consuming psychoactive substances (e.g., costs to buy cigarettes or beer). Thus, in this report, the term “social costs” was used to denote those costs that are imposed on the rest of society by those using psychoactive substances.

The above example of treatment for alcohol dependence makes it clear that the current situation is compared to a **counterfactual scenario**. In the example, we used the scenario of no past or current use of alcohol up to, and including, 2002. Under these circumstances there would be no cases of alcohol-attributable diseases in Canada in 2002 and thus no need to establish

treatment for these diseases. The counterfactual just described also captures the general use of the counterfactual scenario assumptions underlying this study.

As substance use can also have **benefits** relevant to society (for instance the cardio-protective effect of regular moderate drinking without heavy drinking occasions), the choice of the above-described counterfactual scenarios implies that these have to be included in cost analysis, resulting in only net costs of substance use to be reported. Thus, in calculating hospitalization costs, those hospitalizations prevented by use of psychoactive substances were subtracted from the hospitalizations caused by such use, and only the costs of the net number of hospitalizations were reported.

Following the approach of Single et al. (1996), we included so-called discretionary costs as well, such as **research**, **prevention**, and **education** in the current study. This is partially against the recommendations of the guidelines (Single et al., 2001), but again, based on the counterfactual scenario, these costs would have never occurred.

Completely excluded from this study are the so-called **intangible costs**, i.e., the costs of pain and suffering as a consequence of substance use or abuse.

The International Guidelines for Estimating Costs of Substance Abuse (Single et al., 2001) often allow several methodological alternatives in calculations. However, as a general rule, where several different approaches were possible, we always selected the more conservative approach. Given the potential impact of cost studies, this principle is very important, as different stakeholders will scrutinize the results of cost studies and the credibility and final impact will depend on the conservativeness of assumptions. In addition we conducted sensitivity analyses

on the main assumptions with different options, which will allow the reader and policy maker to determine costs for alternative assumptions that they consider more likely.

Costs included in this study

Based on the above choices, the following costs have been included in this report:

1. Direct health care costs: total
 - 1.1 morbidity - acute care hospitalization
 - psychiatric hospitalization
 - 1.2 inpatient specialized treatment
 - 1.3 outpatient specialized treatment
 - 1.4 ambulatory care: physician fees
 - 1.5 family physician visit
 - 1.6 prescription drugs
2. Direct law enforcement costs
 - 2.1 police
 - 2.2 courts
 - 2.3 corrections (including probation)
3. Direct costs for prevention and research
 - 3.1 research
 - 3.2 prevention programs
 - 3.3 salaries and operating funds
4. Other direct costs
 - 4.1 fire damage
 - 4.2 traffic accident damage
 - 4.3 losses associated with the workplace

*4.3.1 EAP and health promotion programs**4.3.2 drug testing in the workplace*

4.4 administrative costs for transfer payments

*4.4.1 social welfare and other programs**4.4.2 workers' compensation*

5. Indirect costs: productivity losses (main scenario)

5.1 due to long-term disability

5.2 due to short-term disability (days in bed)

5.3 due to short-term disability (days with reduced activity)

5.4 due to premature mortality

Methods for estimating direct health care costs

In the following, the different elements for determining substance use attributable to direct health care costs are introduced

- The epidemiological calculations of attributable fractions, i.e., determining the diseases causally linked to substance use and determining the proportion of these diseases that can be attributed to the use of a certain substance.
- Sources of data for cost categories and incurred cost.

Epidemiological derivation of attributable fractions

Four steps are necessary to derive substance-attributable use fractions (AF):

- 1) Determine the disease categories attributable to substance use;
- 2) Determine the relationship of the extent of exposure to the risk factor (substance use at particular levels) to the risk of developing a particular condition at the individual level;
- 3) Determine exposure-risk relationships in the general population;

- 4) Combine information to determine substance-attributable fractions.

Determination of disease categories attributable to substance use

To determine the beneficial and detrimental health conditions causally attributable to substance use for inclusion in the national estimates, the usual epidemiological criteria were used with specific emphasis on the following (Hill, 1965; English et al., 1995; Rothman & Greenland, 1998):

- Consistency across several studies
- Established experimental biological evidence of mediating processes or at least physiological plausibility (biological mechanisms)
- Strength of the association (effect size)
- Temporality (i.e., cause before effect).

Appendices 1-3 give an overview of all the conditions that fulfilled the criteria.

Determination of exposure

To measure alcohol consumption, we followed English et al. (1995) and used four drinking categories based on average volume of alcohol consumed (see Rehm et al., 2006). The prevalence data of different levels of current alcohol consumption were collected between 2003 and 2004 through the Canadian Addiction Survey (CAS) (Canadian Centre on Substance Abuse, 2004). This survey was selected because it contains reliable alcohol consumption exposure data for a time period closest to the mortality data. Alcohol consumption has been relatively stable in Canada over the past years (WHO, 2004), thus a difference of two to three years between mortality and exposure data is negligible.

Smoking prevalence for different levels of tobacco consumption were obtained from the Canadian Community Health Survey (cycle 2.1) (CCHS, 2003). Categories included current,

former, and never smokers by gender and age group, with current smokers categorized as those who reported occasional smoking or daily smoking. Within the category of current smokers, prevalence of different levels of smoking was determined, with the number and definition of levels being based on the disease-specific meta-analyses and the categories used therein (see Baliunas et al., submitted). The prevalence of non-smokers living inside a home where someone smokes was also available from the CCHS dataset and was extracted to calculate 2002 passive smoking deaths.

Most of the disease conditions included under illegal drugs were 100% attributable fractions by definition, so no information about exposure is necessary. Where required, prevalence information on number of injection drug users (estimated as 83,800 in Canada 2003) was taken from Popova (2006), in order to calculate a drug-attributable fraction for low birth weight related to maternal drug use.

Determining attributable fractions

The substance-attributable fraction (AF) is defined as the fraction of the disease in the population that would not have occurred if the effect associated with the substance under consideration were absent (Walter, 1976; 1980). AFs were assessed specifically for each substance for different causes of illnesses by three methods (for details see Baliunas et al., submitted, forthcoming; Popova et al., submitted a, b; Rehm et al., 2006; Taylor et al., submitted):

- For disease conditions that would not exist without the existence of the substance, an AF of 100% was attributed (e.g., alcohol dependence; drug intoxication).
- Chronic disease substance-attributable fractions were calculated by combining exposure data and relative risk estimates from meta-analyses. All relative risks for calculation of

attributable fractions were based on high quality, cohort-based incidence studies found in our literature review.

- Injury substance-attributable fractions were calculated using direct estimates of substance involvement from various statistics, e.g., police statistics on alcohol involvement in traffic accidents.

AFs based on relative risk information: Relative risks (RR) for different alcohol-attributable disease conditions were obtained from several meta-analytic studies (see Appendix 1). Since most of the disease conditions under illegal drugs were either 100% by definition or estimated directly, only one RR had to be obtained: for low birth weight (English, 1995). Drug-attributable fractions (DAF) for acute and subacute endocarditis were taken from Single et al. (1996) (see Appendix 2). To identify the malignant and non-malignant health conditions caused by smoking, our analysis was guided by the Health Consequences of Smoking: A Report from the Surgeon General (U.S. Department of Health and Human Services. (2004). A comprehensive search strategy of current meta-analyses was performed using the Pubmed and OVID (1966 – January Week 3, 2005) databases. Search criteria were: *smoking or tobacco, meta-analysis*, and each disease category is described in this paper. Meta-analyses that included measures of smoking dose were preferred over those that only used current/former/never categories. However, if RRs for dose-responses were not available from the studies, we used the current/ former/ never or ever/ never category where available. Similarly, analyses that included age- and gender-stratified estimates of relative risk were preferred over more crude estimates.

In cases where a more current meta-analysis did not exist, the 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 (see Appendix 3).

The causal role of passive smoking for many diseases is still controversial. Thus, this analysis adopted a conservative approach and included only two diseases for which the evidence converges: lung cancer and ischaemic heart disease. Passive smoking-attributable morbidity was derived by applying age- and sex-specific relative risk and rates of morbidity from lung cancer and ischaemic heart disease (IHD) to the population of Canadians who have never smoked, but are exposed to environmental tobacco smoke (ETS) from spouses and other sources inside the home. Relative risk estimates were obtained from the most comprehensive meta-analyses applicable to Canada (for details see Baliunas et al., submitted).

The relative risk for each condition was combined with different levels of exposure for each sex and age group and an attributable fraction was obtained using the following formula (see Walter, 1976, 1980).

$$AF = \frac{[\sum_{i=1}^k P_i(RR_i - 1)]}{[\sum_{i=0}^k P_i(RR_i - 1) + 1]}$$

Where

i: exposure category with baseline exposure or no exposure i=0

RR(i): relative risk at exposure level i compared to no consumption

P(i): prevalence of the ith category of exposure

Direct estimates of AF: For a number of conditions, mainly injury conditions, direct AFs were used. Appendices 1-3 will give an overview of the sources of these direct estimates.

For AFs on alcohol morbidity and mortality, see Appendix 4 and 5; for illegal drugs, Appendix 6 and for tobacco, Appendix 7.

Further details can be obtained in Baliunas et al. (submitted, forthcoming); Popova et al. (submitted a, b); Rehm et al. (2006) and Taylor et al. (submitted).

Sources of data for cost categories and amount or services incurred

Number of acute care hospitalizations and hospital days

Hospital diagnoses and length-of-stay data in Canada for the year 2002 for acute care hospitals were obtained from the Canadian Institute for Health Information (CIHI) on a national level and provincial level according to the International Classification of Diseases, version 10 (ICD-10). For the national level, data were provided for each disease condition as well as for each sex and age group in five-year increments from 0 to 80+, whereas provincial data were provided on an aggregated basis, i.e., no sex or age breakdown. This was a result of insufficient cell data due to suppressed cells and low numbers of counts due to stratification of groups of ICD codes by age and sex. Estimating them would either inflate or deflate the real numbers.

The national-level data represented only seven provinces and two territories (Alberta, British Columbia, Newfoundland, Northwest Territories, Nova Scotia, Ontario, Prince Edward Island, Saskatchewan, Yukon). Based on these, data for all of Canada were estimated using the total population. On a provincial level, CIHI only provided aggregated data (no sex or age breakdown) for each disease condition for the same seven provinces and two territories. To calculate each sex and age group for each province or territory, we used the distribution of the Canadian population for corresponding sex and age and calculated from the aggregated data of each condition.

Data for Quebec, Manitoba, New Brunswick, and Nunavut were not available according to ICD-10 classification. Hence, aggregated data for each condition was calculated using total

population of that province and estimated data in Canada for that condition. Sex and age group calculations were similar in process to the calculations of the available provinces and territories.

So-called hospital days, i.e., the length of stay associated with a stay in an acute care hospital, were categorized according to the condition coded as Most Responsible Diagnosis (MRD) on the patient's hospital record. In other words, the MRD accounts for the majority of a patient's length of stay in hospital. MRD is the single diagnosis that describes the most significant condition of the patient that is responsible for his/her stay in hospital. In a case where multiple diagnoses may be classified as most responsible, coders are instructed to code the diagnosis responsible for the longest length of stay (CIHI, 2004a). As the hospital days based on the MRD may overlap in cases with more than one MRD, hospital days calculated this way had to be adjusted to the overall hospital days in Canada. This adjustment implied a province-specific application of a shrinkage factor, derived by dividing the number of hospital days in a province by the number of MRD hospital days in the same province.

Number of psychiatric hospitalizations and hospital days

Psychiatric admissions and hospital days data for the 10 provinces of Canada (there were no cases identified in the three territories of Canada) for the year 2002 were obtained from the Hospital Mental Health Database (MHMD) of CIHI according to the International Classification of Diseases, version 9 (ICD - 9).³

³ Please note that CIHI suppressed cells for disease categories with fewer than five cases for either diagnoses/hospitalizations or hospital days in order to protect confidentiality of the data in both acute care and psychiatric hospitals. However, a midpoint of 2.5 was imputed on those cells. For each category with no diagnosis/hospitalization, a 0 was reported.

Number of specialized inpatient and outpatient admissions and days of treatment

Either admissions or days in specialized treatment, including inpatient and outpatient treatment of alcohol and illegal drug dependency for 2002, were obtained from provincial ministerial officials or drug addiction program coordinators from Alberta, Manitoba, Quebec, New Brunswick, Nova Scotia, and two territories (Yukon and Northwest Territories). Only New Brunswick provided comprehensive data on both inpatient and outpatient admissions and days in treatment. Quebec and Manitoba provided total number of inpatient and outpatient admissions without age and sex breakdown. Alberta, Nova Scotia, Northwest Territories and Yukon provided average number of days for both inpatient and outpatient treatment. To estimate the total number of admissions by age and sex for provinces where no data were provided, we used the per-capita average of New Brunswick. To estimate the total number of admissions by age and sex for provinces where aggregated data were provided, we used the age and sex distribution of New Brunswick and apportioned it based on population.

To estimate the total number of days in specialized treatment by age and sex, where average number of days was provided, the average was multiplied by the number of admissions by age and sex. However, to estimate the total number of days by age and sex for those provinces where average data were not available, the average number of days in specialized treatment was calculated based on those provinces who provided such data, which was then applied to those provinces with their admissions by age and sex.

Number of ambulatory care service visits

Total numbers of hospital ambulatory care service visits by province/ territory for 2001-2002 were available from CIHI (2004b; 2004c). Ambulatory care services include emergency visits, day/night care visits, and specialty/ private clinics visits. To estimate substance-attributable

visits, the following assumptions were made: first we reduced the number of visits by 14.3% (one-seventh), which represents the estimate of the Romanow Commission of visits for small, self-treatable ailments among adults, not seen as related to substance abuse (available from NDMAC, <http://www.ndmac.ca/publicat/F-posit.html>). Then we adjusted for visits of children and adolescents under age 15. To the remaining visits, we applied the proportional fractions for alcohol, tobacco and illegal drugs from the acute hospital care system: 5.8% for alcohol, 1.6% for illegal drugs and 10.3% for tobacco.

Family physicians

Total number of full-time family physicians in Canada by province was obtained from the National Physician Database (CIHI, 2004c). Total numbers for three territories were missing; therefore, estimates were based on population.

Sources of cost data and cost calculations

Cost of substance-attributable acute care hospitalizations

Hospital expenditures for 2002 for each province and territory were available from CIHI (2004b). Daily average per-capita cost for acute care hospital separations for each available province and territory was obtained from the above report. For Nunavut, average per-capita cost was not available; therefore, average per-capita cost for Northwest Territories was substituted. To obtain the total costs for each province and territory, daily average per-capita cost was applied to the total number of substance-attributable acute care hospital days.

Cost of substance-attributable psychiatric hospitalization

To estimate costs for psychiatric hospitalizations, data on average cost-per-day in psychiatric hospitals were available for Canada for fiscal year 2001 (CIHI, 2004b). This average cost was

created using data from 19 psychiatric hospitals (short- or long-term) that provided data to the Canadian MIS database (CMDB). Provincial average per-day costs were estimated based on provincial average cost of acute care hospital. For Nunavut, the national estimate was substituted. These average costs were applied to substance-attributable psychiatric hospital days to obtain total psychiatric costs for each province and territory attributable to substance use.

Cost of substance-attributable specialized treatment

To estimate the cost of outpatient specialized treatment for substance abuse, the average cost for each general hospital outpatient service for 2002 was used. This cost was available from CIHI (2004d) for all provinces except Northwest Territories and Nunavut, for which the national estimate was substituted. For inpatient costs, we used the daily cost of treatment at acute care hospitals. The corresponding average cost for each province and territory was applied to both substance-attributable specialized inpatient and outpatient days to obtain the total costs.

Cost of substance-attributable ambulatory care

Ambulatory care costs consist of physician fees. Average national and provincial cost-per-visit to physician for 2002 was available from CIHI (2004d) except for Northwest Territories and Nunavut. National estimates were substituted for these territories. To estimate the total costs for ambulatory care by province, provincial average physician fees were applied to the substance-attributable total ambulatory care services for each province and territory.

Cost of substance-attributable family physician visits

To estimate the overall costs of family physicians, the average annual fee-for-service was calculated for each province from the National Physician Database (CIHI, 2004c) and multiplied

by the number of family physicians for corresponding provinces. Average annual fee-for-service data for three territories were not available, so the national average was substituted.

To estimate substance-attributable costs, the following assumptions were made: first, we reduced the estimated overall cost of visits to family physicians by 14.3% (one-seventh). Then we adjusted for costs of visits incurred by children and adolescents under age 15. To the remaining costs, we applied the proportional fractions for alcohol, tobacco, and illegal drugs from the acute hospital care system: 5.8% for alcohol, 1.6% for drugs and 10.3% for tobacco.

Cost of substance-attributable prescription drugs

Two kinds of costs were available to calculate cost for prescription drugs: national and provincial average per-capita cost of drug expenses (CIHI, 2004d) and total drug expenditures in public and private sector in Canada for 2001-2002 (CIHI, 2004e; 2004f). For this report, we used the cost for prescribed drugs only. Thus, costs for non-prescribed drugs, i.e., “Over the Counter Drugs” (OTC) and Personal Health Supplies (PX) are not part of this report.

To estimate the provincial drug expenditures, three calculations were carried out: (1) we divided the total expenditures for prescribed drugs by the national average of per-capita expense to derive a national total number of cases that had used prescribed drugs in Canada (provincial estimates were based on provincial population relative to national population), (2) AFs were applied to the above provincial totals to estimate the cases by substance, (3) the provincial average per-unit cost of drug prescriptions was applied to the total number of cases to obtain the total prescription costs per province for each substance.

Methods for estimating direct costs of the criminal justice system attributable to substance abuse

Overview of cost categories in the criminal justice system attributable to substance abuse

Costs of the criminal justice system attributable to substance abuse include:

- Attributable fractions of the costs of the crimes, law enforcement, criminal charges, and incarcerations attributable to use of alcohol and illegal drugs;
- direct costs for liquor licensing (operating expenses of provincial liquor licensing boards);
- costs for specialized drug enforcement.

Attributable fractions⁴ for policing costs refer to the costs due to the proportion of crimes attributable to alcohol and illegal drugs. AFs for court costs are similarly based on the proportion of charges attributable to alcohol and drugs. Please note that for court costs we used the same AFs used in crimes. For corrections costs, AFs are based on the proportion of correctional (i.e., jail or prison) sentences that can be attributed to alcohol and illegal drugs.

Determination of fractions of crimes attributable to substance abuse

Crimes/charges attributable to alcohol are impaired driving, underage drinking, illegal production or importation of substances and other violations of provincial liquor regulations, plus a fraction of violent crimes (e.g., homicide, assault, robbery, etc.) attributable to alcohol. Rehm et al. (2006) examined the available statistics and estimated the AF of traffic accidents attributable to alcohol intoxication to be 24.4% of all traffic accidents in Canada for the year 2002. The proportion of non-traffic crimes attributable to alcohol and illegal drugs was based on the estimates from the workgroup of Brochu and Pernanen (Brochu et al., 2005; Pernanen et al., 2002). The former study was conducted as part of the Canadian cost study and provided sex-

⁴ An AF in this context refers to the proportion in a specific crime category that is attributable to (caused by) substance abuse; i.e., this proportion of crimes would not have happened if there had been no substance use in society at that time.

specific AFs from provincial inmates examinations in Ontario for all non-drug crimes. Please note that the Brochu study represents upper limits to the AFs, as they are ultimately determined from self-reports of incarcerated persons who have a vested interest in blaming substance abuse for their crimes.

At the base of these estimates are interviews with prison inmates, which try to solicit answers about the role of different substances before and while committing the offence. Specifically, questions relate to aspects of the psycho-pharmacological model and economic-compulsive model described above. For national estimates of the AFs for males, we relied on the work of Pernanen and colleagues (2002). Female national AFs were estimated based on the male estimates plus the provincial ratio between male and female AFs. For the category of criminal offences that was attributable to both alcohol and illegal drugs, the figures were allocated proportionally to the AFs for single substances. All numbers were weighted by sample size of the interviews. This resulted in the following AFs: 27.1% of non-substance use-specific offences by males were attributable to alcohol, and 10.3% in the same category by females. For illegal drugs, the respective figures were 19.7% and 35.4%. To derive an overall AF for both sexes, the gender ratio from the statistics of people being charged with a crime was applied to the above AFs, thereby producing an AF of 25.4% for alcohol and 21.3% for illegal drugs.

To estimate AFs for provincial prison inmate populations, we again weighted the sex-specific AFs based on their sample size to come up with an overall fraction of crimes attributable to alcohol and illegal drugs for Ontario and Quebec. The respective proportions were: alcohol male: 25.4%, female: 9.7%; illegal drugs male: 21.1%; female: 37.9% (AF of combined sex for alcohol: 23.8%; for illegal drugs: 22.8%).

The AFs for violent crimes for alcohol and illegal drugs were provided by Pernanen and colleagues (2002, table 6.8). AFs were as follows: 28% for alcohol only, 5% for illegal drugs only and 16% for combined alcohol and illegal drugs. To separate the interaction effect of alcohol and illegal drugs (16%), we used a formula⁵ that resulted in an AF of 42% for alcohol and 7% for illegal drugs.

AFs for liquor licensing and specialized drug enforcement are 100% by definition, as these costs would not have been incurred if there had not been any alcohol or illegal drugs in Canadian society in 2002. Data on costs for provincial adult sentences due to alcohol and illegal drugs were available (Canadian Centre for Justice Statistics, 2002a) for all provinces except New Brunswick; therefore, the national cost estimate for provincial adult corrections does not include New Brunswick.

Sources of data to estimate costs in law enforcement attributable to substance abuse

Crimes and charges data were obtained from the Canadian Centre for Justice Statistics (2002a, d). Sentencing data for provincial custody and federal custody were obtained from Adult Correction Services in Canada (Canadian Centre for Justice Statistics, 2002a). Sentencing data for youth offences were taken from the Canadian Centre for Justice Statistics (2002b); however, only those sentenced to secured custodies were counted. Other than Ontario and Quebec, data for youth offenders were provided in regions (Atlantic, Prairies, and Pacific), hence population data were used for estimates according to the provinces.

