AVOIDABLE COST OF ALCOHOL ABUSE IN CANADA 2002

HIGHLIGHTS

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EXECUTIVE SUMMARY

Purpose of the study

To estimate avoidable burden and avoidable costs of alcohol abuse in Canada for the year 2002. To date, this was the first attempt to systematically estimate the avoidable costs of alcohol abuse. It is also a pioneer study in the application of the methodology from the first *International Guidelines for the Estimation of the Avoidable Costs of Substance Abuse* (Collins et al., 2006).

Methodology

To estimate the avoidable alcohol-attributable burden and costs of health care, criminality problems and lost productivity due to disability or premature death we used one of the approaches recommended by *Guidelines*, which is based on the outcome of proven effective major interventions. We modeled the impact of the following six alcohol policy interventions relative to baseline costs obtained from the Second Canadian Cost Study (Rehm et al., 2006): taxation increases, lowering the blood alcohol concentration (BAC) legal limit from 0.08% to 0.05%, zero BAC restriction for all drivers under the age of 21, increasing the minimum legal drinking age (MLDA) from 19 to 21 years, a Safer Bars intervention, and brief interventions. Moreover, in addition to the six interventions that reduce alcohol consumption, we also modeled one intervention frequently discussed in Canada that would actually increase alcohol consumption and alcohol-attributable costs: -- the change from a government monopoly to privatized alcohol sales. The effect of these interventions was modeled for the Canadian population older than 15 years of age with the exception of BAC restriction and MLDA[1], which were modeled for the age group 19-21.

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[1] Alberta, Manitoba and Quebec have a minimum legal drinking age of 18.

Results

Under conservative assumptions, it was estimated that a combination of six interventions related to alcohol policy would result in cost savings of about $1 billion in Canada per year. By implementing all six interventions, the greatest saving would be achieved by lowering productivity losses i.e. more than $561 million or 58%, followed by health care, almost $230 million or 24%, and criminality, almost $178 million or 18% of the total avoidable cost. .

The potential gains to Canadian society may be even higher, as sensitivity analyses on three of the six selected interventions resulted in a doubling of the avoidable alcohol-attributable burden and cost. The largest impact of avoidable burden and costs would result from comprehensive interventions affecting the overall level of drinking such as brief interventions (5% - 12%) and increasing alcohol taxation (2%). Substantial increases in burden (from 8% to 16%) and cost (from 6% to 12%) would occur if Canadian provinces were to privatize alcohol sales.

Conclusion

Alcohol causes considerable health and criminal burden on Canadian society. This study provides the evidence that suggests the implementation of proven effective population-based interventions would reduce alcohol-attributable burden and its costs in Canada to a considerable degree.

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INTRODUCTION

The recently published Second Canadian Study of Social Costs Attributable to Substance Abuse (Rehm et al., 2006) estimated the **attributable burden and costs** of alcohol and other psychoactive substances for Canada in 2002. The manner in which attributable fractions were derived for this study allowed the authors to estimate how many deaths, hospitalizations, and legal problems in 2002 were due to past alcohol abuse (i.e. alcohol abuse prior and up to 2002). If there had been no alcohol abuse, then all of these deaths, hospitalizations and legal problems and consequently the costs would not have occurred. In other words, this cost-of-illness study calculated all the external costs of substance abuse and compared them with a hypothetical situation where no substance abuse existed.

While these aggregate burdens and costs are a valuable indicator of the overall economic burden due to substance abuse in Canada, it does not indicate the proportion of such cost that is potentially avoidable and the nature of the policies to achieve this cost avoidance. However, without prior estimation of aggregate cost of substance abuse, which forms the basis for other types of cost estimates, it would not be possible to estimate avoidable costs. Thus, as a continuation of this research we have made an attempt to estimate the avoidable burden and costs that indicate the benefits potentially available to harm minimization programs in Canada in 2002. To date no such study has been undertaken in Canada or elsewhere to estimate the avoidable costs of alcohol abuse.