Costs for liquor licensing were not available for 2002, so our estimates are based on the Single et al. (1996) estimates for 1992 and inflation-corrected for 2002. Cost data for specialized drug

⁵ AF for Alcohol = $0.28 + \{0.28/(0.28+0.05)*.16\} = 0.42$

enforcement were obtained from the Treasury Board of Canada Secretariat (Royal Canadian Mounted Police [RCMP]).

National cost estimates for federal adult corrections were obtained from the Canadian Centre for Justice Statistics (2002a). National cost estimates for young offender corrections were obtained from the Canadian Centre for Justice Statistics (2002c) for the 1998/1999 fiscal year and was inflation-corrected for the 2002/2003 fiscal year. Estimates for provincial jurisdictions for the above-specified two cost categories were based on per-capita national averages. Provincial adult corrections costs were available from the Canadian Centre for Justice Statistics (2002c) for 2002.

Methods for estimating the direct costs of prevention, research and other substance-attributable matters

Costs of prevention and research

There are no systematic sources for direct costs of prevention and research. Thus, we tried to identify and ask as many different federal and provincial agencies as possible. While the largest agencies could be covered with this procedure (e.g., Health Canada or the Canadian Institutes for Health Research), we are sure that several agencies have been missed.

Canadian Institutes of Health Research provided expenditures on all awards and grants related to prevention and research on alcohol, cannabis, other illegal drugs and tobacco in Canada 2002 (personal communication with Dr. Richard Brière, December, 2005).

The second source for tobacco estimates on prevention and research expenditures was Health Canada, (personal communication with Director of the Federal Tobacco Control Programme Dawn Hachey, December 2005).

In addition, several estimates for prevention and research from the following agencies were obtained (substances relevant for the agency under consideration are in brackets):

- Canadian Cancer Society (alcohol and tobacco)
- National Native Alcohol and Drug Abuse Program (alcohol and illegal drugs)
- Canadian Council for Tobacco Control (tobacco)
- Canadian Lung Association (tobacco)
- Traffic Injury Research Foundation (alcohol)
- Ontario Addiction Research Foundation (alcohol and illegal drugs)
- Alberta Alcohol and Drug Abuse Commission (alcohol and illegal drugs)
- Addictions Foundation of Manitoba (alcohol and illegal drugs).

Fire damage

Fire damage to property totalled almost \$1.19 billion in 2000 (Council of Canadian Fire Marshals and Fire Commissioners, 2003). The proportion of all property damage from fire that can be attributed to alcohol was estimated to be the same as the proportion of non-fatal other unintentional injuries attributable to alcohol (13.2%) (Rehm et al., 2004). The proportion of fires that can be attributed to smoking materials (i.e., pipe, cigar, ashtray, match) was estimated to be 7.3% (Council of Canadian Fire Marshals and Fire Commissioners, 2003). These AFs were applied to the total fire damage in order to obtain costs for alcohol- and tobacco-attributable fire damage.

Traffic accident damage

The Road Safety and Motor Vehicle Regulations Directorate (2003) reports property damage claims arising from traffic accidents in Canada in 2000. The total amount of property damage claims in 2000 was estimated at \$3,942 million. The attributable fraction for alcohol is estimated to be 19.2% and the attributable fraction for illegal drugs is estimated to be 1.7% (Rehm et al., 2006).

Losses associated with the workplace

The category of direct losses due to substance abuse in the workplace included the costs for a portion of Employee Assistance Programs (EAPs), the cost of drug testing in the workplace, and the cost of absenteeism and poor productivity attributable to substance abuse. Unfortunately, it was not possible to obtain newer estimates for the above costs. Therefore, the data were taken from the previous cost study by Single and colleagues (1996) and were inflation-corrected for the year 2002.

Administrative costs for transfer payments

Direct administrative costs for transfer payments include administrative costs for social welfare and other programs, and administrative costs for workers' compensation. A newer estimate for alcohol-attributable social welfare and other programs was not available. Therefore, these data were taken from the Single et al. (1996) cost study and inflation-corrected for the year 2002.

The estimate for workers' compensation was calculated using the methodology from Single et al., 1996. Information from the annual report of the Workers' Compensation Boards indicated that almost \$1,255 million was spent on administration of compensation benefits. In this study, the proportion of administrative costs for workers' compensation attributable to alcohol was estimated from the AF for occupational and machine accidents (Single et al., 1996), which was 4.9%. In the same manner, the portion attributable to illegal drugs was estimated at 0.434%⁶.

⁶ This was calculated by multiplying the ratio of the illegal drug-related non-fatal motor-vehicle accident AF to the AF for alcohol-related non-fatal motor-vehicle accidents (0.017/0.192) by the portion of occupational and machine accidents attributable to alcohol (0.049).

Methods for estimating indirect costs: lost or reduced productivity

In assessing the cost of illness, an important but controversial component of the costs is the value of production that is lost due to premature mortality, long- or short-term disability, and reduced productivity while at work. Most COI studies over the past 35 years have valued lost production using the human capital (HC) approach (Hodgson, 1983). In the HC framework, the cost of premature mortality (or long-term disability) due to a disease is the discounted present value of the projected stream of production for that person—that is, the stream of production that would have occurred if they had not died prematurely.

The rationale for the HC approach involves several assumptions that are unrealistic in contemporary Canadian labour markets. The approach assumes that there is full employment in labour markets, so that production lost by premature death is a permanent societal loss because persons leaving the labour market are not replaced. However, involuntary unemployment has been a persistent feature of the Canadian labour market over several years (Fortin, Keil, & Symons, 2001; Amano & Macklem, 1998). Whether caused by sticky wages or imperfect macroeconomic policy, the result may be that the prevailing wage is higher than the level that would equate the quantity of labour demanded to the quantity supplied.

As an alternative to the full employment assumptions of the HC model, Koopmanschap proposed that the value of lost productivity due to premature death should be limited to the cost of replacing an absent worker—the so-called “friction cost” approach (Koopmanschap, Rutten, van Ineveld, & van Roijen, 1995). For practical calculations, Koopmanschap suggested that the replacement period for worker had a mean of three months (Koopmanschap & Rutten, 1996). The friction cost approach may be more realistic when the labour market is not at full employment, but it does assume that the societal opportunity cost of labour is zero—that is, the sacrifice of replacement workers’ leisure for work has no monetary value. However, lost leisure

is a cost that should be considered, if one adopts the societal perspective that encompasses all costs and benefits that matter to citizens. In this case, the value of lost work beyond the friction period is obviously not zero, but is equal to or greater than the (marginal) reservation wage unemployed workers would require to sacrifice leisure for work. Although determining the value of the marginal reservation wage for unemployed persons empirically is difficult (Shaw, 1992), its lower bound would be the marginal value of leisure. Empirical estimation of the marginal value of leisure is complicated (Alvarez-Farizo, Hanley, & Barberan, 2001), and would require primary data collection that is beyond the scope of the current research. For this reason, we estimated the marginal reservation wage using a replacement wage approach, assigning values to household jobs that replacement workers perform based on Statistics Canada estimates of the value of housekeeping services (Statistics Canada, 1995), and weighted over all household activities using time weights. The time weights were based on Statistics Canada General Social Survey 1998 Cycle 2 data. We then aggregated the marginal reservation wages for all of the replacement workers across their expected productive lives, discounted them to present value using a 5% discount rate, and inflated them by 3% to reflect the projected productivity growth over time.

Productivity costs due to premature mortality

Once the numbers of lost years of life were determined (by gender and age group), we calculated the productivity costs using the modified human capital approach described above. The cost of premature mortality due to mental disorders was calculated as the sum of the friction costs of replacing the deceased worker, plus the discounted present value of the projected future stream of the marginal reservation wage (for the worker who fills the vacant position), adjusted for sex and age-group labour force participation rates. The algebraic form of this cost equation is given in the Appendix 8. To facilitate comparisons of the current study with past COI studies and international guidelines, we performed sensitivity analyses in which we also calculated productivity costs using the traditional HC and friction cost methods.

Productivity costs due to morbidity

Reduced productivity due to substance abuse or dependence could result from long-term disability, from increased rates of absenteeism (including short-term disability spells), or from reduced productivity for workers while on the job. To estimate the productivity costs for those Canadians on long-term disability due to substance abuse or dependence, we first estimated the number of Canadians permanently disabled from working due to alcohol or illicit drug use/dependence using data from Canadian Community Health Survey, Cycle 1.2 (CCHS c1.2). We then used these estimates in conjunction with the age distribution of those permanently disabled to estimate the number of years of lost productive life. From these figures we then calculated productivity losses using the modified Human Capital method described above for premature mortality.

To estimate the productivity losses due to short-term disability, absenteeism, and reduced productivity at work, we ultimately adopted methods similar to those used in some past research. Past COI studies have assumed that these reductions in productivity are reflected by a decline in the wage rates paid to ill workers in the labour market. Based on this assumption, both Rice et al. (Rice et al., 1991) and Goeree et al. (Goeree et al., 1999) used multiple regression analysis (using personal income as the dependent variable) to assess the effect of various mental illnesses on wages. Single (Single et al., 1998) used differences in the annual mean earned income between substance abusers and the general population reported in survey data to calculate the value of productivity losses. These approaches assume that worker productivity is readily observable to the employer, that wages adjust rapidly to reflect changes in productivity, and that the ill employee bears most of the costs of reduced productivity due to illness. Even if these assumptions are reasonable, there are potential weaknesses in the empirical implementation adopted by COI studies. The economics research literature that has

examined the relationship between income and alcohol, illegal drugs, or mental disorders has uniformly acknowledged the potential for biased estimates with multivariate regression methods because of simultaneity and omitted variable biases. Potential simultaneity bias arises because empirical evidence (Blake & Nied, 1997) and theoretical considerations (Becker & Murphy, 1988) suggest reverse causation, i.e., earnings levels affect alcohol consumption, illegal drug use, and mental disorders. Omitted variable bias arises from the fact that predictors of substance use and mental disorders such as personality characteristics (Finn, Sharkansky, Brandt, & Turcotte, 2000), which may have direct importance to labour market outcomes, are generally unavailable in survey datasets. Most of the studies cited above have used selection models to control for unobserved differences between ill and comparison cohorts. However, these studies lacked plausible exclusion restrictions, and they achieved identification primarily through distributional assumptions, a procedure known to yield non-robust estimates. (Puhani, 2000). While we intended to employ Instrumental Variables estimation (Angrist, Imbens, & Rubin, 1996; Greenland, 2000) to address some of these potential limitations, our econometric specification tests revealed that multiple linear regression models for income were an adequate specification, and that IV estimation was unnecessary. Accordingly, to estimate the value of productivity losses for employed persons who remained at work attributable to substance abuse and dependence, we conducted a multivariate linear regression analysis of the personal income data recorded in the CCHS c1.2 for respondents aged 15 to 74 years who participated in the labour force in 2002. The CCHS c1.2 survey asked respondents to report personal income from all sources, and to name all separate sources of income, but it did not record the amount of income from each source. Other socio-demographic and human capital variables included in the income equations were age, marital status, race, geographical residence, categorical variables for education, birth outside of Canada, and dummy variables for several chronic medical conditions. Once the regression models were fit, we took the difference between the predicted mean income of the survey respondents with and without alcohol abuse/dependence,

and with and without illegal drug abuse, controlling for other co-occurring mental disorders, as the final estimate of the productivity losses due to morbidity. All analyses were performed on the CCHS c1.2 microdata at the Toronto Regional Data Centre (RDC) of Statistics Canada.

Methods for allocating costs to provinces

Direct substance-attributable costs were estimated provincially for health care as well as law enforcement. Policy costs (i.e., costs of prevention and research) and other direct costs (such as fire damage, traffic accident damage, losses associated with workplace and administrative costs for transfer payments) associated with substances were estimated nationally, and estimates of provincial costs were based on the per-capita national average. To calculate the substance-attributable costs of productivity losses due to disability, we applied the substance-specific provincial proportions of direct health care costs to the national estimate. Similarly, to allocate the substance-attributable costs of productivity losses due to premature mortality provincially, we applied the substance-specific proportions of provincial mortality to the national cost of productivity losses and calculated the cost to each province accordingly.

CHAPTER III: EPIDEMIOLOGICAL RESULTS

Morbidity due to alcohol

Alcohol-attributable acute care hospital diagnoses and hospital days

Overall in Canada in 2002, there were 195,970 net hospital diagnoses attributable to alcohol, which accounted for 1,246,945 net hospital days in acute care hospitals. Tables 2 and 3 provide the estimates of alcohol-attributable net diagnoses and net hospital days, respectively. Overall, in Canada, 195,970 alcohol-attributable diagnoses among hospital diagnoses from acute care facilities were estimated, accounting for 128,702 hospital diagnoses among males and 67,267 among females.⁷

The 195,970 diagnoses are a net figure, i.e., including estimates of hospital diagnoses prevented by alcohol (61,059). Most of the estimated hospital diagnoses prevented by alcohol were from Ischaemic Heart Disease (IHD) (40,150 hospital diagnoses).

Among acute care hospital diagnoses attributable to alcohol, the three biggest contributors were neuro-psychiatric conditions (36.9%), cardiovascular disease (27.5%), and unintentional injuries (26.5%). With respect to single disease categories within the larger categories, mouth and oropharyngeal cancer (1,591 hospital diagnoses, males: 1,182, females: 409), alcohol dependence syndrome (25,867 hospital diagnoses, males: 18,290, females: 7,577), hypertensive disease (52,167 hospital diagnoses, males: 37,487; females: 14,680), liver cirrhosis (12,126 hospital diagnoses, males: 8,619; females: 3,507), and other unintentional injuries (40,077 hospital diagnoses, males: 23,236; females: 16,841) constituted the largest

⁷ Please note that these numbers were derived by multiplying substance-attributable fractions by hospitalization data for each category, thereby producing numbers with decimals. As a result, there may be rounding errors after collapsing numbers over different categories.

alcohol-attributable categories (Table D-HC-A 1). For provincial estimates of alcohol-attributable acute care hospitalizations see Tables D-HC-A-2 to D-HC-A-14.

Table 3 shows the number of hospital days due to alcohol in acute care facilities in Canada in 2002. Overall, there were 1,246,945 net hospital days due to alcohol (819,065 males; 427,880 females). This constitutes 5.8% of total hospital days in acute care hospitals in Canada 2002. A total of 340,109 hospital days were prevented due to alcohol, with ischaemic heart disease contributing the greatest savings at 205,206 days prevented. The major contributors to hospital days used were identical to those of hospital diagnoses, with the three biggest contributors being neuro-psychiatric disorders (32.4%), cardiovascular diseases (30.1%), and unintentional injuries (28.3%). Individual conditions also showed similar trends to the hospital diagnoses data in terms of dominant contributors: mouth and oropharyngeal cancer (9,704, males: 7,420, females: 2,284), alcohol dependence syndrome (147,027, males: 104,144, females: 42,882), hypertensive disease (302,405, males: 209,406, females: 92,998), liver cirrhosis (84,822, males: 58,477, females: 26,344), other unintentional injuries (288,803, males: 163,488, females: 125,316). For detailed national and provincial estimates of acute care hospital days see Tables D-HC-A-15 to D-HC-A-28.

Alcohol-attributable psychiatric hospitalizations and hospital days

There were 2,058 psychiatric hospitalizations (see Table 4) in 2002 in Canada, which included only alcohol-specific diseases (AAF = 100%) plus an attributable proportion of depression cases. This accounted for 8.1% of all psychiatric hospitalizations in Canada 2002. Overall, males were found to have been admitted between two and six times as often as females for these conditions. Alcohol dependence was the largest contributor in psychiatric admissions, with almost five times as many hospitalizations (1,543, males: 1,046, females: 497) as the next condition (alcohol abuse). Males were responsible for the vast majority of psychiatric

hospitalizations, with over twice as many as females. The highest number of psychiatric hospitalizations was found in males with alcohol dependence syndrome between the ages of 30 and 44, which was the same for females.

Looking at the length-of-stay data, substance-attributable psychiatric hospitalizations accounted for 54,114 days in hospital, which was 1.5% of all psychiatric hospital days in Canada in 2002 (Table 5). Males accounted for approximately 71% of these days. Males and females aged 30–44 constituted the most days in psychiatric hospitals at 12,848 and 5,575, respectively, but these numbers were very similar to those seen in males and females 45–59 as well (12,784 and 4,887, respectively). For both genders, unipolar major depression contributed the fewest substance-attributable hospitalizations and the least number of alcohol-attributable hospital days. For detailed national and provincial estimates of alcohol-attributable psychiatric hospitalizations and hospital days see Tables D-HC-A-29 to D-HC-A-39.

Alcohol-attributable specialized inpatient and outpatient admissions and days of treatment

Specialized treatment centres are also treating a significant portion of alcohol-related diseases (See Table 6). Overall in Canada, it was estimated that there were 183,589 admissions to both inpatient (54%) and outpatient (46%) specialized treatment centres in 2002, the majority of which were among males (74%). This accounted for 3,018,688 hospital days. What is most striking about these data is that, although there were more total inpatient admissions than outpatient admissions, outpatient admissions accounted for almost four times as many hospital days.

Among inpatient admissions, males aged 30–44 accounted for the most admissions at 40% (32,291), but males 40–59 were close behind at 35%. These two age groups together accounted

for three-quarters of all male inpatient admissions and approximately 60% of total inpatient admissions. Among females, those 30–44 also accounted for the most admissions with 8,197 (44% of all females, 8.3% of total) (see Table D-HC-A-40 for Canada and provinces).

With respect to inpatient length of stay, it was estimated that there were 641,168 total alcohol-attributable inpatient hospital days for specialized treatment in Canada in 2002. The same trends are seen with the admissions data, with males accounting for the majority of the hospital days (85%), and middle-aged males 30–59 responsible for the majority of these (45% of total) (see Table D-HC-A-41 for Canada and provinces).

Among outpatients, there were 84,951 alcohol-attributable admissions in Canada in 2002. Males were responsible for the majority of outpatient admissions (66%), especially those aged 30–59, who were responsible for almost 70% of these. Males 30–44 were responsible for the most outpatient admissions (21,907, 26% of total, 39% of all males), but females 15–29 and 30–44 were responsible for a significant number as well (10,499 and 10,234, respectively) (see Table D-HC-A-42 for Canada and provinces).

In 2002, there were 2,377,520 alcohol-attributable outpatient hospital days overall, 66% of which were among males. Men aged 30–59 (collapsed age groups) accounted for the majority of these hospital days (69%) and females aged 15–44 were responsible for the majority among women at 72% (see Table D-HC-A-43 for Canada and provinces).

Mortality due to alcohol

Alcohol-attributable number of deaths

Table 7 provides the estimates of alcohol-attributable net deaths. Overall, in Canada for the year 2002, 4,258 alcohol-attributable net deaths were estimated, accounting for 3,494 deaths

among males and 764 among females. Net deaths of 4,258 constituted 1.9% of all deaths in Canada 2002; males accounted for 3.1% and females accounted for 0.7%.

A total of 8,103 alcohol-attributable deaths were estimated, accounting for 5,744 among males and 2,359 deaths among females. Deaths prevented by alcohol were estimated to be 3,845 accounting for 2,250 among males and 1,595 among females in Canada 2002 (see Table I-A-1).

Among deaths caused by alcohol, cirrhosis of the liver (1,246 deaths, males: 882; females: 364), motor vehicle accidents (909 deaths, males: 746; females: 163), suicides/self-inflicted injuries (603 deaths, males: 493; females: 109), oesophageal cancer (501 deaths, males: 407; females: 95), and cardiac arrhythmias (449 deaths, males: 243; females: 205) constituted the largest alcohol-attributable categories. Most of the estimated deaths prevented by alcohol were from IHD (2,951 deaths) and almost 80% of these prevented deaths occurred after age 70.

With respect to age, the overall average age for alcohol-attributable death was 46.4 years for males and 56.6 years for females. There were notable differences in average age among disease categories. For example, for depression, the average age for alcohol-attributable death was 78.6 years for males and 82.8 years for females. Conversely, deaths due to homicide occurred at the age of about 35.7 years for males and 37 years for females. For detailed provincial estimates of alcohol-attributable mortality see Tables I-A-2 - I-A-14.

Alcohol-attributable years of life lost

In 2002, 147,571 net life-years were lost in Canada due to alcohol, accounting for 113,380 years among males and 34,191 years among females (Table 8). This represents 4.8% of all

PYLLs in Canada 2002 (males 7.0%; females 2.3%). For detailed national and provincial estimates of alcohol-attributable PYLLs, see Table E-P-1.

Morbidity due to illegal drugs

Illegal drug-attributable acute care hospitalizations and hospital days

Table 2 provides estimates of the number of hospital diagnoses due to drug-attributable illnesses in Canada 2002. Overall, for the year 2002, 61,026 drug-attributable diagnoses at acute care hospitals were estimated, accounting for 32,547 for males and 28,479 for females. Hospital diagnoses attributable to use of illegal drugs were dominated by mental and behavioural disorders due to psychoactive substance use. There were 22,291 diagnoses for males and 16,180 for females, totalling 38,470. This constituted about 63% of all illegal drug-attributable diagnoses in acute care hospitals. With respect to single disease conditions within mental and behavioural disorders due to psychoactive substance use, multiple drug use and use of other psychoactive substances was the largest specific cause of hospital diagnoses (11,125 hospital diagnoses, 6,238 males, 4,888 females), followed by cocaine (9,152 hospital diagnoses, 5,344 males, 3,808 females), cannabinoids (9,127 hospital diagnoses, 6,015 males; 3,112 females), and opioids (6,700 hospital diagnoses, 3,270 males; 3,429 females). The second major contributor was opiate (including cannabis) and cocaine poisoning (non-fatal overdoses) (17.7%; 10,810 hospital diagnoses, 4,815 males, 5,996 females). The third and fourth largest drug-attributable category of hospital diagnoses attributable to illegal drug use were hepatitis C (HCV) (7.6%; 4,682 hospital diagnoses, 2,819 males, 1,863 females), followed by non-fatal suicide (6.7%; 4,101 hospital diagnoses, 598 males, 3,503 females).

Overall, illegal drug use affected males and females in terms of morbidity almost equally.

Females had a higher number of hospital diagnoses of illegal drug-attributable suicide and opiate and cocaine poisoning than males. The average age for illegal drug-attributable hospital

diagnosis was 38.3 years for males and 39.8 years for females, but the majority of diagnoses (40,463) occurred at ages 15 to 44, accounting for 66% of total hospital diagnoses attributable to use of illegal drugs. For detailed national and provincial estimates on illegal drug-attributable acute care hospitalizations, see Tables D-HC-D-1 to D-HC-D-14.

Table 3 shows the number of hospital days spent in acute care hospitals due to morbidity attributable to illegal drugs in Canada in 2002. Overall, there were 352,121 hospital days due to illegal drug use (189,657 males, 162,465 females). This constitutes 1.6% of total hospital days in acute care hospitals in Canada 2002.

The major contributors to hospital days used were identical to those of hospital admissions, with the four biggest contributors being: (1) mental and behavioural disorders due to psychoactive substance use, (2) opiate (including cannabis) and cocaine poisoning (non-fatal overdoses), (3) viral hepatitis C, and (4) non-fatal suicide. Individual conditions also showed similar trends to the hospital diagnoses data in terms of dominant contributors: multiple drug use and use of other psychoactive substances was the largest specific cause of hospital days (65,120 hospital days, 34,657 males, 30,463 females), followed by cannabinoids (56,189 hospital days, 39,301 males, 16,888 females), cocaine (43,561 hospital days, 26,301 males, 17,260 females), and opioids (41,694 hospital days, 19,562 males, 22,132 females).

Overall, males stayed longer in hospital than females due to illegal drug morbidity with the same exceptions as for hospital diagnoses: non-fatal suicide and overdoses. For detailed national and provincial estimates of illegal drug-attributable hospital days see Tables D-HC-D-15 to D-HC-D-28.

Illegal drug-attributable psychiatric hospitalizations and hospital days

There were 1,517 illegal drug-attributable psychiatric hospitalizations in Canada in 2002 (male: 1,022; female: 495), which was almost 6% of all hospital separations in Canada 2002 (Table 4). This indicates that twice as many males as females were hospitalized in psychiatric hospitals due to illegal drugs.

Drug psychoses were the largest contributor to psychiatric hospital admissions (352 hospitalizations, 255 males, 97 females), followed by opioid abuse (332 hospitalizations, 199 males, 133 females) and cocaine abuse (329 hospitalizations, 234 males, 95 females).

Overall, illegal drug use affected more males (67.4%) than females in terms of psychiatric morbidity. The highest number of psychiatric hospitalizations (1,237) was found between the ages of 15 and 44, accounting for 81.5% of all illegal drug-attributable psychiatric hospitalizations.

There were 31,508 psychiatric hospital days attributable to illegal drug use, which constituted 0.9% of all psychiatric hospital days in Canada in 2002 (Table 5). The major contributors to hospital days in psychiatric hospital were identical to hospitalizations: drug psychoses (7,995 days, 6,056 males, 1,939 females), opioid abuse (6,896 days, 3,958 males, 2,938 females), and cocaine abuse (6,652 days, 4,882 males, 1,770 females). Males were responsible for the vast majority of illegal drug-attributable hospital days, i.e., 21,881 compared to females at 9,627. For detailed national and provincial estimates of psychiatric hospitalizations and psychiatric hospital days attributable to illegal drugs, see Tables D-HC-D-29 to D-HC-D-39.

Illegal drug-attributable specialized inpatient and outpatient admissions and days of treatment

Overview Table 6 provides estimates of the number of admissions and days in specialized inpatient and outpatient treatment of illegal drug dependency in Canada in 2002, of which there were 47,073 inpatient admissions and 92,700 outpatient admissions. Males had more than twice as many inpatient admissions as females (males: 32,989, females: 14,085). The highest number of admissions for both genders (42,234) for the inpatient group was for the ages 15–44, accounting for 89.7% of all inpatients.

Of the 92,700 outpatient admissions for specialized treatment of illegal drug dependency in Canada, 58,239 were males and 34,461 were females. The highest number of admissions (66,530) for the outpatient group for both genders was for those between the ages of 15 and 29, accounting for 72.0% of all outpatients.

For both the inpatient and outpatient groups, males were responsible for the majority of treatment days. Total treatment days for the inpatient section was 299,694 days (210,783 males, 88,911 females). Total treatment days for the outpatient section accounted for 2,552,135 days, with 1,621,727 males and 930,408 females. For detailed national and provincial estimates of specialized treatment and days in treatment attributable to illegal drug use, see Tables D-HC-D-40 to D-HC-D-43.

Mortality due to illegal drugs

Illegal drug-attributable number of deaths

Table 7 shows the estimates of illegal drug-attributable deaths. Overall, in Canada for the year 2002, 1,695 illegal drug-attributable deaths were estimated, accounting for 1,183 deaths among males and 512 among females. Please note that some of these numbers were derived by multiplying DAFs by the number of deaths for each sex and age groups, thereby producing numbers with decimals. As a result, there may be rounding errors after collapsing numbers over different categories.

The 1,695 illegal drug-attributable deaths constituted 0.8% of all Canadian deaths. Among deaths caused by illegal drugs, the biggest contributor was drug overdose deaths. There were 733 overdoses for males and 225 for females, totalling about 958 deaths. This constituted 56.5% of all illegal drug deaths in Canada. The second major contributor was drug-attributable suicide (17.4%; 295 deaths, males: 146; females 149). The third largest drug-attributable category of death was hepatitis C infection (9.7%; 165 deaths, males: 102; females: 62), followed by HIV infection (5.1%; 87 deaths, males: 74; females: 13).

Overall, illegal drug use affected mortality among males more than among females: in males 1.0% of the deaths were drug-attributable, whereas in females, 0.5% of the deaths were due to illegal drugs (in the age group under 70, 2.4% of the deaths for the same age groups: 2.8% in males; 1.8% in females).

With respect to age, the overall average age for illegal drug-attributable death was 42.1 years for males and 44.2 years for females. There were notable differences in average age among disease categories. For example, for hepatitis C, the average age for illegal drug-attributable

death was 58.4 years for males and 64.3 years for females. Conversely, deaths due to overdoses occurred at the age of about 37 years for both males and females. For detailed national and provincial estimates of illegal drug-attributable mortality see Tables I-D-1 to I-D-14.

Illegal drug-attributable years of life lost

In 2002, Canadian residents lost an estimated 62,110 years of life as a result of premature mortality due to consumption of illegal drugs (42,306 years of life lost among males and 19,805 years lost among females) (Table 8). This represents 2.0% of all PYLLs in Canada 2002 (males: 2.6%; females: 1.3%).

The PYLL rate for deaths due to illegal drug use was 288 per 100,000 males and 135 per 100,000 females aged 0 to 80+. That is, for every 100,000 population, there was a potential loss of 288 years of life among males and 129 years of life among females as a result of premature death due to illegal drug use. The PYLL rate for males was more than twice as great as that for females. For detailed national and provincial estimates of illegal drug-attributable PYLLs, see Table E-P-2.

Morbidity due to tobacco

Tobacco-attributable acute care hospital diagnoses and hospital days

Table 2 provides estimates of tobacco-attributable hospital diagnoses. Overall, in Canada for 2002, 339,179 tobacco-attributable hospital diagnoses from acute care facilities were estimated, accounting for 218,791 hospital diagnoses among males and 120,388 among females. Among hospital diagnoses caused by tobacco, the three biggest contributors were cardiovascular disease, malignant neoplasms and respiratory disease. The single disease category of ischaemic heart disease accounted for 30.3% of the tobacco-attributable hospital diagnoses

(102,704 diagnoses; males: 75,814; females: 26,890). The next largest single categories were cardiac arrhythmias (29,623 hospital diagnoses, males: 19,222, females: 10,401), and lung cancer (28,929 hospital diagnoses, males: 18,488, females: 10,441). With respect to age, the overall average age for a tobacco-attributable hospital diagnosis was 61.9 years for males and 62.8 years for females. There were notable differences among disease categories. For fire injuries, the average age for a tobacco-attributable hospital diagnosis was 44.9 years for males and 53.9 years for females. The average age for tobacco-attributable hospital diagnoses due to the toxic effects of tobacco and nicotine occurred at the age of 29.5 years for males and 37.0 years for females. For detailed national and provincial estimates of tobacco-attributable acute care hospital diagnoses, see Tables D-HC-S-1 to D-HC-S-14.

Table 3 provides estimates of tobacco-attributable hospital days. Overall, in Canada for the year 2002, 2,210,155 hospital days were estimated to be attributable to tobacco (males: 1,359,159; females: 850,996). This constitutes 10.3% of all hospital days in acute care hospitals in Canada 2002 (males: 14.1%; females: 7.2%).

Among the hospital days caused by tobacco, the three biggest contributors were cardiovascular disease, malignant neoplasms and respiratory disease. The single disease categories that accounted for the most tobacco-attributable hospital days were ischaemic heart disease (21.0%; 463,625 hospital days; males: 327,021; females: 136,604). The next largest single categories were lung cancer (8.9%; 199,362 hospital days, males: 124,082; females: 75,280), and pneumonia and influenza (8.7%; 193,684 hospital days; males: 118,770, females: 74,914). For detailed national and provincial estimates of tobacco-attributable acute care hospital days, see Tables D-HC-S-15 to D-HC-S-28.

Mortality due to tobacco

Tobacco-attributable number of deaths

Table 7 provides the estimates of SAM by disease and PSAM for lung cancer and IHD. Results show that, overall in Canada, 37,209 tobacco-attributable deaths were estimated, accounting for 23,766 deaths among males and 13,443 among females for the year 2002, including 58 boys and 33 girls under the age of one who died as a result of tobacco-attributable causes. The 37,209 tobacco-attributable deaths constituted 16.6% of all Canadian deaths, 21.0% among males and 12.2% among females (there were 113,266 male and 110,337 female deaths in Canada in 2002).

Most of the deaths attributable to tobacco can be grouped into three broad categories. The three biggest contributors were cancers (malignant neoplasms), cardiovascular diseases (CVD) and respiratory diseases (see Table I-S-1). Cancer accounted for 46.8% of tobacco-attributable deaths (17,427 deaths, males: 11,861; females: 5,566), CVD accounted for 27.6% (10,275 deaths, males: 6,373; females: 3,902), respiratory disease accounted for 22.3% (8,282 deaths, males: 4,788; females: 3,494) and total deaths due to ETS (lung cancer and IHD) accounted for 2.2% (831 deaths, males: 507, females: 324). With respect to single disease categories within these broad categories, lung cancer (13,401 deaths, males: 9,028; females: 4,373), COPD (7,533 deaths, males: 4,378; females 3,155), and IHD (5,343 deaths, males: 3,837; females:1,506), constituted the largest tobacco-attributable categories. These three diseases, together, accounted for more than two-thirds (70.6%) of all tobacco-attributable deaths in Canada in 2002. Almost two-thirds (63.9%) of those who died from tobacco-attributable causes in Canada were males.

In addition, 2.2% of all deaths (831 deaths, males: 507; females: 324) aged 15 years and over died as a result of ETS exposure in 2002. Specifically, 252 Canadians (males: 157; females: 95)

died from lung cancer PSAM while 579 Canadians (males: 350; females: 228) died from IHD PSAM.

For some of the individual causes of death, tobacco was responsible for more than 75% of the deaths: lung cancer (78.0%), pulmonary circulatory disease (79.1%), and COPD (79.7%). In terms of absolute numbers, more males than females died of tobacco-attributable causes. This probably is a reflection of the higher rates of current smoking tobacco among males. Smoking caused 28% (55) out of 198 fire deaths. For detailed provincial estimates of tobacco-attributable mortality, see Tables I-S-2 to I-S-14.

Tobacco-attributable years of life lost

Canadian residents lost an estimated 515,607 PYLLs as a result of premature mortality resulting from tobacco smoking (316,417 years of life lost among males and 199,191 years lost among females) (Table 8). The PYLL rate for deaths due to tobacco was 2,151 per 100,000 for males and 1,302 per 100,000 for females aged 0 to 80+. That is, for every 100,000 population, there was a potential loss of 2,151 years of life among males and 1,302 years of life among females as a result of premature death due to tobacco. A high PYLL rate for males was observed, indicating a 65% higher level of premature mortality among males compared to females. Cancer was the leading cause of tobacco-attributable PYLL in Canada in 2002, responsible for 262,261 years of potential life lost (162,612 male and 99,649 female). CVD caused a loss of 151,604 years (97,824 male and 53,780 female). Respiratory disease caused 79,328 years to be lost (42,009 male and 37,319 female). This represents 16.7% of all PYLLs in Canada 2002 (males: 19.6%; females: 13.5%).

Overall, tobacco smoking affected more males than females: in males 21% of the deaths were tobacco-attributable, compared to 12.2% of the deaths among females. The overall average

age for tobacco-attributable death was 71.2 years for males and 73.4 years for females. There was no large notable difference found between disease categories except fire injury. For this category, the average age for a tobacco-attributable death was 46.7 years for males and 58.0 years for females. For detailed national and provincial estimates of tobacco-attributable PYLLs, see Table E-P-3.

CHAPTER IV: DIRECT HEALTH CARE COSTS

Costs of substance-attributable acute care hospitalizations

It was estimated that there were 1,246,945 acute care hospital days attributable to alcohol, 352,121 days attributable to illegal drugs (including cannabis: 58,575 days) and 2,210,155 days attributable to tobacco (including passive smoking: 46,700 days) in Canada in 2002. The cost of these hospital days is estimated to be \$1,458.6 million for alcohol, \$426.4 million for illegal drugs (including cannabis: \$73.0 million) and \$2,551.2 million for tobacco (including passive smoking: \$53.6 million). Thus, the total cost of substance-attributable acute care hospitalizations is estimated at more than \$4.4 billion. Details of the acute care costs are presented in Table 9.

Costs of substance-attributable psychiatric hospitalizations

It was estimated that there were 54,114 psychiatric hospital days attributable to alcohol and 31,508 days attributable to illegal drugs (including cannabis: 4,000 days) in Canada in 2002 (no psychiatric hospital days were attributable to tobacco) (Table 5). The cost of these hospital days is estimated to be \$19.6 million for alcohol and \$11.5 million for illegal drugs (including cannabis: \$1.5 million). Thus the total cost of substance-attributable psychiatric hospitalizations is estimated at approximately \$31.2 million. Details of the psychiatric cost are presented in Table 9.

Costs of substance-attributable inpatient specialized treatment

It was estimated that there were 641,168 inpatient specialized treatment days attributable to alcohol and 299,694 inpatient specialized treatment days attributable to illegal drugs in Canada in 2002 (no inpatient specialized treatment data for tobacco were available) (Table 6). The

costs of these inpatient specialized treatment days is estimated to be \$754.9 million for alcohol and \$352.1 million for illegal drugs. Thus, the total cost of substance-attributable inpatient specialized treatment days is estimated at more than \$1.1 billion. Details of the inpatient specialized treatment cost are presented in Table 9.

Costs of substance-attributable outpatient specialized treatment

It was estimated that there were 2,377,520 outpatient specialized treatment days attributable to alcohol and 2,552,135 outpatient specialized treatment days attributable to illegal drugs in Canada in 2002 (no outpatient specialized treatment data for tobacco were available) (Table 6). The costs of these outpatient specialized treatment days is estimated to be \$52.4 million for alcohol and \$56.3 million for illegal drugs. Thus, the total cost of substance-attributable outpatient specialized treatment days is estimated to be in excess of \$108.7 million. Details of the outpatient specialized treatment cost are presented in Table 9.

Costs of substance-attributable ambulatory care

In this report, ambulatory care costs are estimated based on physician fees. Ambulatory care visits include emergency visits, day/night care visits, and specialty/private clinic visits. It was estimated that there were 1,537,269 ambulatory care services attributable to alcohol, 434,104 ambulatory care services attributable to illegal drugs, and 2,724,741 ambulatory care services attributable to tobacco. For national and provincial number of ambulatory care services attributable to substance abuse, please see Table D-HC-8. The costs of these ambulatory care services were estimated to be \$80.2 million for alcohol, \$22.6 million for illegal drugs, and \$142.2 million for tobacco. Thus, the total cost of substance-attributable ambulatory care services was estimated at more than \$245.0 million. Details of the cost of ambulatory care are presented in Table 9.

Costs of substance-attributable family physicians

The family physician visit costs were estimated to be \$172.8 million for alcohol, \$48.8 million for illegal drugs, and \$306.3 million for tobacco. Thus, the total cost of substance-attributable family physician fees was estimated at more than \$527.9 million. Details of the cost relating to family physician fees are presented in Table 9.

Costs of substance-attributable prescription drugs

In Canada, \$13.2 billion was spent on prescription drugs in 2002. For the treatment of substance abuse, total cost of prescription drugs was estimated at more than \$2.3 billion. Costs of prescription drugs dispensed in retail stores for the individual treatment of alcohol, illegal drugs and tobacco was estimated to be \$767.6 million for alcohol, \$216.8 million for illegal drugs, and \$1,360.5 million for tobacco. Details of the cost of prescription drugs are presented in Table 9.

For provincial overall health care costs due to alcohol, illegal drugs and tobacco, see Table 10.

CHAPTER V: DIRECT COSTS OF LAW ENFORCEMENT ATTRIBUTABLE TO SUBSTANCE ABUSE

Substance-attributable policing costs

Given the information currently available, it was estimated that 30.4% of all recorded criminal offences are attributable to alcohol and 22.1% of such offences are attributable to illegal drugs. These fractions were translated into 761,638 incidents caused by alcohol and 554,131 incidents due to illegal drugs. Of all alcohol-attributable incidents, almost 79.5% of crimes were provincial alcohol statutes, 3.8% were due to impaired driving and 16.7% were violent crimes. Similarly, of all illegal drug-attributable incidents, 96.2% of incidents involved drug laws and 3.8% of all incidents were violent crimes. Details of the calculations and costs are presented in Table 11 and 12.

In 2002, total public policing costs in Canada were estimated at \$6,149.2 million. The cost of policing attributable to alcohol is estimated at \$1,898.76 million, and the cost of policing attributable to illegal drugs is estimated at \$1,431.96 million for 2002.

Substance-attributable court costs

It was estimated that 35.8% of all criminal charges dealt with in courts are attributable to alcohol and 23.1% are attributable to illegal drugs. These fractions were translated into 206,594 alcohol-induced and 133,120 illegal drug-induced charges. Of all alcohol-attributable incidents, almost 61% of charges were with regard to provincial alcohol statutes, 9.5% of charges were due to impaired driving and 29.5% were violent crimes. Similarly, of all illegal drug-attributable incidents, 92.4% of incidents involved drug laws and 7.6% of all incidents involved violent charges.

Court costs attributable to the processing of alcohol- and drug-attributable criminal charges are estimated to be \$513.07 million for alcohol and \$330.6 million for illegal drugs in Canada for 2002. These costs include all expenses for court staff, including judges, as well as expenditures associated with legal aid services and prosecutors. Details of the calculations and costs are presented in Table 13 and 14.

Substance-attributable correctional costs

Correctional costs include costs for penal institutions, probation and parole services for adult and young offenders at both the provincial and federal level. It was estimated that 24,236 of total adult sentences to provincial custody were due to alcohol, including violent crimes (4,271), and 19,838 were due to illegal drugs, including violent crimes (712). Of all youth offenders sentenced to provincial custody, 2,103 were sentenced for alcohol, including violent crimes (371), and 1,721 were sentenced for illegal drugs, including violent crimes (62). Of all adult sentences to federal custody, 1,823 offenders were sentenced due to alcohol and 1,746 offenders were sentenced due to illegal drugs.

It was estimated that the costs of correctional services for persons sentenced for alcohol-attributable offences were \$660.4 million (adult corrections: \$269.6 million, youth corrections: \$158.2 million, federal adult corrections: \$232.6 million) and drug-attributable offences were \$573.0 million (adult corrections: \$220.7 million, youth corrections: \$129.5 million, federal adult corrections: \$222.8 million). Details of the calculations and costs are presented in Table 15.

CHAPTER VI: DIRECT COSTS FOR PREVENTION, RESEARCH AND OTHER SUBSTANCE-ATTRIBUTABLE MATTERS

Costs for prevention and research

Prevention and research are policy costs attributable to alcohol, illegal drugs and tobacco. They represent expenditures, usually by governments, for programs that are assumed to prevent even higher costs than would be the case if these programs were not in place.

Table D-PR-1 shows estimates of direct costs for substance-attributable prevention and research in Canada 2002. The Canadian Institutes of Health Research provided expenditures on all awards and grants related to research on alcohol, illegal drugs, cannabis and tobacco in Canada 2002. Expenditures for alcohol were \$1.5 million, for illegal drugs were \$4.7 million (including cannabis \$197,408) and for tobacco were \$1.5 million.

The second source for tobacco estimates on prevention and research was the Federal Tobacco Control Program, Health Canada. In 2002, \$7.5 million was spent on tobacco research and \$48.4 million for tobacco prevention. The budget for prevention was allocated to the following tobacco control activities: Regulations (\$4.1 million); Compliance (\$7.0 million); Prevention, Cessation and Protection Activities (\$9.6 million); Policy and International Work (\$2.9 million); Mass Media Campaigns (\$14.8 million); and Mass Media Contribution Fund (\$6,874). In addition, the First Nations and Inuit Health Branch also received \$10 million to carry out prevention, cessation and protection activities for First Nation populations living on-reserve and for Inuit populations living in the three territories.

In addition, estimates for prevention and research from other agencies were obtained: \$51.4 million was spent on alcohol, \$11.8 million on illegal drugs, and \$20.8 million on smoking

tobacco prevention and research. An estimated amount of \$1.8 million was spent on salaries and operating funds (this estimate was available only for alcohol).

In total, it was estimated that \$147.6 million was spent on alcohol, illegal drugs and tobacco prevention and research in Canada 2002. Of this total, \$53.0 million was spent on alcohol, \$16.5 million on illegal drugs and \$78.1 million on tobacco prevention and research (Table 16).