What is the nature of avoidable costs and why we measure it? Avoidable cost estimates provide an indication of the benefits potentially available to the community as a whole by directing public resources to specific policies, strategies and programs (Collins et al. 2006). These estimates not only provide valuable economic information on the basis of which a more efficient allocation of productive resources could be achieved but also help identify information gaps, target problems, and identify potential solutions, effective strategies, policies and programs.

To calculate avoidable costs, we have to identify a counterfactual scenario, i.e. the conditions against which the current conditions should be evaluated. This counterfactual scenario should depict the situation of alcohol abuse on the lowest possible level for our society, the so-called **feasible minimum**. We based the counterfactual scenario for avoidable costs on the recently published first *International Guidelines for the Estimation of the Avoidable Costs of Substance Abuse* developed by world experts of the field (Collins et al., 2006). These guidelines were commissioned by Health Canada as part of an international initiative to develop methodologies and approaches for pilot studies, in both developed and developing countries, on estimating the socioeconomic avoidable costs of substance abuse. In this document, the authors argue that the target of zero alcohol or other substance abuse is unrealistic and unachievable for societies such as Canada. Thus a feasible minimum, different from zero alcohol consumption, has to be adopted.

The guidelines suggest a number of different approaches that can be used to estimate both avoidable burden and avoidable costs of alcohol abuse. In partnership with the Steering Committee for the study, we adopted one of the recommended approaches, based on the outcome of **proven effective major interventions**. We believe that this approach is more politically relevant because it can estimate the impact of the available effective interventions on alcohol-attributable burden and its cost. Thus, it is potentially most useful from a policy implementation perspective. This approach relies on the evidence about the effectiveness of interventions designed to reduce or alleviate the effects of substance abuse and can be seen as one way to operationalize the **feasible minimum**, i.e. the maximum reduction in burden that can be achieved by the interventions. A comparison between existing substance abuse policies and available interventions shown to be effective in reducing alcohol consumption and attributable harm in Canada and similar societies may indicate the extent to which aggregate costs are avoidable.

The most common evidence-based interventions, which are specifically aimed at reducing alcohol consumption and/or alcohol-attributable harm, were identified from monograph under the title Alcohol: No Ordinary Commodity; Research and Public Policy,

produced in collaboration with the World Health Organization (Babor et al., 2003). The Steering Committee assisted the research team in selecting the most effective and cost-effective interventions in alcohol control feasible for Canada. Most of the selected interventions are highly cost-effective (with low money cost to implement) and associated with considerable health and social benefits based on scientific evidence from different jurisdictions. The choice of the combination of these interventions was made based on evidence that suggests the most effective approach is to implement multiple alcohol policies of the following strategies: increase in alcohol prices, reducing the availability of alcohol, and measures against drunk driving and underage drinking (WHO, 2004). Ratings on effectiveness, research support, cost of implementation, and target groups of selected interventions, based on Babor et al. (2003) are presented in Table 1.

To estimate avoidable alcohol-attributable burden and costs of health care, criminality problems and indirect costs of lost productivity due to disability or premature death, the effects of the six selected policy interventions were modeled: taxation increases, lowering the blood alcohol concentration (BAC) legal limit from 0.08% to 0.05%, zero BAC restriction for all drivers under the age of 21, increasing the minimum legal drinking age (MLDA) from 19 to 21 years, a Safer Bars intervention, and brief interventions. Moreover, in addition to the six interventions that reduce alcohol consumption, we also modeled one intervention that would actually increase alcohol consumption and is frequently discussed in Canada -- the change from a government monopoly to privatized alcohol sales. We believe that it was important to demonstrate what would happen in terms of alcohol-attributable burden and associated costs if all Canadian provinces and territories gave up monopoly on alcohol sales.