Fire damage

Estimated AFs for alcohol and tobacco were applied to the total fire damage to property in Canada 2000 (\$1.19 billion) which resulted in estimates of \$156.5 million for alcohol-attributable fire damage and \$86.5 million for tobacco-attributable fire damage, resulting in total of \$243 million (Table 16).

Traffic accident damage

Estimated AFs for alcohol and illegal drugs were applied to the total property damage claims of \$3,942 million arising from traffic accidents in Canada in 2000. These resulted in estimates of \$756.9 million for alcohol-attributable and \$67.0 million for illegal drugs property damage from motor vehicle accidents (Table 16).

Losses associated with the workplace

It was estimated that in 2002, \$21.7 million was spent on EAP and health promotion programs: \$17.0 attributable to alcohol, \$4.2 million attributable to illegal drugs and \$0.5 million attributable to tobacco (Table 16). In addition, 2.4 million for illegal drugs was spent on drug testing in the workplace.

Administrative costs for transfer payments

Administrative costs for social welfare and other programs attributable to alcohol were estimated to be \$4.3 million in Canada 2002. In addition, \$66.9 million was spent on administrative costs for workers' compensation programs: \$61.5 million for alcohol and \$5.4 million for illegal drugs (Table 16).

CHAPTER VII: INDIRECT COSTS

Productivity losses due to short-term disability

Tables I-PR-1 and I-PR-3 present the number of days Canadians spent in bed and days with reduced activity due to alcohol or drugs dependence in 2002. Corresponding productivity losses as measured by forgone income are also reported.

The figures were obtained by analyzing data from the Canadian Community Health Survey, Cycle 1.2. Self-reported days in bed/days with reduced activity due to own mental health or alcohol or drug addictions were based on a 14-day recall period, adjusted for the labour force participation rate derived from the survey, and converted to annual figures. Multivariate linear regression modelling was used to apportion the number of days in bed with reduced activity to a specific condition, such as alcohol or drug dependence. To monetize the value of bed-days, respondents' daily wage was imputed from self-reported annual income adjusted for labour force participation derived from the survey.

In 2002, Canadians spent 1,079,626 days in bed due to either alcohol, tobacco or illegal drug dependence. A total of 311,293 days in bed were attributable to alcohol dependence, 216,581 days in bed were due to illegal drug dependence and 551,753 were due to tobacco dependence. These bed-days translated into \$62,041,167 in addiction-attributable income losses, \$15,884,710 of income lost due to alcohol dependence, \$21,797,508 lost to illegal drug dependence and \$24,358,948 due to tobacco dependence (see Table I-PR-2).

Table I-PR-3 reports days with reduced activity and corresponding income losses. In 2002 Canadians reported 540,715 days with reduced activity attributable to alcohol, drugs or tobacco. This translated into \$59,786,966 in lost income/productivity losses on an annual basis. The

methods to monetize the reduced activity days were the same as for total bed days, except that respondents were assumed to be only half as productive on reduced activity days as on regular days (see Table I-PR-4).

Productivity losses due to long-term disability

Tables I-PR-5 and I-PR-6 report the number of Canadians who did not participate in the labour market due to their own disability. Overall, 62,846 Canadians were not looking for work and were not part of the labour force in 2002 due to their own illness/disability. Assuming that these respondents were permanently disabled, the number of lost years of productivity was 2,322,243 overall, with 718,512 in years of productivity lost due to alcohol dependence, 564,375 due to illegal drug dependence and 1,039,356 due to tobacco dependence. These figures do not add up to the total due to overlap of alcohol- and drug-dependent conditions.) The figures were obtained as a product of the number of persons who didn't look for work due to their own disability and the number of expected productive years of life lost.

The years of productivity losses translated into \$21,109.1 million overall for alcohol, illegal drug and tobacco dependence, with \$6,163.9 million lost due to alcohol dependence, \$4,408.4 million lost due to illegal drug dependence and \$10,536.8 million lost due to tobacco dependence.

These values were derived by multiplying the number of potential years of productivity losses by average earnings in Canada, adjusted by labour force participation and productivity growth rate, and discounted to the present value using a 5% discount rate.

Productivity losses estimated using the Friction Cost Approach

Friction costs due to alcohol

Alcohol-attributable deaths translated into \$29,982,063 (2002 Canadian dollars) of productivity losses represented by the costs of replacing prematurely deceased workers. This cost was estimated by the product of the number of alcohol-attributable deaths and the three month-weighted annual average earnings (in 2002 Canadian dollars) adjusted for gender and age-specific labour force participation rates. Those permanently excluded from the labour market due to their own disability were considered separately (see Table I-PR-7).

Friction costs due to illegal drugs

Illegal drug-attributable deaths translated into \$7,175,316 in productivity losses, \$6,202,926 among males (86%) and \$972,390 among females (14%) (see Table I-PR-7).

Friction costs due to tobacco

It was estimated that tobacco-attributable deaths translated into \$68,651,729 in productivity losses related to costs of replacing the prematurely deceased workers. Eighty-one percent (81%) of tobacco-attributable productivity losses estimated using the friction cost method were attributable to males (\$55,947,747 in terms of dollar value) and 19% to females (\$12,703,981). The gap between gender distribution of deaths and the value of productivity losses by gender was due to gender differences in labour force participation rates as well as differences in average earnings.

Overall, the friction cost of replacing the prematurely deceased workers amounted to \$105,809,107 in Canada 2002. Tobacco accounted for 65% of these costs, alcohol was responsible for 28% and illegal drug-attributable deaths accounted for 7% of the total. Eighty-

three percent (83%) of the total friction costs were caused by substance-attributable deaths among males and 17% were attributable to females (see Table I-PR-7).

The computations were based on the following data sources: "Causes of deaths 1999" tables by Statistics Canada, Aetiological fraction tables, Labour Force Participation rates for Canada 2002 by age group and gender (based on Labour Force Survey for 2002 by Statistics Canada) and "Earnings of Canadians" by gender based on Census 2001 data inflated to 2002 level using the Fixed Weighted Index of Average Hourly earnings for all employees.

Hybrid approach to calculating substance-attributable productivity losses

Substance abuse was responsible for \$3,045.0 million of productivity losses measured by the Hybrid Approach. A total of \$2,013.0 million was attributable to substance consumption by males (66% of total) and \$1,032.1 million by females (34% of total) (see Table I-PR-7).

The costs estimated by the Hybrid Approach were derived as a sum of Friction Cost and Discounted Present Value of Reservation Wage Stream. This was obtained by adjusting the potential years of life lost by the labour force participation rates and productivity growth rates, multiplying these numbers by average reservation wage and discounting the reservation wage stream to the present using a 5% discount rate. The 2000 value of reservation wage was computed based on data from the General Social Survey 1998, Cycle 12: "Time Use as well as Statistics Canada's publication "Households' Unpaid Work". The Replacement Specialist Approach was used to assign value to various jobs comprising household work, which were averaged over all household activities using time weights. These values were inflated to the 2002 level using the general CPI. Both the PV of the Reservation Wage Stream for the Replacement Worker (a component of the Hybrid Approach depicted in the Summary Table)

and the PV of Annual Earnings for the Deceased Worker (Human Capital Approach) were adjusted for age and gender-specific labour force participation rates, productivity growth rates (assumed to be 3% a year), and were discounted to the present using a 5% discount rate.

Human capital approach to calculating substance-attributable productivity losses

Substance abuse-attributable productivity losses were estimated at \$5,440.0 million in Canada 2002. Eighty-one percent (81%) of this amount was attributable to males and 19% to females. Alcohol accounted for 34%, illegal drugs for 9% and tobacco for 58% of total costs. The gender distribution reflects differences in potential years of life lost for males and females, differences in labour force participation rates, and average earnings disparities by gender (see Table I-PR-7).

The Costs were estimated based on potential years of life lost adjusted for labour force participation and productivity growth rates as well as the Present Value of Annual Average Earnings Stream. The 2000 level of Discounted Present Value of future annual earnings stream (by gender) was inflated to 2002 level using a wage inflation index for Canada.

CHAPTER VIII: COMPARISON OF EPIDEMIOLOGICAL RESULTS WITH PREVIOUS COST STUDY

In 1996, Eric Single and colleagues produced a landmark publication that summarized the overall social cost of substance abuse for the year 1992, and which included a comprehensive summary of substance-attributable health-related indicators. It is important that, given the update of this information for 2002, a comparison be drawn against that original document to investigate changes to the epidemiological profile. The following summary highlights the differences and similarities between 1992 and 2002 in terms of substance-attributable mortality and morbidity indicators using a number of different measures such as deaths, potential years of life lost, and number of acute hospital days. In such a comparison, it is first necessary to account for any major differences between these two time points that may confound the interpretation.

In Canada from 1992 to 2002, there have been three major epidemiological shifts that may affect comparisons between these two time points. The first is that Canada's resident population has been growing (Statistics Canada, 2005). This results in greater numbers of deaths as a whole (increase of 13.5% from almost 197,000 deaths in 1992 to 223,600 in 2002), as well as in most substance-attributable disease categories that are accounted for in this study, so all comparisons will be drawn relative to the 2002 population. The second major epidemiological shift is that Canada's population became older on the whole, with relatively higher numbers in those age groups (65 years and older) that tend to account for the majority of the death, disability, and disease. A third shift is much harder to capture, and is related to trends in population rates of disease and subsequent changes in distributions among diseases. For example, the standardized rate of cardiovascular death has been declining for more than four decades (1960: 617 deaths per 100,000; 1999: 233 deaths; Public Health Agency of Canada,

2002) and at a higher rate than other mortality categories, and thus cardiovascular deaths have become relatively less important in the period between 1992 and 2002. To capture these effects for more than 80 substance-attributable disease categories in a relatively short time period of 10 years and relate them to risk factors is, however, an almost impossible task, so that we restrict ourselves to describing only major epidemiological shifts.

To summarize: there have been major epidemiological shifts in Canada and it is clear that in comparing trends of substance-attributable mortality and morbidity, non-substance-related epidemiological trends have to be recognized for their impact on substance-attributable outcomes over the time period examined.

Comparisons of causes of death in the elderly bring some particular methodological problems. With increasing age, causes of death as officially certified tend to be less valid than for younger aged populations because of multiple causes involved (Minder, 1984; Kesteloot & Verbeke, 2005). Second, relative risks (RR) for substance-attributable mortality and morbidity indicators tend to be applicable for mid-age deaths and there is a strong indication that relative risks tend to converge to one with increasing age (Rehm et al., 2006), thus leading to an overestimation of substance-attributable fractions in older age groups. Therefore, in this analysis, death was compared in two different ways: overall deaths and deaths for those under the age of 70.

This analysis contrasted and compared 1992 and 2002 estimates of substance-attributable deaths, potential years of life lost, and hospital days in two different ways:

- Using identical methodology (from Single et al., 1996).
- Using the new methodology as described earlier in this study: this analysis compared 2002 data based on the Single et al. (1996) method with the Rehm et al. (2006) method.

Comparison based on Single et al. (1996) methodology

Using identical methods clearly improves the 10-year comparison by incorporating “internal controls”, where similar assumptions and potential inconsistencies are accounted for, meaning that differences between the two time points can be seen more clearly and attributed to real changes in exposure and epidemiological shifts in distribution. Using the Single et al. method, the RRs for 1992 were kept the same for the 2002 calculations; theoretically the only methodological difference between the 1992 and 2002 data is exposure measurement. Any changes seen can be attributed to a combination of the true exposure change (e.g., higher volume of alcohol consumed per person) and the exposure measurement change (i.e., improvements in measuring both volume of alcohol (for more information see Rehm et al., 2001, 2004), and epidemiological shifts.

Table 17 shows the overall comparisons of substance-attributable health burden between 1992 and 2002 for three separate indicators using Single’s methodology: deaths, PYLL, and hospital days. These calculations show that, overall, similar trends can be seen across all the indicators. Both total number of deaths and PYLLs increased from 1992 to 2002, but total number of hospital days and deaths under 70 years decreased overall. It should be noted that these totals summing up the substance-specific consequences are an overestimate and give a rough estimate only because relationships among the three types of substance-attributable deaths have been shown to be multiplicative in theory and practice, thus leading to overlap in attributable mortality and morbidity among substances (Taylor & Rehm, in press). However, the overestimate may not be very problematic; Collins and Lapsley (2002) found for Australia in 1998-1999, that double counting led to an overestimate of 2.2% of the total mortality caused by addictive substances.

The relative difference over all indicators between 1992 and 2002 saw illegal drug-related indicators increase the most, followed by alcohol-related indicators, and lastly tobacco-related indicators. There are a number of reasons that contribute to this overall increase in drug-attributable morbidity and mortality. First, increases look bigger for this class of substances since illegal drugs account for the lowest raw numbers for all three measures, so small increases are proportionally much larger than for alcohol or tobacco. Second, there were simply more drug overdose deaths in 2002 compared to 1992 (958 vs. 172), in part because the current study relied on coroners' reports rather than on official Statistics Canada mortality statistics. Third, in 2002, drug-attributable hepatitis C deaths and traffic accident deaths attributable to cannabis and cocaine were also estimated in 2002, which was not accounted for in 1992. The last reason is that the regular drug-using population in 2002 was older than in 1992, thereby increasing their risk of death naturally.

Another interesting trend is that tobacco, alcohol, and illegal drugs follow the same rank order in 1992 and 2002 as high, middle, and low contributors (tobacco as a negative contributor in deaths and hospital days) for each indicator, respectively.

Looking at the mortality data only, alcohol deaths net-increased approximately 19.6%, and illegal drug-attributable deaths increased almost 75.1% in 2002 relative to the 1992 study; however, absolute differences were small. Tobacco deaths decreased relative to 1992 when adjusted to the level of overall mortality (-2.2%), even though the actual number of deaths increased by about 3,710. Among deaths under age 70, substance-specific patterns were similar compared to the overall deaths for 2002. However, the most striking difference was that the number of overall deaths in this age group decreased from 1992 to 2002, due to the finding that tobacco-attributable deaths fell by almost 2,500 deaths in this period, reflecting a 6.5% relative decrease.

In terms of PYLLs, the alcohol and drug trend is similar (relative increases of 11.9% and 89.4%, respectively), and tobacco remains almost stable with a positive increase in 2002 of 1.4%.

Total number of substance-attributable hospital days showed a similar trend to deaths. Total number of days in 2002 decreased by approximately 47,000 days compared to 1992, with tobacco responsible for the fall with an overall decrease of more than 708,000 days. However, tobacco-attributable hospital days increased by 47.8% relative to 1992 data when looking at the proportion of the overall hospital days. The largest relative increase was in drug-attributable hospital days, which increased almost 950% from 1992 to 2002, with alcohol increasing by about 160%.

Comparisons based on Single et al. (1996) versus Rehm et al. (2006) methodology

The methods developed by Rehm et al. (2006) in this report differ from those of Single et al. (1996) in a number of ways. The Rehm et al. method uses the most updated RR (mostly later than 2000). In addition, for some diseases, risk estimates were more dose-specific than the prior estimates. In addition, new diseases were added in the Rehm et al. (2006) study, and others were dropped, reflecting the best epidemiological knowledge to date.

Table 18 shows the comparison of Single et al. (1996) method and Rehm et al. (2006) method.

Overall trends seen were the same for all indicators comparing 1996 to 2002. Comparing the two different methods for the 2002 data showed that using the Rehm method resulted in more conservative estimates overall than the Single method except for overall deaths under age 70.

For this category, both illegal drug-attributable deaths and tobacco-attributable deaths increased by approximately 11% and 5%, respectively, accounting for the overall increase observed. In

fact, for all indicators, illegal drug-attributable outcomes increased by using the Rehm method compared to the Single method, which is mainly due to the large increase in overdose deaths (Popova et al., 2006) and to a lesser extent to the inclusion of estimates for cannabis- and cocaine-attributable traffic accidents.

Conclusions

Overall, using the Single et al. (1996) method to compare 1992 and 2002 data resulted in overall relative increases in 2002 for all attributable mortality and morbidity outcomes. However, in terms of absolute numbers, only death and potential years of life lost showed corresponding increases, whereas overall decreases were seen in numbers of deaths under age 70 and hospital days. For these two indicators, tobacco-attributable outcomes were responsible for the decreases seen. Moreover, tobacco-attributable mortality decreased, when adjusted for overall level of mortality.

Over the past 10 years, there has been a change in the exposure to both tobacco and alcohol that has seen the prevalence of tobacco use decrease, while alcohol prevalence in the higher drinking categories has increased (Baliunas et al., submitted; Rehm et al., 2006; Taylor et al., submitted). Tobacco-attributable outcomes tend to be related to both cumulative use and consequently to more chronic disease outcomes. Alcohol, on the other hand, is linked to more acute outcomes such as injury based on current exposure. Therefore, tobacco-related indicators with high chronic disease contributions like PYLL and older-age deaths relate to exposure prior to 2002, whereas hospital days and younger deaths may reflect the decreasing prevalence. For alcohol, on the other hand, relative and actual increases may reflect the increasing prevalence of heavy drinking occasions and the related impact in more acute categories.

CHAPTER IX: DISCUSSION AND CONCLUSIONS

Discussion of national results

Overall, tobacco caused more deaths than alcohol and illicit drugs together, but many of the tobacco-related deaths occurred late in life. Please note that the alcohol-attributable deaths are a net estimate, already taking into account the cardio-protective effect of regular light to moderate drinking (Rehm et al., 2003).

In total, 19.3% of all deaths in Canada and 29.9% of deaths in Canada below age 70 were caused by substance use. The total is a slight overestimate, as there is some overlap among substance-attributable deaths. For example, esophageal cancer is influenced by the interplay of alcohol and tobacco use (Taylor & Rehm, in press), so if alcohol consumption ends, these cancer deaths would disappear. Thus, they are alcohol-attributable. Likewise, the same happens if tobacco consumption were to be taken away, making these cancer deaths countable as tobacco-attributable in addition to being alcohol-attributable. However, the overall effect of this interaction is not very large: Collins and Lapsley (2002) found that double-counting as described above led to an overestimate of 2.2% of the total mortality caused by addictive substances in Australia in 1998-1999.

In terms of potential years of life lost (PYLL), 16.7% of all years of life were lost due to tobacco, whereas alcohol resulted in 4.8%, and illegal drugs totalled 2% of all years of life lost in 2002. If we translate this into number of potential years, tobacco caused Canadians to lose 515,607 years of human life and alcohol and illegal drugs caused 147,571 years and 62,110 years, respectively. Overall, 17.8% of total hospital days were spent in acute care due to substance use in Canada 2002. Alcohol caused 5.8%, tobacco caused 10.3%, and illegal drugs were

responsible for 1.6% of all hospital days. Nineteen percent (19.1%) of all hospital days were due to substance use for Canadians 70 years and younger.

In terms of psychiatric and specialized treatment, including inpatient and outpatient, due to substance use, overall, 1.5% of all psychiatric hospital days were due to alcohol and 0.9% due to illegal drugs in Canada 2002. Specialized treatment accounted for about three million days each for alcohol and illegal drugs.

The Table below gives an overview of the social costs attributable to substance abuse by cost category for 2002. The indirect costs of this table are based on a modified human capital approach and thus the numbers in this category and the overall numbers cannot be directly compared to the costs from Single et al. (1996).

	(in millions dollars)			
	Alcohol	Illegal drugs	Tobacco	TOTAL ADT
1. Direct health care costs: total	3,306.2	1,134.6	4,360.2	8,800.9
2. Direct law enforcement costs	3,072.2	2,335.5	--	5,407.8
3. Direct costs for prevention and research	53.0	16.5	78.1	147.6
4. Other direct costs	996.1	79.1	87.0	1,162.2
5. Indirect costs: productivity losses (main scenario)	7,126.4	4,678.6	12,470.9	24,275.9
5.1 due to long-term disability	6,163.9	4,408.4	10,536.8	21,109.1
5.2 due to short-term disability (days in bed)	15.9	21.8	24.4	62.0
5.3 due to short-term disability (days with reduced activity)	23.6	-0.1	36.2	59.8
5.4 due to premature mortality	923.0	248.5	1,873.5	3,045.0
Total	14,554.0	8,244.3	16,996.2	39,794.4
Total per capita (in \$)	\$463	\$262	\$541	\$1,267
Total as % of all substance-related costs	36.6%	20.7%	42.7%	100.0%

ADT - Alcohol, Illegal Drugs, and Tobacco

"--" not available

It is estimated that the cost of substance abuse in Canada was about \$39.8 billion in 2002.

- Alcohol accounted for about \$14.6 billion in costs. This represented 36.6% of the total costs of substance abuse. The largest economic costs of alcohol were \$7,126.4 billion for lost productivity due to illness and premature death, \$3.3 billion in direct health care costs, and \$3.1 billion in law enforcement costs.

- Costs of illegal drugs were estimated to be approximately \$8.2 billion. The largest economic costs were \$4.7 billion for lost productivity due to illness and premature death, \$2.3 billion for law enforcement costs, and more than \$1.1 billion in direct health care costs.
- The economic costs of tobacco abuse were estimated at \$17.0 billion. This was almost 42.7% of total substance abuse costs. The largest cost for this substance (approximately \$12.5 billion) was for lost productivity due to illness and premature death. Direct health care costs due to tobacco were estimated at about \$4.4 billion.

Overall, productivity losses constituted the largest part of the social costs (see also Figure 1). This is a common finding of all social cost studies in the field of substance abuse and, even more generally, in the field of cost-of-illness studies. As our sensitivity analyses showed, although the exact level of costs depends on the assumptions made, the general finding of high productivity losses still persists except for the friction cost approach. Figure 1 gives an overview of the relative proportion of the different cost categories.

In terms of the direct costs attributable to substance abuse, the two major categories were health care costs and costs for law enforcement (see Figure 1). Health care costs were by far the largest category, and they were mainly composed of hospital costs, not only in acute care hospitals, but also in psychiatric and other specialized treatment institutions. Although the overall number of hospital days went down markedly in the past decade, hospital days attributable to substance use did not follow this trend and stayed at about the same level as in 1992.

The costs for law enforcement attributable to substance abuse were very high for both illegal drugs and alcohol; overall, they constituted more than one-third of the total direct costs. It should be noted that the costs for law enforcement were composed of only costs attributable to alcohol and illegal drugs. Law enforcement costs included the major categories of policing,

courts, and corrections (including probation); however, there were additional costs in law enforcement that we were unable to quantify for 2002 in a reliable manner. These refer to customs and excise, as well as to all tobacco-attributable law enforcement costs (e.g., controls for illegal import or export; enforcement of tobacco by-laws). Overall, the level of costs for substance-attributable law enforcement can serve as an important marker that substance abuse is not only a health problem, but a larger public health and social problem as well. This issue consumes a huge number of resources, both economic and social, in Canadian society. Compared to the health and the law enforcement sector, all the other direct costs are of lesser importance.

Total cost *per capita* for substance abuse was about \$1,267 in 2002; \$463 for alcohol, \$262 for illegal drugs, and \$541 for tobacco (see Figure 2).

The social costs attributable to substance abuse increased from 1992. However, the numbers are hard to compare, as one would have to simultaneously consider the epidemiological changes (increase in population, longer average life expectancy, high number of deaths), the economic changes (inflation, differential inflation for health care sector), and social changes (changes in the health care and legal sectors). To compare changes of the impact of substance abuse, the best option is to restrict oneself to the impact on mortality and morbidity measured with the same instruments (see Tables 17 and 18).

Sensitivity analyses

Productivity losses are the most important category of social costs. In order to depict how different methodological approaches affect these estimates, three different scenarios were estimated for the core of these costs, i.e., costs due to long-term disability and premature mortality. These scenarios include the main scenario (see Table 16) as well as two sensitivity

analyses. The first sensitivity analysis was based on the human capital approach and can be seen as the upper bound for these cost categories. The second sensitivity analysis was based on the friction approach, i.e., only for mortality and disability on the costs for replacement were counted, and this can be seen as the lower bound. Table 19a and 19b gives an overview of the resulting indirect cost categories.

The resulting upper estimate for overall social costs was \$54.8 billion using the human capital approach; the lower estimate was \$16.2 billion based on the friction cost approach. This latter approach resulted in dramatically reduced estimates of productivity loss.

Provincial results

Table 20 gives an overview of provincial costs. Overall, the toll of substance abuse was relatively uniform across Canada, with the territories being the most notable exceptions with higher social costs attributable to substance abuse compared to the provinces. The estimates for the territories are still underestimates since some specialized treatment of territorial residents actually occurs in nearby provincial hospitals (for example psychiatric disease requiring hospitalization may have to be treated in another province, and are thus counted there. As well, the differences among provinces are slightly attenuated, as we used national averages in cases where no provincial data were available. However, in terms of cost per capita, differences were as large as 88%.

However, it is safe to say that alcohol, tobacco, and other drugs affect people across the whole of Canada, and measures to reduce substance-attributable costs should also be applied in the whole country.

Data gaps and limitations

Data gaps

The current study has several limitations in terms of costs not included in the study. First and foremost, we could not include the cost of prescription drug abuse. The topic of prescription drug abuse in Canada has been repeatedly mentioned as a potentially large public health problem (Haydon et al., 2005), yet the requisite minimum data are simply not available to make a comprehensive cost analyses. In order to change this, at minimum, questions on prescription drug abuse should be included in one of the large Canadian household surveys as a first step for more comprehensive analyses. Secondly, we had to exclude the costs of direct law enforcement for tobacco, as there are no data that allow the quantification of this cost category. Finally, in terms of major gaps, the indirect costs of imprisonment were not counted.

Limitations to estimating attributable fractions in law enforcement

The difficulties and limitations of the data collected in the criminal justice system must, at this point, be acknowledged. In our communication with various levels of law enforcement, our requests for quantitative data on substance-attributable issues could not be fulfilled because the data are simply not collected or organized this way. On the other hand, contrary to the health care system, there exist few systematic research studies that try to quantify the impact of risk factors like substance use on criminal activities.

As an example, the quantification of time and costs allocated to the policing of alcohol, tobacco, cannabis, and the use of other illegal drugs was requested from police forces in select cities of Canada. However, only a few agencies (the RCMP and Halifax Police Service) provided the study with a dollar figure for these policing costs. Due to these data limitations, the proportions of overall law enforcement costs attributable to policing alcohol, illegal drug and tobacco

smuggling infractions might be incorrectly specified in this study and thus do not constitute a true national estimate.

In order to get better estimates in the future, we suggest the routine implementation of record management systems, including the involvement of drugs and alcohol in crimes. Such a system could help police fight certain types of crime related to substance abuse.

Conclusions

At almost \$40 billion in 2002, the social costs of substance abuse were considerable for Canada, and they seem to have increased over the past decade, particularly for illegal drugs. Neither the current level, nor the past increases in social costs for substance abuse are inevitable, as there are cost-effective, evidence-based approaches to reducing substance-attributable costs in available literature. For alcohol, control measures have been shown to be effective and cost effective, including taxation or other means to increase price, state monopolies to prevent selling to minors, and strictly enforced laws with respect to traffic and workplace safety (Babor et al., 2003; Chisholm et al., 2004). For tobacco, control measures have also generally been shown to be effective (Shibuya et al., 2003), and some of the reduced burden of disease in Canada can probably be attributed to improved tobacco control measures since the 1980s. For illegal drugs, the evidence is much less clear, but there are other developed countries with successes in reducing the burden attributable to illegal drugs, and perhaps some of these programs could be adapted to the Canadian situation.

Estimating social costs is important, not only for assessing the status quo, but also for future programming and policy making in associated areas. However, estimating social costs can only be the first step. For concrete programming and policy making, it would be necessary to have analyses of avoidable costs. The costs given above are all costs attributable to substance

abuse, no matter if they are avoidable or not. To give one example: if all smoking of tobacco stopped today, there would still be tobacco-attributable lung cancers in the next year. There are many other examples and, in the past year, there have been efforts to systematically determine the avoidable costs attributable to substance abuse (Collins et al., 2006). Given the level of substance use-related costs in Canada, it is important to start the work on quantifying avoidable costs soon in order to have more focused input into programs and policies to reduce these costs.

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Table 2. Acute care hospital diagnoses due to morbidity attributable to alcohol, illegal drugs and tobacco by age and sex, Canada 2002

	Alcohol	Illegal Drugs*	Cannabis	Tobacco [§]	Passive smoking
Males					
0 - 14	3,671	551	126	6,772	--
15 - 29	13,767	9,879	3,454	2,587	17
30 - 44	23,639	12,109	2,041	14,241	221
45 - 59	32,686	6,510	625	62,772	1,797
60+	54,939	3,499	109	132,418	4,021
Total Males	128,702	32,547	6,356	218,791	6,056
Females					
0 - 14	2,203	671	122	5,059	--
15 - 29	6,594	8,822	1,837	2,600	8
30 - 44	12,471	9,653	1,023	8,722	63
45 - 59	16,065	4,802	292	26,848	548
60+	29,935	4,532	64	77,159	2,380
Total Females	67,267	28,479	3,337	120,388	2,999
Total All	195,970	61,026	9,693	339,179	9,054

Numbers for alcohol are net numbers i.e., taking into consideration the beneficial effects of alcohol use

* Including cannabis

§ Including active and passive smoking

Note: Calculation proportions is meaningless because a single person can have multiple diagnoses

Table 3. Acute care hospital days due to morbidity attributable to alcohol, illegal drugs and tobacco by age and sex, Canada 2002

	Alcohol	Illegal Drugs*	Cannabis	Tobacco [§]	Passive smoking
Males					
0 - 14	26,173	2,929	585	59,907	--
15 - 29	59,416	54,681	23,406	16,090	57
30 - 44	101,449	62,843	12,309	64,024	686
45 - 59	185,795	39,056	3,800	307,299	6,758
60+	446,232	30,148	796	911,838	21,734
Total Males	819,065	189,657	40,897	1,359,159	29,235
Male as % of all cause	8.48%	1.96%	0.42%	14.07%	0.30%
Females					
0 - 14	17,082	3,227	675	42,580	--
15 - 29	25,953	39,292	9,288	12,376	20
30 - 44	54,316	49,351	5,667	45,670	247
45 - 59	86,116	27,732	1,710	151,276	2,346
60+	244,414	42,861	338	599,094	14,851
Total Females	427,880	162,465	17,679	850,996	17,465
Female as % of all cause	3.63%	1.38%	0.15%	7.22%	0.15%
Total All	1,246,945	352,121	58,575	2,210,155	46,700
Total as % of all cause	5.82%	1.64%	0.27%	10.31%	0.22%

Numbers for alcohol are net numbers i.e., taking into consideration the beneficial effects of alcohol use

* Including cannabis

§ Including active and passive smoking

Table 4. Psychiatric hospitalizations due to morbidity attributable to alcohol and illegal drugs by age and sex, Canada 2002

	Alcohol	Illegal Drugs*	Cannabis
Males			
0 - 14	5	0	0
15 - 29	192	394	69
30 - 44	591	470	47
45 - 59	475	143	9
60+	152	15	0
Total Males	1,414	1,022	125
% of substance-attributable hospitalizations to all hospitalizations among males	9.94%	7.19%	0.88%
Females			
0 - 14	5	1	0
15 - 29	103	139	25
30 - 44	280	234	20
45 - 59	201	103	6
60+	55	17	0
Total Females	644	495	51
% of substance-attributable hospitalizations to all hospitalizations among females	5.78%	4.44%	0.46%
Total all	2,058	1,517	176
% of substance-attributable hospitalizations to all hospitalizations among all	8.11%	5.98%	0.69%

*Including cannabis

Table 5. Psychiatric hospital days due to morbidity attributable to alcohol and illegal drugs by age and sex, Canada 2002

	Alcohol	Illegal Drugs*	Cannabis
Males			
0 - 14	0	0	0
15 - 29	3,979	8,263	1,918
30 - 44	12,848	9,337	746
45 - 59	12,784	3,866	231
60+	8,991	415	0
Total Males	38,602	21,881	2,895
% of substance-attributable hospital days to all hospital days among males	2.69%	1.53%	0.20%
Females			
0 - 14	1	3	0
15 - 29	2,141	2,476	438
30 - 44	5,575	4,721	511
45 - 59	4,887	2,059	156
60+	2,908	369	0
Total Females	15,512	9,627	1,105
% of substance-attributable hospital days to all hospital days among females	0.74%	0.46%	0.05%
Total all	54,114	31,508	4,000
% of substance-attributable hospital days to all hospital days among all	1.53%	0.89%	0.11%

*Including cannabis

Table 6. Specialized treatment on alcohol and illegal drugs dependency by age and sex, Canada 2002

	Alcohol				Illegal Drugs			
	Inpatient		Outpatient		Inpatient		Outpatient	
	admissions	days	admissions	days	admissions	days	admissions	days
Males								
0 - 14	13	91	391	12,109	104	652	3,746	116,319
15 - 29	11,708	75,487	14,289	387,104	15,564	99,156	43,473	1,205,920
30 - 44	32,291	210,574	21,907	616,208	14,181	90,838	8,852	240,193
45 - 59	27,567	181,573	16,881	475,575	2,871	18,412	2,105	57,770
60+	8,267	54,065	3,028	89,362	270	1,725	63	1,525
Total Males	79,846	521,790	56,496	1,580,358	32,989	210,783	58,239	1,621,727
Females								
0 - 14	15	91	857	28,758	34	210	2,191	59,180
15 - 29	4,044	25,618	10,499	288,581	7,036	44,334	23,057	632,960
30 - 44	8,197	52,102	10,234	287,447	5,453	34,442	6,871	178,020
45 - 59	5,210	33,207	6,001	166,646	1,448	9,194	1,848	48,639
60+	1,326	8,360	865	25,731	114	730	495	11,608
Total Females	18,791	119,378	28,455	797,162	14,085	88,911	34,461	930,408
Total All	98,638	641,168	84,951	2,377,520	47,073	299,694	92,700	2,552,135

Table 7. Mortality attributable to alcohol, illegal drugs and tobacco by age and sex, Canada 2002

	Alcohol	Illegal Drugs*	Cannabis	Tobacco [§]	Passive smoking
Males					
0 - 14	50	24	1	58	--
15 - 29	682	238	9	40	1
30 - 44	842	379	6	522	9
45 - 59	1,045	408	5	3,708	91
60+	875	134	5	19,438	407
Total Males	3,494	1,183	26	23,766	507
Male as % of all cause total	3.08%	1.04%	0.02%	20.98%	0.45%
Females					
0 - 14	26	10	1	33	--
15 - 29	124	95	3	29	0
30 - 44	218	163	2	293	3
45 - 59	386	153	2	1,782	36
60+	9	92	4	11,305	284
Total Females	764	512	13	13,443	324
Female as % of all cause total	0.69%	0.46%	0.01%	12.18%	0.29%
Total	4,258	1,695	39	37,209	831
Total as % of all cause	1.90%	0.76%	0.02%	16.64%	0.37%

Table 7a. Substance-attributable death total as percent of ages before age 70

	Alcohol	Illegal Drugs*	Cannabis	Tobacco [§]	Passive smoking
Male < 70 yr.	3,160	1,135	23	9,699	226
Male as % of all cause total < 70 yr.	7.67%	2.75%	0.06%	23.53%	0.55%
Female < 70 yr.	955	464	10	4,550	89
Female as % of all cause total < 70 yr.	3.72%	1.81%	0.04%	17.74%	0.35%
Total <70 yr.	4,115	1,599	33	14,249	315
Total as % of all cause total < 70 yr.	6.15%	2.39%	0.05%	21.31%	0.47%

Numbers for alcohol are net numbers i.e., taking into consideration the beneficial effects of alcohol use

*Including cannabis (traffic accidents only)

[§]Including active and passive smoking

Table 8. Potential years of life lost due to mortality attributable to alcohol, illegal drugs and tobacco by age and sex, Canada 2002

	Alcohol	Illegal Drugs*	Cannabis	Tobacco [§]	Passive smoking
Males					
0 - 14	3,413	1,675	86	3,978	0
15 - 29	37,071	12,927	481	2,151	37
30 - 44	33,664	15,154	241	20,888	344
45 - 59	27,325	10,677	128	96,954	2,372
60+	11,907	1,873	54	192,445	4,215
Total Males	113,380	42,306	989	316,417	6,967
Male as % of all cause total	7.01%	2.61%	0.06%	19.56%	0.43%
Females					
0 - 14	1,933	703	64	2,459	0
15 - 29	7,416	5,679	199	1,750	16
30 - 44	9,787	7,312	102	13,163	156
45 - 59	11,840	4,681	76	54,633	1,109
60+	3,215	1,429	46	127,184	2,996
Total Females	34,191	19,805	488	199,191	4,277
Female as % of all cause total	2.32%	1.34%	0.03%	13.52%	0.29%
Total All	147,571	62,110	1,478	515,607	11,244
Total as % of all cause	4.77%	2.01%	0.05%	16.68%	0.36%

Numbers for alcohol are net numbers i.e., taking into consideration the beneficial effects of alcohol use

* Including cannabis (traffic accidents only)

§ Including active and passive smoking

Table 9. Costs of direct health care attributable to alcohol, illegal drugs and tobacco in Canada, 2002

Costs	(in millions dollars)			TOTAL
	Alcohol	Illegal drugs	Tobacco	
Acute care hospitalizations	1458.6	426.4	2551.2	4436.2
Psychiatric hospitalizations	19.6	11.5	--	31.2
Inpatient specialized treatment	754.9	352.1	--	1107.1
Outpatient specialized treatment	52.4	56.3	--	108.7
Ambulatory care physician fees	80.2	22.6	142.2	245.0
Family physician visits	172.8	48.8	306.3	527.9
Prescription drugs	767.6	216.8	1360.5	2344.9
TOTAL	3306.2	1134.6	4360.2	8800.9

Table 10. Overall health care costs attributable to alcohol, illegal drugs and tobacco by provinces, territories and Canada, 2002

Provinces	Alcohol	Illegal Drugs*	Cannabis	Tobacco [§]	Passive smoking	GROSS Total
British Columbia	\$550,981,434	\$241,630,876	\$20,375,651	\$605,447,226	\$7,052,339	\$1,398,059,537
Alberta	\$406,850,630	\$149,231,596	\$12,460,470	\$470,591,789	\$5,961,172	\$1,026,674,015
Saskatchewan	\$118,221,767	\$36,742,567	\$2,977,782	\$154,859,736	\$2,225,658	\$309,824,070
Manitoba	\$113,905,497	\$34,770,974	\$3,086,581	\$175,297,986	\$2,528,206	\$323,974,456
Ontario	\$1,160,104,734	\$373,786,833	\$13,328,784	\$1,553,091,863	\$17,873,434	\$3,086,983,430
Quebec	\$650,762,680	\$201,984,623	\$14,692,863	\$991,095,114	\$12,020,787	\$1,843,842,417
New Brunswick	\$120,804,282	\$43,398,473	\$1,930,521	\$120,106,346	\$1,571,450	\$284,309,101
Nova Scotia	\$97,258,752	\$26,820,891	\$2,825,711	\$161,507,074	\$2,242,568	\$285,586,718
Prince Edward Island	\$12,444,607	\$4,172,071	\$240,150	\$19,755,398	\$250,803	\$36,372,076
Newfoundland	\$62,186,245	\$18,333,968	\$550,148	\$95,217,802	\$1,712,253	\$175,738,015
Yukon	\$2,427,080	\$776,773	\$40,636	\$2,726,587	\$18,653	\$5,930,440
Northwest Territories	\$6,408,139	\$1,659,880	\$391,860	\$5,037,594	\$32,992	\$13,105,613
Nunavut	\$3,876,706	\$1,252,665	\$119,321	\$5,419,592	\$97,681	\$10,548,963
CANADA	\$3,306,232,552	\$1,134,562,190	\$73,020,478	\$4,360,154,108	\$53,587,998	\$8,800,948,850

* Including cannabis

[§]Including active and passive smoking tobacco

Table 11. Alcohol-attributable crimes and costs: provinces, territories, and Canada, 2002

	Canada	BC	Alberta	Sask	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	PEI	Nfld	Yukon	Northwest Territories	Nunavut
Population	31,414,000	4,141,272	3,113,586	1,011,808	1,150,848	12,068,301	7,455,208	756,652	944,765	139,913	531,595	29,924	41,403	28,715
Incidence data: Total crimes excluding traffic	2,384,247	478,347	289,873	135,262	129,935	732,930	424,732	50,001	71,890	10,673	31,003	7,995	13,340	8,266
Criminal code traffic accidents	117,633	15,037	16,388	10,218	3,809	35,450	28,174	2,711	2,832	651	1,335	357	544	127
Total crime incidents	2,501,880	493,384	306,261	145,480	133,744	768,380	452,906	52,712	74,722	11,324	32,338	8,352	13,884	8,393
Violent crime incidents	303,294	49,641	33,539	18,331	18,925	99,990	53,625	7,373	10,380	1,210	4,751	1,137	2,355	2,037
Alcohol-attributable crimes: provincial statutes	605,599	121,500	73,628	34,357	33,003	186,164	107,882	12,700	18,260	2,711	7,875	2,031	3,388	2,100
Criminal code impaired driving	28,655	3,663	3,992	2,489	928	8,636	6,863	660	690	159	325	87	133	31
Violent crimes due to alcohol	127,383	20,849	14,086	7,699	7,949	41,996	22,523	3,097	4,360	508	1,995	478	989	856
Alcohol-attributable total crimes	761,638	146,012	91,706	44,545	41,880	236,796	137,268	16,457	23,310	3,378	10,195	2,595	4,510	2,986
Alcohol-attributable crimes as % of all crimes	30.4%	29.6%	29.9%	30.6%	31.3%	30.8%	30.3%	31.2%	31.2%	29.8%	31.5%	31.1%	32.5%	35.6%
Total costs of policing (\$million)	\$6,149.19	\$654.99	\$530.31	\$175.47	\$211.77	\$2,596.18	\$1,616.83	\$104.54	\$130.55	\$17.07	\$66.25	\$10.51	\$19.33	\$16.21
Police costs attributable to alcohol incidents	\$1,871.97	\$193.84	\$158.79	\$53.73	\$66.31	\$800.08	\$490.03	\$32.64	\$40.72	\$5.09	\$20.89	\$3.27	\$6.28	\$5.77
Additional policing: liquor licensing	\$26.79	\$3.53	\$2.66	\$0.86	\$0.98	\$11.16	\$5.49	\$0.65	\$0.81	\$0.12	\$0.45	\$0.03	\$0.04	\$0.02
Total policing costs attributable to alcohol (\$million)	\$1,898.76	\$197.37	\$161.45	\$54.59	\$67.29	\$811.24	\$495.52	\$33.28	\$41.53	\$5.21	\$21.34	\$3.29	\$6.32	\$5.79

Source for Crime Statistics: Canadian Crime Statistics 2002. catalogue no. 85-205-XIE

Source for Crime Statistics: Canadian Crime Statistics 2002. catalogue no. 82-221-XIE

For liquor licensing Quebec and Ontario estimates of 1992 were used and inflated to 2002 (19.36%) then estimated based on per capita average in Ontario and Quebec

Table 12. Illegal drug-attributable crimes and costs: provinces, territories, and Canada, 2002

	Canada	BC	Alberta	Sask	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	PEI	Nfld	Yukon	Northwest Territories	Nunavut
Incidence data: Total crime incidents	2,501,880	493,384	306,261	145,480	133,744	768,380	452,906	52,712	74,722	11,324	32,338	8,352	13,884	8,393
Violent crime incidents	303,294	49,641	33,539	18,331	18,925	99,990	53,625	7,373	10,380	1,210	4,751	1,137	2,355	2,037
Illegal drug-attributable crimes: violations of drug laws	532,900	105,091	65,234	30,987	28,487	163,665	96,469	11,228	15,916	2,412	6,888	1,779	2,957	1,788
Violent crime due to illegal drugs	21,231	3,475	2,348	1,283	1,325	6,999	3,754	516	727	85	333	80	165	143
Illegal drug-attributable total crimes	554,131	108,566	67,581	32,270	29,812	170,664	100,223	11,744	16,642	2,497	7,221	1,859	3,122	1,930
Illegal drug-attributable crimes as % of all crimes	22.1%	22.0%	22.1%	22.2%	22.3%	22.2%	22.1%	22.3%	22.3%	22.0%	22.3%	22.3%	22.5%	23.0%
Total costs of policing (\$million)	6,149.19	654.99	530.31	175.47	211.77	2,596.18	1,616.83	104.54	130.55	17.07	66.25	10.51	19.33	16.21
Specialised drug enforcement	70.00	9.23	6.94	2.25	2.56	26.89	16.61	1.69	2.11	0.31	1.18	0.07	0.09	0.06
Police costs attributable to illegal drugs incidents	1,361.96	144.13	117.02	38.92	47.20	576.64	357.79	23.29	29.08	3.76	14.79	2.34	4.35	3.73
Total police costs attributable to illegal drugs (\$million)	1,431.96	153.35	123.96	41.18	49.77	603.53	374.40	24.98	31.18	4.07	15.98	2.41	4.44	3.79