Table 1. Ratings of policy-relevant strategies and interventions (Adapted from Babor et al., 2003)

Strategy or intervention	Effectiveness	Breadth of research support	Cross-cultural testing	Cost to implement	Target group[a] (TG) and comments
Regulating physical availability					
Minimum legal drinking age	+++	+++	++	Low	TG = HR; Reduces hazardous drinking, but does not eliminate drinking. Effective with minimal enforcement but enforcement substantially increases effectiveness.
Government monopoly of retail sales (vs privatization)	+++	+++	++	Low	TG = GP; Effective only if operated with public health and public order goals.
Taxation and pricing					
Alcohol taxes	+++	+++	+++	Low	TG = GP; Effectiveness depends on government oversight and control of alcohol production and distribution. High taxes can increase smuggling and illicit production.
Altering the drinking context					
Safer Bars program: Training bar staff and managers to prevent and better manage aggression	+	+	+	Moderate	TG = HR

Strategy or intervention	Effectiveness	Breadth of research support	Cross-cultural testing	Cost to implement	Target group[a] (TG) and comments
Drinking-driving countermeasures					
Lowered BAC Limits	+++	+++	++	Low	TG = GP; Diminishing returns at lower levels (e.g., 0.05-0.02%), but still significant.
Low BAC for young drivers ('zero tolerance')	+++	++	+	Low	TG = HR
Treatment and early intervention					
Brief intervention with at-risk drinkers	++	+++	+++	Moderate	TG = HR; Primary care practitioners lack training and time to conduct screening and brief interventions.

[a] Each strategy applies to one of the following three target groups (TG): GP, the general population of drinkers; HR, high-risk drinkers or groups considered to be particularly vulnerable to the adverse effects of alcohol (e.g., adolescents); HD, persons already manifesting harmful drinking and alcohol dependence.

MECHANISM AND EFFECTS OF SELECTED INTERVENTIONS

PRICING AND TAXATION

Research has demonstrated a strong link between the price of alcohol and its consumption. The evidence indicates that increases in the cost of alcohol to the consumer will decrease consumption rates and, therefore, decrease alcohol-related problem rates. Thus, this intervention affects all alcohol-attributable disease, injury and all criminality categories (see criminality section) examined in this study. The effect of this measure was modeled via the impact of taxation on price specific to each beverage type (for details see Chisholm et al., 2004). We used a hypothetical 25% increase in tax, which resulted in price increases of 1.7% for beer, 6.8% for spirits, and 7.5% for wine, which together resulted in a 4.1% reduction in the alcohol consumption rate in Canada.

LOWERING BLOOD ALCOHOL CONCENTRATION (BAC) LEVEL

Several research studies observed that lowering a BAC level from 0.08% to 0.05% impacted drinking and driving behavior and produced a reduction in alcohol-related collisions. A reduction of 12% in alcohol-related fatal collisions due to implementation of this measure, estimated by Mann and colleagues (1998) from different jurisdictions, was used in calculating avoidable burden and costs of alcohol-attributable traffic injury categories (morbidity and mortality) and drinking and driving criminality.

ZERO BAC RESTRICTION FOR YOUNG DRIVERS UNDER THE AGE 21

Young drivers are more vulnerable to the risk of an alcohol-related crash, due to their inexperience as both drivers and drinkers. The existing research clearly supports the enactment of a zero BAC restriction for young drivers under the age of 21. This measure mainly affects drinking and driving behavior. A twelve percent reduction in alcohol-related crashes after implementation of this policy, reported in the USA study (Villaveces et al., 2003), was used in the estimation of the avoidable burden and costs of alcohol-attributable traffic injury categories (morbidity and mortality) and drinking and driving criminality.

To calculate total impaired driving incidents for young adults between 19 to 21 years old, we estimated the proportion of drinking and driving cases (13.3%) based on the CAMH Monitoring Survey of Ontario, 2001-2006 (unpublished data).

RAISING OF MINIMUM LEGAL DRINKING AGE (MLDA) FROM 19 TO 21 YEARS

Many studies found that this measure reduces alcohol use. In particular, it affects drinking and driving behavior among young people and in turn, reduces alcohol-related problems including traffic crashes, alcohol-related injury admissions to hospitals and injury fatalities. The percentages of reduction in fatal (8%) and non-fatal (6%) motor vehicle injuries of young adults after implementation of this measure, reported in the USA study (Shults et al., 2001), was used to estimate avoidable burden and costs of alcohol-attributable traffic injury categories (morbidity and mortality) and drinking and driving criminality.