Source for Crime Statistics: Canadian Crime Statistics 2002. catalogue no. 85-205-XIE

Source for Crime Statistics: Canadian Crime Statistics 2002. catalogue no. 82-221-XIE

For liquor licensing, Quebec and Ontario estimates of 1992 were used and inflated to 2002 (19.36%) then estimated based on per capita average in Ontario and Quebec

Table 13. Alcohol-attributable charges and costs: provinces, territories, and Canada, 2002

	Canada	BC	Alberta	Sask	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	PEI	Nfld	Yukon	Northwest Territories	Nunavut
Total charges excluding traffic	496,594	64,336	68,932	37,861	32,346	176,977	78,048	9,683	14,065	1,500	7,185	1,273	2,443	1,945
Criminal code traffic accidents - charges	80,830	9,336	13,219	6,254	3,189	24,073	18,285	2,216	2,179	447	978	219	372	63
Total charges	577,424	73,672	82,151	44,115	35,535	201,050	96,333	11,899	16,244	1,947	8,163	1,492	2,815	2,008
Violent crime charges	144,689	20,049	15,552	8,484	10,611	52,577	25,780	2,650	4,317	430	2,039	383	893	924
Alcohol-attributable charges: provincial statutes														
	126,135	16,341	17,509	9,617	8,216	44,952	19,824	2,459	3,573	381	1,825	323	621	494
Criminal code impaired driving	19,690	2,274	3,220	1,523	777	5,864	4,454	540	531	109	238	53	91	15
Violent crime charges due to alcohol	60,769	8,421	6,532	3,563	4,457	22,082	10,828	1,113	1,813	181	856	161	375	388
Alcohol-attributable total charges	206,594	27,036	27,261	14,703	13,449	72,899	35,106	4,112	5,916	670	2,920	538	1,086	897
Alcohol-attributable charges as % of all charges														
	35.8%	36.7%	33.2%	33.3%	37.8%	36.3%	36.4%	34.6%	36.4%	34.4%	35.8%	36.0%	38.6%	44.7%
Total court costs (\$million)	1,003.37	152.82	120.49	39.73	46.26	361.26	178.04	22.91	43.53	4.57	17.34	5.23	7.30	3.80
Legal aid & crown attorney costs for criminal cases (\$million)	430.63	32.76	43.06	14.68	8.31	193.90	76.30	6.48	15.12	1.23	2.82	10.60	14.37	11.02
Total court costs attributable to alcohol (\$million)	513.07	68.10	54.27	18.13	20.65	201.30	92.69	10.16	21.36	1.99	7.21	5.70	8.36	6.62

Source for Crime Statistics: Canadian Crime Statistics 2002. catalogue no. 85-205-XIE

Source for Crime Statistics: Canadian Crime Statistics 2002. catalogue no. 82-221-XIE

Table 14. Illegal drug-attributable charges and costs: provinces, territories, and Canada, 2002

	Canada	BC	Alberta	Sask	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	PEI	Nfld	Yukon	Northwest Territories	Nunavut
Charges data: total charges	577,424	73,672	82,151	44,115	35,535	201,050	96,333	11,899	16,244	1,947	8,163	1,492	2,815	2,008
Violent crime charges	144,689	20,049	15,552	8,484	10,611	52,577	25,780	2,650	4,317	430	2,039	383	893	924
Illegal drug-related charges: violations of drug laws	122,991	15,692	17,498	9,396	7,569	42,824	20,519	2,534	3,460	415	1,739	318	600	428
Violent crime charges due to drugs	10,128	1,403	1,089	594	743	3,680	1,805	186	302	30	143	27	63	65
Illegal drug-attributable total charges	133,120	17,096	18,587	9,990	8,312	46,504	22,324	2,720	3,762	445	1,881	345	662	492
Illegal drug-attributable charges as % of total charges	23.1%	23.2%	22.6%	22.6%	23.4%	23.1%	23.2%	22.9%	23.2%	22.8%	23.0%	23.1%	23.5%	24.5%
Total court costs (\$million)	1,003.37	152.82	120.49	39.73	46.26	361.26	178.04	22.91	43.53	4.57	17.34	5.23	7.30	3.80
Legal aid & crown attorney costs for criminal cases (\$million)	430.63	32.76	43.06	14.68	8.31	193.90	76.30	6.48	15.12	1.23	2.82	10.60	14.37	11.02
Total court costs attributable to illegal drugs (\$million)	330.60	43.06	37.00	12.32	12.76	128.41	58.94	6.72	13.58	1.32	4.65	3.66	5.10	3.63

Source for Crime Statistics: Canadian Crime Statistics 2002. catalogue no. 85-205-XIE

Source for Crime Statistics: Canadian Crime Statistics 2002. catalogue no. 82-221-XIE

Table 15. Alcohol and illegal drug-attributable provincial and federal prison sentences and costs: provinces, territories, and Canada, 2002

	Canada	BC	Alberta	Sask	Manitoba	Ontario	Quebec	New Brunswick	Nova Scotia	PEI	Nfld	Yukon	Northwest Territories	Nunavut
Population	31,414,000	4,141,272	3,113,586	1,011,808	1,150,848	12,068,301	7,455,208	756,652	944,765	139,913	531,595	29,924	41,403	28,715
Total Sentenced to Provincial Custody	83,885	8,740	16,190	3,576	3,316	33,050	13,423	1,458	1,376	594	1,031	206	685	240
Provincial adult corrections costs(millions\$)	\$933.300	\$145.890	\$71.717	\$53.007	\$48.953	\$393.887	\$150.520	\$12.401	\$12.028	\$4.331	\$18.059	\$5.855	\$12.505	\$4.147
Sentenced for alcohol offence	19,965	2,080	3,853	851	789	7,866	3,195	347	327	141	245	49	163	57
Sentenced for violent crime: alcohol	4,271	445	824	182	169	1,683	683	74	70	30	52	10	35	12
Sentenced for illegal drugs offence	19,126	1,993	3,691	815	756	7,535	3,060	332	314	135	235	47	156	55
Sentenced for violent crime: illegal drugs	712	74	137	30	28	280	114	12	12	5	9	2	6	2
Costs attributable to alcohol (\$million)	\$269.6	\$42.1	\$20.7	\$15.3	\$14.1	\$113.8	\$43.5	\$3.6	\$3.5	\$1.3	\$5.2	\$1.7	\$3.6	\$1.2
Costs attributable to illegal drugs (\$million)	\$220.7	\$34.5	\$17.0	\$12.5	\$11.6	\$93.1	\$35.6	\$2.9	\$2.8	\$1.0	\$4.3	\$1.4	\$3.0	\$1.0
Total youth offenders sentenced to provincial custody*	7,278	563	1,038	873	277	3,031	819	235	24	39	282	18	53	26
Young offender corrections costs (\$million)	\$547.434	\$72.168	\$54.259	\$17.632	\$20.055	\$210.307	\$129.918	\$13.186	\$16.464	\$2.438	\$9.264	\$0.521	\$0.722	\$0.500
Sentenced for alcohol offence	1,732	134	247	208	66	721	195	56	6	9	67	4	13	6
Sentenced for violent crime: alcohol	371	29	53	44	14	154	42	12	1	2	14	1	3	1
Sentenced for illegal drugs offence	1,659	128	237	199	63	691	187	54	5	9	64	4	12	6
Sentenced for violent crime: illegal drugs	62	5	9	7	2	26	7	2	0	0	2	0	0	0
Costs attributable to alcohol (\$million)	\$158.2	\$20.9	\$15.7	\$5.1	\$5.8	\$60.8	\$37.5	\$3.8	\$4.8	\$0.7	\$2.7	\$0.2	\$0.2	\$0.1
Costs attributable to illegal drugs (\$million)	\$129.5	\$17.1	\$12.8	\$4.2	\$4.7	\$49.7	\$30.7	\$3.1	\$3.9	\$0.6	\$2.2	\$0.1	\$0.2	\$0.1
Total sentenced to Federal Custody	7,659	896	1,305	424	482	1,904	1,758	277	346	51	194	6	9	6
Federal adult corrections costs (millions\$)	\$977.229	\$128.827	\$96.858	\$31.475	\$35.801	\$375.422	\$231.917	\$23.538	\$29.390	\$4.352	\$16.537	\$0.931	\$1.288	\$0.893
Sentenced for alcohol offence	1,823	213	311	101	115	453	418	66	82	12	46	2	2	1
Sentenced for illegal drug offence	1,746	204	297	97	110	434	401	63	79	12	44	1	2	1
Costs attributable to alcohol (\$million)	\$232.6	\$30.7	\$23.1	\$7.5	\$8.5	\$89.4	\$55.2	\$5.6	\$7.0	\$1.0	\$3.9	\$0.2	\$0.3	\$0.2
Costs attributable to illegal drugs (\$million)	\$222.8	\$29.4	\$22.1	\$7.2	\$8.2	\$85.6	\$52.9	\$5.4	\$6.7	\$1.0	\$3.8	\$0.2	\$0.3	\$0.2
Total corrections costs attributable to alcohol (\$million)	\$660.4	\$93.7	\$59.4	\$27.9	\$28.5	\$263.9	\$136.2	\$13.0	\$15.2	\$3.0	\$11.8	\$2.1	\$4.1	\$1.6
Total corrections costs attributable to illegal drugs (\$million)	\$573.0	\$80.9	\$51.9	\$23.9	\$24.5	\$228.5	\$119.2	\$11.4	\$13.4	\$2.6	\$10.2	\$1.7	\$3.4	\$1.3

Provincial totals taken from catalogue 85-211, Table 6

Federals totals taken from catalogue 85-211, Table 28

Alcohol figures attained by adding impaired driving with liquor offences (pages 20 and 21 in catalogue 85-211)

Alcohol offence includes both impaired driving and "other criminal code traffic" offence (less than 5% are these other ones)

Youth offender costs were available for 1998/99 (inflated for fiscal year 2002/2003)

Youth offenders sentenced - Juristat Cat. No 85-002 vol. 24(2) table 5 (only those sentenced to secured custodies are counted)

Table 16. The social costs of alcohol, illegal drugs and tobacco abuse in Canada, 2002

	(in millions dollars)			
	Alcohol	Illegal drugs	Tobacco	TOTAL ADT
1. Direct health care costs: total	3,306.2	1,134.6	4,360.2	8,800.9
1.1 morbidity - acute care hospitalization	1,458.6	426.37	2,551.2	4,436.2
- psychiatric hospitalization	19.6	11.5	--	31.2
1.2 inpatient specialized treatment	754.9	352.1	--	1,107.1
1.3 outpatient specialized treatment	52.4	56.3	--	108.7
1.4 ambulatory care: physician fees	80.2	22.6	142.2	245.0
1.5 family physician visit	172.8	48.8	306.3	527.9
1.6 prescription drugs	767.6	216.8	1,360.5	2,344.9
2. Direct law enforcement costs	3,072.2	2,335.5		5,407.8
2.1 police	1,898.8	1,432.0	--	3,330.7
2.2 courts	513.1	330.6	--	843.7
2.3 corrections (including probation)	660.4	573.0	--	1,233.4
3. Direct costs for prevention and research	53.0	16.5	78.1	147.6
3.1 research	17.3	8.6	9.0	34.9
3.2 prevention programs	33.9	7.9	69.1	110.9
3.3 salaries and operating funds	1.8	--	--	1.8
4. Other direct costs	996.1	79.1	87.0	1,162.2
4.1 fire damage	156.5	--	86.5	243.0
4.2 traffic accident damage	756.9	67.0	--	823.9
4.3 losses associated with the workplace	17.0	6.6	0.5	24.1
<i>4.3.1 EAP & health promotion programs</i>	<i>17.0</i>	<i>4.2</i>	<i>0.5</i>	<i>21.7</i>
<i>4.3.2 drug testing in the workplace</i>	<i>--</i>	<i>2.4</i>	<i>N/A</i>	<i>2.4</i>
4.4 administrative costs for transfer payments	65.8	5.4	0.0	71.3
<i>4.4.1 social welfare and other programs</i>	<i>4.3</i>	<i>--</i>	<i>--</i>	<i>4.3</i>
<i>4.4.2 workers' compensation</i>	<i>61.5</i>	<i>5.4</i>	<i>--</i>	<i>66.9</i>
5. Indirect costs: productivity losses (main scenario)	7,126.4	4,678.6	12,470.9	24,275.9
5.1 due to long-term disability	6,163.9	4,408.4	10,536.8	21,109.1
5.2 due to short-term disability (days in bed)	15.9	21.8	24.4	62.0
5.3 due to short-term disability (days with reduced activity)	23.6	-0.1	36.2	59.8
5.4 due to premature mortality	923.0	248.5	1,873.5	3,045.0
Total	14,554.0	8,244.3	16,996.2	39,794.4
Total per capita (in \$)	\$463	\$262	\$541	\$1,267
Total as % of all substance-related costs	36.6%	20.7%	42.7%	100.0%

ADT - Alcohol, Illegal Drugs, and Tobacco

N/A - not applicable

"--" not available

EAP - Employee Assistance Programs

Categories in italics are sub-categories of immediate prior category

Table 17. Comparison of mortality and morbidity indicators using Single et al., 1996 methodology

	All deaths caused			% of all deaths		
	1992	2002	Difference	1992	2002	Relative Difference*
Alcohol	6,701	9,100	2,399	3.4%	4.1%	19.6%
Illegal drugs	732	1,455	723	0.4%	0.7%	75.1%
Tobacco	33,498	37,208	3,710	17.0%	16.6%	-2.2%
All substances combined	40,931	47,763	6,832	20.8%	21.4%	2.8%
	All deaths caused under age 70 years			% of all deaths under age 70		
Alcohol	4,913	5,500	587	6.6%	8.2%	23.9%
Illegal drugs	719	1,441	722	1.0%	2.2%	121.8%
Tobacco	16,077	13,579	-2,498	21.7%	20.3%	-6.5%
All substances combined	21,709	20,520	-1,189	29.3%	30.7%	4.6%
	PYLL			% of all PYLL		
Alcohol	186,257	209,096	22,839	6.05%	6.76%	11.9%
Illegal drugs	31,147	59,220	28,073	1.01%	1.92%	89.4%
Tobacco	495,640	504,609	8,969	16.09%	16.32%	1.4%
All substances combined	713,044	772,925	59,881	23.15%	25.00%	8.0%
	Acute care hospital days			% of all hospital days		
Alcohol	1,149,106	1,550,554	401,448	2.8%	7.2%	160.4%
Illegal drugs	58,571	318,409	259,838	0.1%	1.5%	948.9%
Tobacco	3,024,265	2,316,166	-708,099	7.3%	10.8%	47.8%
All substances combined	4,231,942	4,185,129	-46,813	10.2%	19.5%	90.8%

Please note that the numbers for alcohol are gross numbers; that is, they only account for mortality and morbidity caused by alcohol and not mortality and morbidity prevented by alcohol

* Adjusted for trends in all-cause level of respective health indicator, i.e. all-cause mortality, PYLL and acute care hospitalizations

PYLL - potential years of life lost

Table 18. Comparison of mortality and morbidity using Single et al., 1996 and Rehm et al., 2006 methodology

	1992		2002		1992 vs 2002		Relative Difference*
	Single et al., 1996	Single et al., 1996	Rehm et al., 2006	Rehm et al., 2006	1992	2002	
All deaths caused							
Alcohol	6,701	9,100	8,103	8,103	3.4%	3.6%	6.5%
Illegal drugs	732	1,455	1,695	1,695	0.4%	0.8%	104.0%
Tobacco	33,498	37,208	37,209	37,209	17.0%	16.6%	-2.2%
All substances combined	40,931	47,763	47,007	47,007	20.8%	21.0%	1.2%
All deaths caused under age 70 years							
Alcohol	4,913	5,500	5,061	5,061	6.6%	7.6%	14.0%
Illegal drugs	719	1,441	1,599	1,599	1.0%	2.4%	146.1%
Tobacco	16,077	13,579	14,249	14,249	21.7%	21.3%	-1.9%
All substances combined	21,709	20,520	20,909	20,909	29.3%	31.3%	6.6%
All PYLL							
Alcohol	186,257	209,096	191,136	191,136	6.0%	6.2%	2.2%
Illegal drugs	31,147	59,220	62,110	62,110	1.0%	2.0%	98.7%
Tobacco	495,640	504,609	515,607	515,607	16.1%	16.7%	3.7%
All substances combined	713,044	772,925	768,853	768,853	23.1%	24.9%	7.4%
Acute hospital days							
Alcohol	1,149,106	1,550,554	1,587,054	1,587,054	2.8%	7.4%	166.5%
Illegal drugs	58,571	318,409	352,121	352,121	0.1%	1.6%	1060.0%
Tobacco	3,024,265	2,316,166	2,210,155	2,210,155	7.3%	10.3%	41.0%
All substances combined	4,231,942	4,185,129	4,149,330	4,149,330	10.2%	19.4%	89.2%

Please note that the numbers for alcohol are gross numbers; that is, they only account for mortality and morbidity caused by alcohol and not mortality and morbidity prevented by alcohol

* Adjusted for trends in all-cause level of respective health indicator, i.e. all-cause mortality, PYLL and acute care hospitalizations

PYLL - potential years of life lost

Table 19a. Sensitivity analyses of substance-attributable indirect costs (in million \$)

	Main Scenario	Friction Cost Approach	Human Capital Approach
Costs of productivity losses due to long-term disability			
Alcohol	\$6,163.9	\$133.1	\$9,848.5
Illegal drugs	\$4,408.4	\$93.1	\$7,046.9
Tobacco	\$10,536.8	\$235.9	\$16,821.6
Total	\$21,109.1	\$462.1	\$33,717.0
Costs of productivity losses due to premature mortality			
Alcohol	\$923.0	\$30.0	\$1,822.7
Illegal drugs	\$248.5	\$7.2	\$468.6
Tobacco	\$1,873.5	\$68.7	\$3,148.6
Total	\$3,045.0	\$105.8	\$5,440.0
TOTAL	\$24,154.1	\$567.9	\$39,157.0

Table 19b. Sensitivity analyses of substance-attributable direct and indirect costs (in million \$)

	Main Scenario	Friction Cost Approach	Human Capital Approach
Direct health care costs			
Alcohol	\$3,306.2	\$3,306.2	\$3,306.2
Illegal drugs	\$1,134.6	\$1,134.6	\$1,134.6
Tobacco	\$4,360.2	\$4,360.2	\$4,360.2
Total	\$8,800.9	\$8,800.9	\$8,800.9
Direct law enforcement costs			
Alcohol	\$3,072.2	\$3,072.2	\$3,072.2
Illegal drugs	\$2,335.5	\$2,335.5	\$2,335.5
Tobacco			
Total	\$5,407.8	\$5,407.8	\$5,407.8
Direct costs for prevention and research			
Alcohol	\$53.0	\$53.0	\$53.0
Illegal drugs	\$16.5	\$16.5	\$16.5
Tobacco	\$78.1	\$78.1	\$78.1
Total	\$147.6	\$147.6	\$147.6
Other direct costs			
Alcohol	\$996.1	\$996.1	\$996.1
Illegal drugs	\$79.1	\$79.1	\$79.1
Tobacco	\$87.0	\$87.0	\$87.0
Total	\$1,162.2	\$1,162.2	\$1,162.2
TOTAL DIRECT COSTS	\$15,518.5	\$15,518.5	\$15,518.5
Indirect costs of productivity losses due to short-term disability			
Alcohol	\$39.5	\$39.5	\$39.5
Illegal drugs	\$21.7	\$21.7	\$21.7
Tobacco	\$60.6	\$60.6	\$60.6
Total	\$121.8	\$121.8	\$121.8
Indirect costs of productivity losses due to long-term disability			
Alcohol	\$6,163.9	\$133.1	\$9,848.5
Illegal drugs	\$4,408.4	\$93.1	\$7,046.9
Tobacco	\$10,536.8	\$235.9	\$16,821.6
Total	\$21,109.1	\$462.1	\$33,717.0
Indirect costs of productivity losses due to premature mortality			
Alcohol	\$923.0	\$30.0	\$1,822.7
Illegal drugs	\$248.5	\$7.2	\$468.6
Tobacco	\$1,873.5	\$68.7	\$3,148.6
Total	\$3,045.0	\$105.8	\$5,440.0
TOTAL INDIRECT COSTS	\$24,275.9	\$689.7	\$39,278.8
TOTAL	\$39,794.4	\$16,208.3	\$54,797.3

Table 20. Total costs of substance abuse in Canadian provinces, 2002

Province	BC	AB	SK	MB	ON	QC	NB	NS	PE	NF	YT	NW	NV
Population	4,141,272	3,113,586	1,011,808	1,150,848	12,068,301	7,455,208	756,652	944,765	139,913	531,595	29,924	41,403	28,715
GDP (\$million LCU)	149,957	112,744	36,638	41,673	436,997	269,956	27,399	34,210	5,066	19,249	1,084	1,499	1,040
Alcohol total costs (\$million)	2,219.0	1,640.6	508.7	518.4	5,318.4	3,098.8	451.7	418.9	53.9	246.5	20.6	39.5	27.6
Total as % of GDP	1.5	1.5	1.4	1.2	1.2	1.1	1.6	1.2	1.1	1.3	1.9	2.6	2.7
Total per capita (\$)	536	527	503	450	441	416	597	443	385	464	687	954	961
Total as % of all substance abuse	36.6	37.3	36.9	35.4	37.2	35.7	38.1	33.7	33.2	33.5	47.4	49.3	44.0
Illegal drugs total costs (\$million)	1,507.9	979.0	268.6	270.0	2,923.5	1,626.9	264.4	200.2	30.1	126.8	12.0	21.5	15.1
Total as % of GDP	1.0	0.9	0.7	0.6	0.7	0.6	1.0	0.6	0.6	0.7	1.1	1.4	1.5
Total per capita (\$)	364	314	265	235	242	218	349	212	215	239	400	520	526
Total as % of all substance abuse	24.9	22.2	19.5	18.4	20.4	18.7	22.3	16.1	18.5	17.2	27.6	26.9	24.1
Tobacco total costs (\$million)	2,331.2	1,782.9	599.7	676.2	6,057.2	3,963.5	468.0	625.5	78.6	363.7	10.8	19.1	20.0
Total as % of GDP	1.6	1.6	1.6	1.6	1.4	1.5	1.7	1.8	1.6	1.9	1.0	1.3	1.9
Total per capita (\$)	563	573	593	588	502	532	618	662	562	684	362	460	697
Total as % of all substance abuse	38.5	40.5	43.5	46.2	42.4	45.6	39.5	50.3	48.3	49.3	25.0	23.8	31.9
Total substance abuse costs (\$million)	6,058.1	4,402.6	1,376.9	1,464.6	14,299.1	8,689.2	1,184.1	1,244.6	162.5	737.0	43.4	80.1	62.7
Total per capita (\$)	1,463	1,414	1,361	1,273	1,185	1,166	1,565	1,317	1,162	1,386	1,449	1,934	2,184

LCU - Local Currency Unit

Figure 1. Total social costs of alcohol, illegal drugs and tobacco abuse in Canada, 2002 (in million \$)

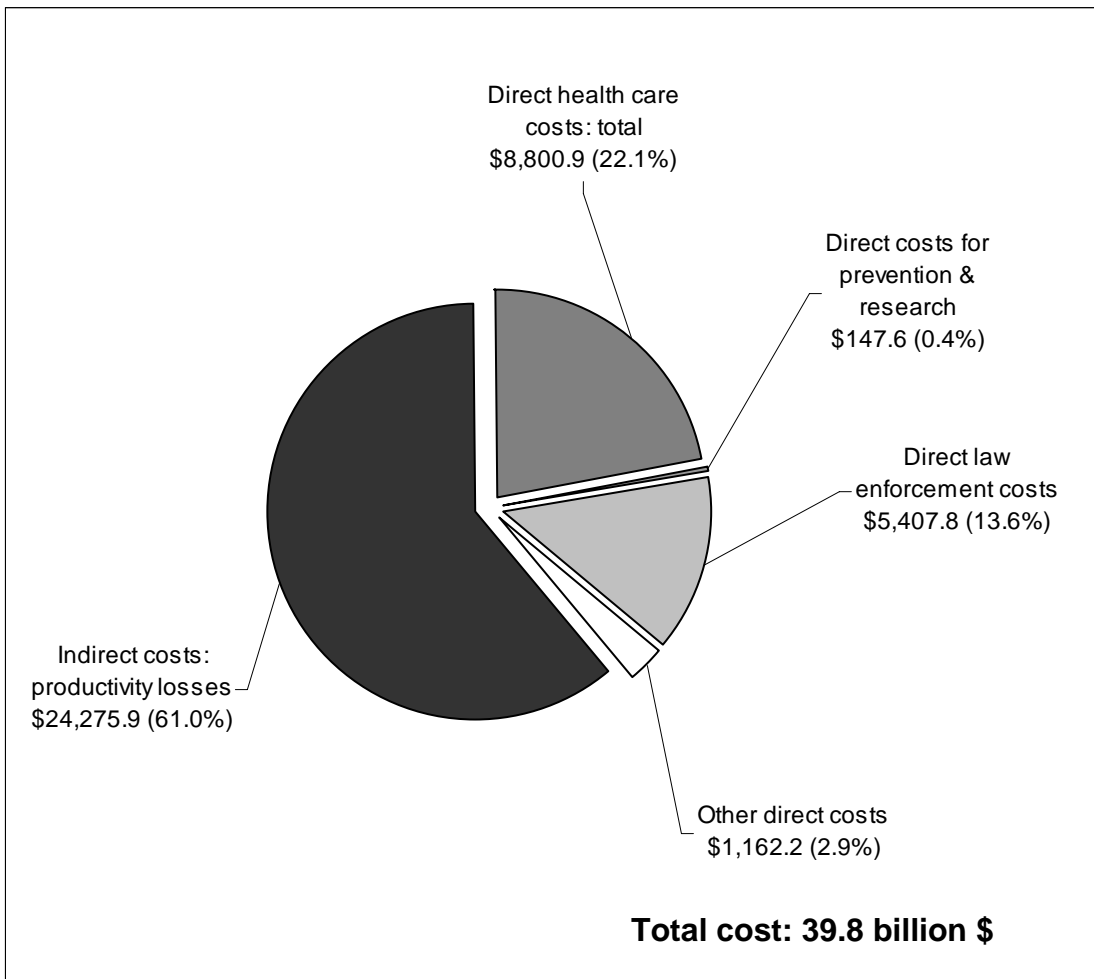
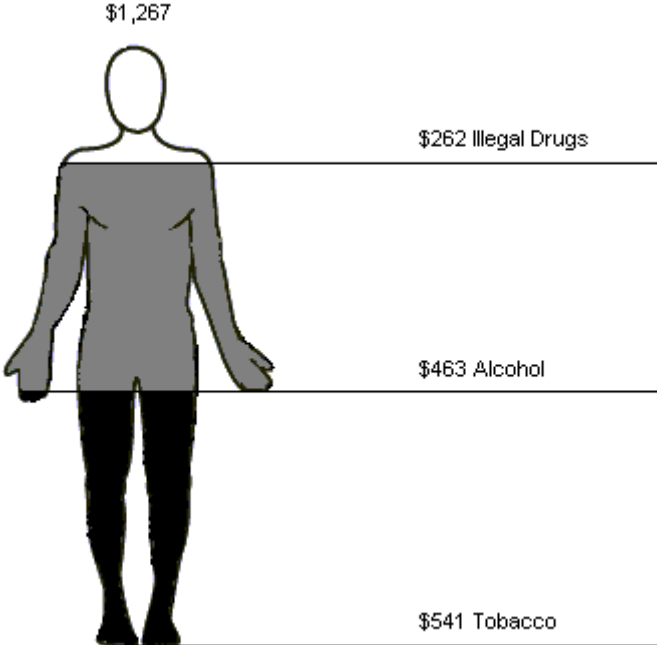


Figure 2. Total social costs of substance abuse *per capita* in Canada, 2002



Appendix 1. ICD-10 codes for disease conditions attributable to alcohol and sources for determining risk relations including alcohol-attributable fractions (AAFs)

Condition	ICD-10 Code	Source for meta-analysis or AAF
Malignant neoplasms		
Oropharyngeal cancer	C00 - C14	Gutjahr et al., 2001
Oesophageal cancer	C15	Gutjahr et al., 2001
Liver cancer	C22	Gutjahr et al., 2001
Laryngeal cancer	C32	Gutjahr et al., 2001
Breast cancer	C50	Ridolfo & Stevenson, 2001
Other neoplasms	D00-D48	Rehm et al., 2004
Diabetes		
Diabetes mellitus	E10 - E14	Gutjahr et al., 2001
Neuro-psychiatric conditions		
Alcoholic psychoses	F10.0, F10.3 - F10.9	100% AAF per definition
Alcohol dependence syndrome	F10.2	100% AAF per definition
Alcohol abuse	F10.1	100% AAF per definition
Unipolar major depression	F32 - F33	Rehm et al., 2004
Degeneration of nervous system due to alcohol	G31.2	100% AAF per definition
Epilepsy	G40 - G41	Gutjahr et al., 2001
Alcoholic polyneuropathy	G62.1	100% AAF per definition
Cardiovascular diseases		
Hypertensive disease	I10 - I15	Corrao et al., 1999
Ischaemic heart disease	I20 - I25	Corrao et al., 2000; Rehm et al., 2004
Alcoholic cardiomyopathy	I42.6	100% AAF per definition
Cardiac arrhythmias	I47 - I49	Gutjahr et al., 2001
Heart failure and ill-defined complications of heart disease	I50 - I52, I23, I25.0, I97.0, I97.1, I98.1	This is an unspecific category with no identification of underlying pathology. Therefore, the relationship between average volume of consumption cannot be determined by usual meta-analysis.
Cerebrovascular disease	I60 - I69	
Ischaemic stroke	I60 - I62	Reynolds et al., 2003
Haemorrhagic stroke	I63 - I66	Reynolds et al., 2003
Oesophageal varices	I85	Gutjahr et al., 2001
Digestive diseases		
Alcoholic gastritis	K29.2	100% AAF per definition
Cirrhosis of the liver	K70, K74	Rehm et al., 2004

Cholelithiasis	K80	Gutjahr et al., 2001
Acute and chronic pancreatitis	K85, K86.1	Corrao et al., 1999
Chronic pancreatitis (alcohol induced)	K86.0	100% AAF per definition
Skin diseases		
Psoriasis	L40	Gutjahr et al., 2001
Conditions arising during the perinatal period		
Low birth weight & short gestation (as defined by the global burden of disease study) *	P05 - P07	Gutjahr et al., 2001
Foetal alcohol syndrome (dysmorphic)	Q86.0	100% AAF per definition
Unintentional injuries		
Motor vehicle accidents	§	Traffic Injury Research Foundation of Canada, 2004; Transport Canada, 2004
Poisonings	X40 - X49	Rehm et al., 2004; adjusted to Canada by AAF for traffic accidents
Accidental poisoning & exposure to alcohol	X45	100% AAF per definition
Falls	W00 - W19	Rehm et al., 2004; adjusted to Canada by AAF for traffic accidents
Fires	X00 - X09	Council of Canadian Fire Marshals and Fire Commissioners, 2003.
Drowning	W65-W74	Rehm et al., 2004; adjusted to Canada by AAF for traffic accidents
Other unintentional injuries	† Rest of V & W20 - W64, W75 - W99, X10 -X39, X50 - X59, Y40 -Y86, Y88, Y89	Rehm et al., 2004; adjusted to Canada by AAF for traffic accidents
Intentional injuries		
Suicide, self-inflicted injuries	X60 - X84, Y87.0	Rehm et al., 2004; adjusted to Canada by AAF for traffic accidents
Intentional self-poisoning by and exposure to alcohol	X65	100% AAF per definition
Homicide	X85 -Y09, Y87.1	Rehm et al., 2004; adjusted to Canada by AAF for traffic accidents
Other intentional injuries	Y35	Rehm et al., 2004; adjusted to Canada by AAF for traffic accidents
Ethanol and methanol toxicity, undetermined intent	Y15	100% AAF per definition
Finding of alcohol in blood	R78.0	100% AAF per definition

* Relative risk refers to drinking of mothers

§ V021-V029, V031-V039, V041-V049, V092, V093, V123-V129, V133-V139, V143-V149, V194-V196, V203-V209, V213-V219, V223-V229, V233-V239, V243-V249, V253-V259, V263-V269, V273-V279, V283-V289, V294-V299, V304-V309, V314-V319, V324-V329, V334-V339, V344-V349, V354-V359, V364-V369, V374-V379, V384-V389, V394-V399, V404-V409, V414-V419, V424-V429, V434-V439, V444-V449, V454-V459, V464-V469, V474-V479, V484-V489, V494-V499, V504-V509, V514-V519, V524-V529, V534-V539, V544-V549, V554-V559, V564-V569, V574-V579, V584-V589, V594-V599, V604-V609, V614-V619, V624-V629, V634-V639, V644-V649, V654-V659, V664-V669, V674-V679, V684-V689, V694-V699, V704-V709, V714-V719, V724-V729, V734-V739, V744-V749, V754-V759, V764-V769, V774-V779, V784-V789, V794-V799, V803-V805, V811, V821, V830-V833, V840-V843, V850-V853, V860-V863, V870-V878, V892.

† Rest of V = V-series MINUS §

Appendix 2. ICD-10 codes for disease conditions attributable to illegal drugs and sources for determining risk relations including drug-attributable fractions (DAFs)

Condition	ICD-10	Source for meta-analysis or DAF
Mental & behavioural disorders due to use of		
Opioids	F11	100% DAF per definition
Cannabinoids	F12	100% DAF per definition
Cocaine	F14	100% DAF per definition
Other stimulants, including caffeine	F15	100% DAF per definition
Hallucinogens	F16	100% DAF per definition
Multiple drug use of other psychoactive substances	F19	100% DAF per definition
Drug psychoses	--	100% DAF per definition
Infectious diseases		
HIV	B20-B24	Geduld et al., 2003
Viral hepatitis C	B17.1, B18.2	Remis, 2004
Viral hepatitis B	B16, B18.0-B18.1	Single et al., 1996
Infective (acute and subacute) endocarditis	I33	Single et al., 1996
Conditions arising during the perinatal period		
Pregnancy complications	O44-O46, O67, O35.5, O36.5	Relative risk for low birth weight was taken from English et al., 1995
Foetus and newborn affected by maternal use of drugs of addiction	P04.4	Relative risk for low birth weight was taken from English et al., 1995
Neonatal conditions; low birth weight & short gestation; maternal opiate use	P02.0-P02.2, P04.8, P05-P07, P96.1	Relative risk for low birth weight was taken from English et al., 1995
Unintentional injuries		
Cannabis attributable traffic accidents	Specific codes V01-V89*	MacDonald et al., 2003
Cocaine attributable traffic accidents	Specific codes V01-V89*	MacDonald et al., 2003
Accidental poisoning by and exposure to narcotics and psychodysleptics [hallucinogens], not elsewhere classified	X42	100% DAF per definition
Intentional injuries		
Suicide, self-inflicted injuries	X60-X84, Y87.0	see methodology section in Popova et al., submitted a

Homicide	X85-Y09, Y87.1	100% DAF per definition
Poisonings		
Poisoning by Opium	T40.0	100% DAF per definition
Heroin	T40.1	100% DAF per definition
Other opioids	T40.2	100% DAF per definition
Methadone	T40.3	100% DAF per definition
Other synthetic narcotics	T40.4	100% DAF per definition
Cocaine	T40.5	100% DAF per definition
Cannabis	T40.7	100% DAF per definition
Local anaesthetics (cocaine)	T41.3	100% DAF per definition
Drugs, medicaments and biological substances causing adverse effects in therapeutic use		
Opioids and related analgesics causing adverse effects in therapeutic use	Y45.0	100% DAF per definition

* V021-V029, V031-V039, V041-V049, V092, V093, V123-V129, V133-V139, V143-V149, V194-V196, V203-V209, V213-V219, V223-V229, V233-V239, V243-V249, V253-V259, V263-V269, V273-V279, V283-V289, V294-V299, V304-V309, V314-V319, V324-V329, V334-V339, V344-V349, V354-V359, V364-V369, V374-V379, V384-V389, V394-V399, V404-V409, V414-V419, V424-V429, V434-V439, V444-V449, V454-V459, V464-V469, V474-V479, V484-V489, V494-V499, V504-V509, V514-V519, V524-V529, V534-V539, V544-V549, V554-V559, V564-V569, V574-V579, V584-V589, V594-V599, V604-V609, V614-V619, V624-V629, V634-V639, V644-V649, V654-V659, V664-V669, V674-V679, V684-V689, V694-V699, V704-V709, V714-V719, V724-V729, V734-V739, V744-V749, V754-V759, V764-V769, V774-V779, V784-V789, V794-V799, V803-V805, V811, V821, V830-V833, V840-V843, V850-V853, V860-V863, V870-V878, V892

Appendix 3. ICD-10 codes for disease conditions attributable to tobacco and sources for determining risk relations including smoking-attributable fractions (SAFs)

Condition	ICD-10	Source for meta-analysis or SAF
Mental and behavioural disorders due to use of tobacco	F17	100% SAF per definition
Toxic effect of tobacco and nicotine	T65.2	100% SAF per definition
Malignant neoplasms		
Oropharyngeal cancer	C00-C14, D00.0	English et al., 1995
Oesophageal cancer	C15, D00.1	English et al., 1995
Stomach cancer	C16, D00.2	Tredaniel et al., 1997
Pancreas cancer	C25, D01.9	English et al., 1995
Laryngeal cancer	C32, D02.0	English et al., 1995
Trachea, bronchus and lung cancers	C33-C34	Simonato et al., 2001
Cervical cancer	C53, D06	Plummer et al., 2003
Urinary tract cancer	C64-C68	Zeegers et al., 2000
Renal cell carcinoma	C64	Hunt, 2005
Bladder cancer	C67, D09.0	Brennan et al., 2000; 2001
Acute myeloid leukaemia	C92.0	Brownson et al., 1993
Cardiovascular diseases		
Ischaemic heart disease	I20-I25	Law, 1997 & Law, 2003
Pulmonary circulatory disease	I26-I28	English et al., 1995
Cardiac arrhythmias	I47-I49	Follow IHD
Heart failure; complications and ill-defined descriptions and of heart disease	I50-I51	Follow IHD
Cerebrovascular diseases	I60-I69	English et al., 1995
Atherosclerosis	I70-I79	English et al., 1995
Respiratory diseases		
Pneumonia & influenza	J10-J18	English et al., 1995
Chronic obstructive pulmonary disease	J40-J44	Single et al., 1996
Ulcers	K25-K28	English et al., 1995
Conditions arising during the perinatal period		
Foetus and newborn affected by maternal use of tobacco	P04.2	100% SAF per definition
Low birth weight & short gestation	P05-P07	English et al., 1995
Sudden infant death syndrome	R95	English et al., 1995
Unintentional injuries		
Fires	X00-X09	Council of Canadian Fire Marshals and Fire Commissioners, 2003

Appendix 4. Continued

CONDITION	Alcohol-attributable fractions													
	0-14 yrs		15-29 yrs		30-44 yrs		45-59 yrs		60-69 yrs		70-79 yrs		80+ yrs	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
SKIN DISEASES														
Psoriasis	--	--	0.317	0.204	0.300	0.191	0.281	0.178	0.262	0.164	0.248	0.154	0.234	0.143
CONDITIONS ARISING DURING THE PERINATAL PERIOD														
Low birth weight	0.068	0.068	--	--	--	--	--	--	--	--	--	--	--	--
Fetal alcohol syndrome	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UNINTENTIONAL INJURIES														
Motor vehicle accidents	0.143	0.095	0.345	0.127	0.354	0.169	0.195	0.149	0.110	0.078	0.110	0.078	0.110	0.078
Poisonings	0.000	0.000	0.188	0.151	0.096	0.090	0.105	0.105	0.073	0.069	0.039	0.035	0.039	0.035
<i>Accidental poisoning & exposure to alcohol</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>
Falls	0.000	0.000	0.145	0.091	0.135	0.084	0.149	0.149	0.078	0.043	0.056	0.017	0.056	0.017
Fires	0.155	0.155	0.241	0.114	0.207	0.103	0.172	0.083	0.138	0.062	0.117	0.052	0.097	0.041
Drownings	0.000	0.000	0.169	0.163	0.185	0.180	0.204	0.204	0.117	0.112	0.117	0.112	0.117	0.112
Other unintentional injuries	0.096	0.027	0.188	0.151	0.174	0.140	0.161	0.161	0.112	0.086	0.112	0.086	0.112	0.086
INTENTIONAL INJURIES														
Self-inflicted injuries	0.000	0.000	0.097	0.067	0.090	0.062	0.074	0.074	0.052	0.039	0.022	0.022	0.022	0.022
<i>Intentional self-poisoning by and exposure to alcohol</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>
Homicide	0.080	0.080	0.175	0.175	0.163	0.163	0.180	0.180	0.125	0.125	0.125	0.125	0.125	0.125
Other Intentional injuries	0.000	0.000	0.133	0.133	0.124	0.124	0.136	0.136	0.095	0.095	0.048	0.048	0.048	0.048
OTHER														
Ethanol and methanol toxicity, undetermined intent	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Finding of alcohol in blood	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Categories in italic are subcategories of immediate prior category

Appendix 5. Continued

CONDITION	Alcohol-attributable fractions													
	0-14 yrs		15-29 yrs		30-44 yrs		45-59 yrs		60-69 yrs		70-79 yrs		80+ yrs	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
SKIN DISEASES														
Psoriasis	--	--	0.317	0.204	0.300	0.191	0.281	0.178	0.262	0.164	0.248	0.154	0.234	0.143
CONDITIONS ARISING DURING THE PERINATAL PERIOD														
Low birth weight & short gestation	0.068	0.068	--	--	--	--	--	--	--	--	--	--	--	--
Fetal alcohol syndrome	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
UNINTENTIONAL INJURIES														
Motor vehicle accidents	0.215	0.143	0.517	0.190	0.531	0.253	0.293	0.223	0.165	0.117	0.165	0.117	0.165	0.117
Poisonings	0.000	0.000	0.422	0.340	0.215	0.202	0.237	0.237	0.165	0.156	0.088	0.078	0.088	0.078
<i>Accidental poisoning & exposure to alcohol</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>
Falls	0.000	0.000	0.326	0.204	0.303	0.190	0.335	0.335	0.175	0.097	0.126	0.039	0.126	0.039
Fires	0.349	0.349	0.543	0.256	0.465	0.233	0.388	0.186	0.310	0.140	0.264	0.116	0.217	0.093
Drownings	0.000	0.000	0.381	0.367	0.417	0.405	0.460	0.460	0.263	0.253	0.263	0.253	0.263	0.253
Other unintentional injuries	0.215	0.060	0.422	0.340	0.392	0.316	0.363	0.363	0.253	0.194	0.253	0.194	0.253	0.194
INTENTIONAL INJURIES														
Self-inflicted injuries	0.000	0.000	0.218	0.150	0.202	0.139	0.167	0.167	0.117	0.088	0.049	0.049	0.049	0.049
<i>Intentional self-poisoning by and exposure to alcohol</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>	<i>1.000</i>
Homicide	0.179	0.179	0.394	0.394	0.367	0.367	0.404	0.404	0.282	0.282	0.282	0.282	0.282	0.282
Other Intentional injuries	0.000	0.000	0.299	0.299	0.278	0.278	0.307	0.307	0.214	0.214	0.107	0.107	0.107	0.107
OTHER														
Ethanol and methanol toxicity	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Finding of alcohol in blood	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Categories in italics are sub-categories of immediate prior category