SAFER BARS

Aggressive behavior, violence and homicide are major problems associated with drinking in licensed premises in many countries. One strategy for reducing these problems is the modification of the drinking context by reducing the heavy consumption of alcohol. In order to reach this goal, bar staff are trained to provide Responsive Beverage Service (RBS). The primary goal of RBS is preventing intoxication and underage drinking. The reviewed literature showed that modifying the drinking context is an effective measure for reducing the heavy consumption of alcohol and thus, for reducing alcohol-related problems such as violence and physical aggression. In a randomized controlled trial in Canadian bars, Graham and colleagues (2004) reported a 34% reduction in violence and aggressive behavior after implementation of a comprehensive RBS program entitled Safer Bars. Assuming 10% of all alcohol-attributable crimes in Canada are bar related (expert opinion; Graham, 2007) we modeled the effect of the Safer Bars program on avoidable burden and costs of alcohol-attributable homicide (morbidity and mortality) and homicide and other violent crimes.

BRIEF INTERVENTIONS

Several research studies confirmed that routine screening for alcohol misuse and brief behavioral counseling sessions provided by family physicians to high risk drinkers have the potential to reduce the prevalence of hazardous drinking by increasing remission rates and reducing disability. Efficacy reviews of brief interventions estimated that they lead to a 22% net reduction in consumption among hazardous drinkers under ideal circumstances (Chisholm et al., 2004). However, the effectiveness of this intervention deployed in the community would be reduced by non-compliance and the inability to completely target the at-risk population of hazardous drinkers. Assuming that treatment compliance was 70% and that only 50% of target hazardous drinkers received the interventions, we estimated the real-world effectiveness of these interventions at 7.7%. This percentage of reduction in alcohol consumption among hazardous drinkers was used to estimate avoidable alcohol-attributable disease and injury categories and all three alcohol-attributable criminality categories examined in this study.

STATE MONOPOLY ON ALCOHOL SALES (PRIVATIZATION)

Experience from several jurisdictions where privatization or demonopolization of the alcohol distribution system has been implemented showed that this measure was associated with an increase in the density and types of retail outlets, days and hours of sales, sales promotions, advertising, and changes of alcohol retail prices. As a result, this increased physical availability of alcohol leads to an increase in alcohol consumption and alcohol-related harm (Her et al., 1999).

Thus, as an opposite scenario to the selected interventions listed above, privatization of alcohol sales would not result in cost savings, but cost increases. These additional costs incurred by privatization were also modeled.

Based on evidence that monopoly systems limit both alcohol consumption and alcohol-related problems, this policy would affect all alcohol-attributable disease, injury and criminality categories examined in this study. The effect of this policy was modeled based on the research of Her and colleagues (1998), which postulated that should Ontario’s government controlled alcohol systems be fully privatized it would result in an increase in alcohol consumption of approximately 10% (a conservative estimate).

OTHER INTERVENTIONS CONSIDERED

In addition to the selected six interventions, the following interventions were also considered but finally excluded from the modeling due to various reasons: 1) restriction of hours and days of retail sale (no data to allow a modeling for Canada available);
2) limiting outlet density (no data to allow a modeling for Canada available);
3) awareness campaigns (e.g., educational type of initiatives) (no evidence for effectiveness on reducing alcohol-attributable harm, so no avoidable costs expected);
4) warning labels (evidence for effectiveness to reduce alcohol-attributable harm is weak, and there are no data to model this effect for Canada); and 5) low-risk drinking guidelines (lack of evaluation research on effectiveness).

UNDERLYING MECHANISMS

The mechanisms and effects on morbidity/mortality and criminality of the selected interventions are summarized in Table 2.