Appendix 7. Smoking-attributable fractions for mortality or morbidity by sex, age and disease category in Canada, 2002

CONDITION/ CAUSE OF DEATH	Smoking-attributable fractions													
	<1 yr		15-29 yrs		30-44 yrs		45-59 yrs		60-69 yrs		70-79 yrs		80+ yrs	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
ACTIVE SMOKERS														
MALIGNANT NEOPLASMS														
Oropharyngeal cancer	--	--	0.630	0.561	0.669	0.608	0.662	0.614	0.581	0.519	0.509	0.460	0.476	0.362
Oesophageal cancer	--	--	0.518	0.476	0.550	0.500	0.547	0.503	0.495	0.432	0.456	0.382	0.441	0.318
Stomach cancer	--	--	0.128	0.185	0.189	0.164	0.191	0.167	0.171	0.138	0.151	0.114	0.147	0.091
Pancreatic cancer	--	--	0.216	0.190	0.230	0.196	0.221	0.194	0.186	0.153	0.153	0.122	0.143	0.092
Laryngeal cancer	--	--	0.686	0.642	0.727	0.677	0.729	0.686	0.678	0.616	0.653	0.571	0.640	0.505
Trachea, bronchus and lung cancers	--	--	0.860	0.579	0.884	0.645	0.904	0.720	0.897	0.678	0.877	0.614	0.872	0.493
Cervical cancer	--	--	--	0.346	--	0.378	--	0.386	--	0.349	--	0.317	--	0.275
Urinary tract cancer	--	--	0.587	0.517	0.685	0.485	0.686	0.486	0.608	0.419	0.519	0.374	0.483	0.314
Renal cell carcinoma	--	--	0.245	0.084	0.280	0.103	0.291	0.107	0.273	0.083	0.253	0.064	0.248	0.047
Bladder cancer	--	--	0.599	0.524	0.647	0.570	0.675	0.583	0.682	0.559	0.679	0.526	0.681	0.485
Acute myeloid leukemia	--	--	0.185	0.174	0.218	0.202	0.240	0.210	0.246	0.194	0.243	0.175	0.245	0.152
TOBACCO ABUSE														
Tobacco abuse	--	--	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Toxic effect of tobacco and nicotine	--	--	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
CARDIOVASCULAR DISEASES														
Ischaemic heart disease														
Age < 45 yrs	--	--	0.466	0.406	0.521	0.453	--	--	--	--	--	--	--	--
45-59 yrs	--	--	--	--	--	--	0.422	0.373	--	--	--	--	--	--
60-69 yrs	--	--	--	--	--	--	--	--	0.291	0.234	--	--	--	--
70-79 yrs	--	--	--	--	--	--	--	--	--	--	0.100	0.073	--	--
80+ yrs	--	--	--	--	--	--	--	--	--	--	--	--	0.089	0.051
Pulmonary circulatory disease	--	--	0.808	0.792	0.831	0.813	0.841	0.819	0.838	0.796	0.830	0.769	0.829	0.733
Cardiac arrhythmias														
Age < 45 yrs	--	--	0.466	0.406	0.521	0.453	--	--	--	--	--	--	--	--
45-59 yrs	--	--	--	--	--	--	0.422	0.373	--	--	--	--	--	--
60-69 yrs	--	--	--	--	--	--	--	--	0.291	0.234	--	--	--	--
70-79 yrs	--	--	--	--	--	--	--	--	--	--	0.100	0.073	--	--
80+ yrs	--	--	--	--	--	--	--	--	--	--	--	--	0.089	0.051

Appendix 7. Continued

CONDITION/ CAUSE OF DEATH	Smoking-attributable fractions													
	<1 yr		15-29 yrs		30-44 yrs		45-59 yrs		60-69 yrs		70-79 yrs		80+ yrs	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Heart failure														
Age < 45 yrs	--	--	0.466	0.406	0.521	0.453	--	--	--	--	--	--	--	--
45-59 yrs	--	--	--	--	--	--	0.422	0.373	--	--	--	--	--	--
60-69 yrs	--	--	--	--	--	--	--	--	0.291	0.234	--	--	--	--
70-79 yrs	--	--	--	--	--	--	--	--	--	--	0.100	0.073	--	--
80+ yrs	--	--	--	--	--	--	--	--	--	--	--	--	0.089	0.051
Cerebrovascular diseases*														
Age < 65 yrs	--	--	0.388	0.391	0.428	0.376	0.412	0.373	0.347	0.299	--	--	--	--
>= 65 yrs	--	--	--	--	--	--	--	--	0.172	0.142	0.145	0.116	0.137	0.088
Atherosclerosis	--	--	0.371	0.426	0.390	0.444	0.399	0.427	0.358	0.414	0.325	0.411	0.282	0.267
RESPIRATORY DISEASES														
Pneumonia/ Influenza	--	--	0.175	0.162	0.200	0.181	0.212	0.186	0.207	0.165	0.199	0.144	0.198	0.122
Chronic obstructive pulmonary disease	--	--	0.808	0.792	0.831	0.813	0.841	0.819	0.838	0.796	0.830	0.769	0.829	0.733
INTESTINAL DISEASE														
Ulcer	--	--	0.374	0.373	0.441	0.416	0.479	0.433	0.487	0.410	0.492	0.385	0.495	0.349
CONDITIONS ARISING DURING THE PERINATAL PERIOD														
Low birthweight and short gestation	0.247	0.206	--	--	--	--	--	--	--	--	--	--	--	--
Sudden infant death syndrome	0.312	0.265	--	--	--	--	--	--	--	--	--	--	--	--
INJURY														
Fire injury	--	--	0.280	0.280	0.280	0.280	0.280	0.280	0.280	0.280	0.280	0.280	0.280	0.280
PASSIVE SMOKERS														
Lung cancer	--	--	0.035	0.032	0.016	0.013	0.020	0.018	0.018	0.016	0.015	0.013	0.010	0.009
Ischaemic heart disease	--	--	0.040	0.036	0.018	0.015	0.023	0.020	0.021	0.018	0.017	0.014	0.011	0.011

Appendix 8. Productivity cost equation due to premature mortality

The algebraic form of the cost equation is as follows:

$$PC^m = \sum_i^2 \sum_j^k N_{ij}^m \left[\frac{p(E)_{ij}^m \times Y(E)_{ij} \times W_{ij}^m \times FP}{12} + \sum_{t=d}^{65} \frac{RW_{ijt}^m}{(1+r)^{t-d}} \right],$$

where for mental disorder m ,

i is the gender group

j is the age group, $j = 1, \dots, k$

t is time (in years), $t = d, d + 1, \dots, 65$

r is the discount rate

N_{ij}^m is the number of premature deaths + permanently disabled attributable to mental disorder m of the ij th population group

$p(E)_{ij}^m$ is the probability that a person with mental disorder m of the ij th population group is in paid employment

W_{ij}^m is the percentage of earnings of the general population for persons with mental disorder m in the ij th population group

RW_{ijt} is the marginal reservation wage for persons in the ij th population group at time t

FP is the friction period (in months).

Appendix 9. The costs of alcohol, illegal drugs and tobacco based on Human Capital Approach in Canada, 2002

	(in millions dollars)			
	Alcohol	Illegal drugs	Tobacco	TOTAL ADT
1. Direct health care costs: total	3,306.2	1,134.6	4,360.2	8,800.9
1.1 morbidity - acute care hospitalization	1,458.6	426.37	2,551.2	4,436.2
- psychiatric hospitalization	19.6	11.5	--	31.2
1.2 inpatient specialized treatment	754.9	352.1	--	1,107.1
1.3 outpatient specialized treatment	52.4	56.3	--	108.7
1.4 ambulatory care: physician fees	80.2	22.6	142.2	245.0
1.5 family physician visit	172.8	48.8	306.3	527.9
1.6 prescription drugs	767.6	216.8	1,360.5	2,344.9
2. Direct law enforcement costs	3,072.2	2,335.5		5,407.8
2.1 police	1,898.8	1,432.0	--	3,330.7
2.2 courts	513.1	330.6	--	843.7
2.3 corrections (including probation)	660.4	573.0	--	1,233.4
3. Direct costs for prevention and research	53.0	16.5	78.1	147.6
3.1 research	17.3	8.6	9.0	34.9
3.2 prevention programs	33.9	7.9	69.1	110.9
3.3 salaries and operating funds	1.8	--	--	1.8
4. Other direct costs	996.1	79.1	87.0	1,162.2
4.1 fire damage	156.5	--	86.5	243.0
4.2 traffic accident damage	756.9	67.0	--	823.9
4.3 losses associated with the workplace	17.0	6.6	0.5	24.1
<i>4.3.1 EAP & health promotion programs</i>	17.0	4.2	0.5	21.7
<i>4.3.2 drug testing in the workplace</i>	--	2.4	N/A	2.4
4.4 administrative costs for transfer payments	65.8	5.4	0.0	71.3
<i>4.4.1 social welfare and other programs</i>	4.3	--	--	4.3
<i>4.4.2 workers' compensation</i>	61.5	5.4	--	66.9
5. Indirect costs: productivity losses	11,710.8	7,537.2	20,030.8	39,278.8
5.1 due to long-term disability (Human Capital Method)	9,848.5	7,046.9	16,821.6	33,717.0
5.2 due to short-term disability (days in bed)	15.9	21.8	24.4	62.0
5.3 due to short-term disability (days with reduced activity)	23.6	-0.1	36.2	59.8
5.4 due to premature mortality (Human Capital Method)	1,822.7	468.6	3,148.6	5,440.0
Total	19,138.4	11,102.8	24,556.1	54,797.3
Total as % of GDP (2002 LCU)	1.68%	0.98%	2.16%	4.82%
Total per capita (in \$)	\$609	\$353	\$782	\$1,744
Total as % of all substance-related costs	34.9%	20.3%	44.8%	100.0%

ADT - Alcohol, Illegal Drugs, and Tobacco

N/A - not applicable

"--" not available

LCU - Local Currency Unit

EAP - Employee Assistance Programs

Categories in italics are sub-categories of immediate prior category

Appendix 10. List of additional tables

All these tables are available on CD ROM from the Canadian Centre on Substance Abuse. Please contact CCSA at 75 Albert St., Suite 300, Ottawa ON K1P 5E7, tel.: 613-235-4048, or e-mail: info@ccsa.ca. You can also consult CCSA's website at www.ccsa.ca for instructions on how to obtain the tables.

Table Number	Title of Table
DIRECT COSTS	
<i>Health care cost</i>	
D-HC-1	Costs of acute care hospitalizations due to alcohol, illegal drugs and tobacco in provinces, territories, and Canada, 2002
D-HC-2	Costs of psychiatric hospitalizations due to alcohol and illegal drugs in provinces, territories, and Canada, 2002
D-HC-3	Costs of inpatient specialized treatment due to alcohol and illegal drugs in provinces, territories, and Canada, 2002
D-HC-4	Costs of outpatient specialized treatment due to alcohol and illegal drugs in provinces, territories, and Canada, 2002
D-HC-5	Costs of ambulatory care services (physician fees) in provinces, territories, and Canada, 2002
D-HC-6	Costs of family physician visits due to alcohol, illegal drugs and tobacco by provinces, territories and Canada, 2002
D-HC-7	Costs of prescribed drugs due to alcohol, illegal drugs and tobacco in provinces, territories, and Canada, 2002
D-HC-8	Number of ambulatory care services attributable to alcohol, illegal drugs and tobacco in provinces, territories, and Canada, 2002
<i>Cost of substance-attributable prevention and research</i>	
D-PR-1	Costs of prevention and research attributable to alcohol, illegal drugs and tobacco in Canada, 2002
<i>Morbidity estimates</i>	
<i>Alcohol acute care hospitalizations (diagnoses)</i>	
D-HC-A-1	Alcohol-attributable fractions, mean age at hospital diagnosis, and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in Canada, 2002
D-HC-A-2	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in BC, 2002
D-HC-A-3	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in AB, 2002
D-HC-A-4	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in SK, 2002
D-HC-A-5	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in MB, 2002
D-HC-A-6	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in ON, 2002
D-HC-A-7	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in QC, 2002
D-HC-A-8	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in NB, 2002
D-HC-A-9	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in NS, 2002
D-HC-A-10	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in PEI, 2002
D-HC-A-11	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in NF, 2002
D-HC-A-12	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in YT, 2002
D-HC-A-13	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in NWT, 2002
D-HC-A-14	Alcohol-attributable fractions and number of hospital diagnoses due to morbidity attributable to alcohol by sex, age and disease category in NU, 2002
<i>Alcohol acute care hospital days</i>	
D-HC-A-15	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in Canada, 2002
D-HC-A-16	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in BC, 2002
D-HC-A-17	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in AB, 2002
D-HC-A-18	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in SK, 2002
D-HC-A-19	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in MB, 2002
D-HC-A-20	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in ON, 2002
D-HC-A-21	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in QC, 2002
D-HC-A-22	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in NB, 2002
D-HC-A-23	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in NS, 2002
D-HC-A-24	Alcohol-attributable fractions and number of hospital days due to morbidity attributable to alcohol by sex, age and disease category in PEI, 2002

D-HC-S-25	Smoking-attributable fractions and number of hospital days due to morbidity attributable to tobacco by sex, age and disease category in NF, 2002
D-HC-S-26	Smoking-attributable fractions and number of hospital days due to morbidity attributable to tobacco by sex, age and disease category in YT, 2002
D-HC-S-27	Smoking-attributable fractions and number of hospital days due to morbidity attributable to tobacco by sex, age and disease category in NWT, 2002
D-HC-S-28	Smoking-attributable fractions and number of hospital days due to morbidity attributable to tobacco by sex, age and disease category in NU, 2002

INDIRECT COSTS*Productivity losses*

I-PR-1	Short-term disability: Days in bed due to alcohol, illegal drugs and tobacco in Canada, 2002
I-PR-2	Short-term disability: Income lost due to days in bed due to alcohol, illegal drugs and tobacco in Canada, 2002
I-PR-3	Short-term disability: Days with reduced activity due to alcohol, illegal drugs and tobacco in Canada, 2002
I-PR-4	Short term disability: Income losses due to days with reduced activity attributable to alcohol, illegal drugs and tobacco in Canada, 2002

Long term disability

I-PR-5	Long-term disability: Years of lost productivity due to alcohol, illegal drugs and tobacco in Canada, 2002
I-PR-6	Long-term disability: Productivity losses due to alcohol, illegal drugs and tobacco in Canada, 2002
I-PR-7	Productivity losses due to premature deaths attributable to alcohol, illegal drugs and tobacco in Canada, 2002

*Mortality estimates**Alcohol*

I-A-1	Alcohol-attributable fractions, mean age at death, and number of deaths attributable to alcohol by sex, age and disease category in Canada, 2002
I-A-2	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in BC, 2002
I-A-3	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in AB, 2002
I-A-4	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in SK, 2002
I-A-5	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in MB, 2002
I-A-6	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in ON, 2002
I-A-7	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in QC, 2002
I-A-8	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in NB, 2002
I-A-9	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in NS, 2002
I-A-10	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in PEI, 2002
I-A-11	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in NF, 2002
I-A-12	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in YT, 2002
I-A-13	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in NWT, 2002
I-A-14	Alcohol-attributable fractions and number of deaths attributable to alcohol by sex, age and disease category in NU, 2002

Illegal drugs

I-D-1	Drug-attributable fractions, mean age at death, and number of deaths attributable to illegal drugs by sex, age, and disease category in Canada, 2002
I-D-2	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in BC, 2002
I-D-3	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in AB, 2002
I-D-4	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in SK, 2002
I-D-5	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in MB, 2002
I-D-6	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in ON, 2002
I-D-7	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in QC, 2002
I-D-8	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in NB, 2002
I-D-9	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in NS, 2002
I-D-10	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in PEI, 2002
I-D-11	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in NF, 2002
I-D-12	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in YT, 2002
I-D-13	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in NWT, 2002
I-D-14	Drug-attributable fractions and number of deaths attributable to illegal drugs by sex, age, and disease category in NU, 2002

Tobacco

I-S-1	Smoking-attributable fractions, mean age at death, and number of deaths attributable to tobacco by sex, age and disease category in Canada, 2002
I-S-2	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in BC, 2002

I-S-3	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in AB, 2002
I-S-4	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in SK, 2002
I-S-5	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in MB, 2002
I-S-6	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in ON, 2002
I-S-7	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in QC, 2002
I-S-8	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in NB, 2002
I-S-9	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in NS, 2002
I-S-10	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in PEI, 2002
I-S-11	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in NF, 2002
I-S-12	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in YT, 2002
I-S-13	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in NWT, 2002
I-S-14	Smoking-attributable fractions and number of deaths attributable to tobacco by sex, age and disease category in NU, 2002

Potential Years of Life Lost

E-P-1	Potential years of life lost due to alcohol by sex and age in provinces, territories, and Canada, 2002
E-P-2	Potential years of life lost due to illegal drugs by sex and age in provinces, territories, and Canada, 2002
E-P-3	Potential years of life lost due to tobacco by sex and age in provinces, territories, and Canada, 2002

APPENDICES

APP-1	Prevalence of alcohol consumption in Canada, by age, sex, and drinking category
APP-2	Prevalence of smoking, by age and sex, used in the calculation of SAFs for the following diseases: cerebrovascular diseases: atherosclerosis, ulcer, oropharyngeal, pancreatic, laryngeal, oesophageal cancers, and pneumonia/influenza
APP-3	Prevalence of smoking, by age and sex, used in the calculation of SAFs for the following diseases: chronic obstructive pulmonary disorder, pulmonary circulatory disease
APP-4	Prevalence of smoking, by age and sex, used in the calculation of SAFs for the following diseases: bladder cancer and acute myeloid leukaemia
APP-5	Prevalence of smoking, by age and sex, used in the calculation of SAFs for stomach cancer
APP-6	Prevalence of smoking, by age and sex, used in the calculation of SAFs for urinary tract cancer
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APP-8	Prevalence of smoking, by age and sex, used in the calculation of SAFs for cervical cancer
APP-9	Prevalence of smoking, by age and sex, used in the calculation of SAFs for lung cancer
APP-10	Relative risks used for estimation of alcohol-attributable fractions, morbidity and mortality
APP-11	Relative risks used for estimation of smoking-attributable fractions, morbidity and mortality
APP-12	Alcohol-attributable fractions for morbidity by sex, age and disease condition in provinces, territories and Canada, 2002
APP-13	Alcohol-attributable fractions for mortality by sex, age and disease condition in provinces, territories and Canada, 2002
APP-14	Drug-attributable fractions for mortality or morbidity by sex, age and disease condition in provinces, territories and Canada, 2002
APP-15	Smoking-attributable fractions for mortality or morbidity by sex, age and disease condition in provinces, territories and Canada, 2002
APP-16	ICD-9 and ICD-10 codes for disease conditions attributable to alcohol
APP-17	ICD-9 and ICD-10 codes for disease conditions attributable to illegal drugs
APP-18	ICD-10 codes for disease conditions attributable to tobacco

Appendix 11. List of specific articles on epidemiological aspects

The following manuscripts are available upon request from the authors.

Morbidity attributable to substance abuse

Baliunas, D., Patra, J., Rehm, J., Taylor, B., Popova, S., & Kaiserman, M. (forthcoming). Smoking-attributable morbidity in Canada 2002: conclusions for prevention and policy.

Popova, S., Rehm, J., Patra, J., Baliunas, D., & Taylor, B. (submitted). Illegal drug-attributable morbidity in Canada 2002: implications for prevention and policy. *Drug and Alcohol Review*.

Rehm, J., Giesbrecht, N., Patra, J., & Roerecke, M. (accepted). Estimating chronic-disease deaths and hospitalizations due to alcohol use in Canada in 2002 – Implications for policy and prevention strategies. *Preventing Chronic Disease: Public Health Research, Practice, and Policy*.

Taylor, B., Rehm, J., Patra, J., Popova, S., Baliunas, D. (submitted). Alcohol-attributable morbidity and resulting health care costs in Canada 2002: recommendations for policy and prevention. *Journal of Alcohol Studies*.

Mortality attributable to substance abuse

Baliunas, D., Patra, J., Rehm, J., Popova, S., Kaiserman, M., & Taylor, B. (submitted). Smoking-attributable mortality and potential years of life lost in Canada 2002: conclusions for prevention and policy. *Chronic Diseases in Canada*.

Popova, S., Rehm, J., & Patra, J. (submitted). Illegal drug-attributable mortality and potential years of life lost in Canada 2002: conclusions for prevention and policy. *Contemporary Drug Problems*.

Rehm, J., Patra, J., & Popova, S. (2006). Alcohol-attributable mortality and potential years of life lost in Canada 2001: implications for prevention and policy. *Addiction*, 101(3), 373-384.

Rehm, J., Patra, J., & Popova, S. (2006). *Alcohol-attributable mortality and potential years of life lost in Canada 2002: implications for prevention and policy*. Toronto, Canada: Centre for Addiction and Mental Health.

Patra, J., Taylor, B., Rehm, J., Baliunas, D., & Popova, S. (submitted). Substance-attributable morbidity and mortality changes to Canada's epidemiological profile: measurable differences over a ten-year period. *Canadian Journal of Public Health*.

Social costs attributable to substance abuse

Rehm, J., Giesbrecht, N., Popova, S., Patra, J., Adlaf, E., & Mann, R. (in press). Overview of positive and negative effects of alcohol consumption—implications for preventive policies in Canada. Ottawa, Canada: Health Canada.

Rehm, J., Popova, S., Patra, J., Gnam, W., Sarnocinska-Hart, A., Baliunas, D., & Taylor, B. (forthcoming). The costs of alcohol, illegal drugs and tobacco in Canada 2002. *American Journal of Public Health*.