AVOIDABLE BURDEN: MORTALITY, YEARS OF LIFE LOST AND MORBIDITY

An implementation of six interventions related to alcohol policy combined would result in a savings of about 800 lives, 26,000 years of life lost (YLL) and more than 88 thousand acute care hospital days in Canada per year (Table 3).

The most effective intervention of avoidable burden due to mortality, YLL and morbidity (measured as acute care hospital days) was brief interventions, followed by lowering BAC for mortality and YLL. The second most effective intervention of morbidity was increasing taxes.

The results also indicated that substantial ***increases*** in mortality, YLL and morbidity would occur if Canadian provinces were to privatize alcohol sales.

Table 2. Mechanism and effects on morbidity/mortality and criminality of the selected interventions

INTERVENTION	MECHANISM	EFFECT ON MORBIDITY/MORTALITY	EFFECT ON CRIMINALITY
Increase in taxes	Economics principle: impacts on purchases and thus on the alcohol consumption level	affects all alcohol-attributable disease and injury categories	affects all three alcohol-attributable criminality categories
Lowering BAC	affects probability of driving under the influence of alcohol and thus alcohol-attributable traffic injuries	affects alcohol-attributable traffic injury categories (morbidity and mortality)	affects only one category of alcohol-attributable criminality: drinking driving
Zero BAC under the age 21	affects probability of driving under the influence of alcohol and thus alcohol-attributable traffic injuries	affects alcohol-attributable traffic injury categories (morbidity and mortality)	affects only one category of alcohol-attributable criminality: drinking driving
MLDA	affects probability of driving under the influence of alcohol and thus alcohol-attributable traffic injuries	affects alcohol-attributable traffic injury categories (morbidity and mortality)	affects only one category of alcohol-attributable criminality: drinking driving
Safer Bars program	affects a heavy consumption of alcohol and thus reduces violence and physical aggression in bars	affects alcohol-attributable homicide (morbidity and mortality)	affects only one category of alcohol-attributable criminality: homicide and other violent crimes
Brief interventions	affects the prevalence of hazardous drinking	affects all alcohol-attributable disease and injury categories	affects all three alcohol-attributable criminality categories
Privatization (vs. state monopoly on alcohol sales)*	affects alcohol consumption level	affects all alcohol-attributable disease and injury categories	affects all three alcohol-attributable criminality categories

BAC - Blood alcohol concentration

MLDA - Minimum legal drinking age

*The effect of privatization of alcohol sales was modeled. Therefore, this effect goes in opposite direction, showing increase in morbidity/mortality and all three components of criminality (a, b, & c)

Table 3. Net savings of alcohol-attributable mortality, years of life lost (YLLs) and morbidity due to implementation of selected interventions in Canada (based on 2002)

Selected Interventions	Mortality	YLLs	Acute care hospital days
Increase in taxes by 25%	4,143	144,833	1,217,872
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	115	2,737	29,073
Relative change between baseline and this intervention	2.7%	1.9%	2.3%
Lowering BAC from 0.08% to 0.05%: 12% reduction in collisions fatalities	4,085	140,234	1,245,064
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	173	7,337	1,881
Relative change between baseline and this intervention	4.1%	5.0%	0.2%
Zero BAC under age 21 years	4,228	145,925	1,246,130
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	30	1,646	814
Relative change between baseline and this intervention	0.7%	1.1%	0.1%
MLDA 19-21 years	4,140	142,597	1,246,004
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	117	4,974	940
Relative change between baseline and this intervention	2.7%	3.4%	0.1%
Safer bars: 15% of bar related crimes	4,257	147,546	1,246,927
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	1	25	17
Relative change between baseline and this intervention	0.0%	0.0%	0.0%
Brief interventions: 7.7% reductions in alcohol consumption	3,896	138,589	1,191,186
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	362	8,982	55,759
Relative change between baseline and this intervention	8.5%	6.1%	4.5%
Privatization: 10% increase in alcohol consumption	4,962	159,959	1,349,208
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	-704	-12,389	-102,264
Relative change between baseline and this intervention	-16.5%	-8.4%	-8.2%
Difference between baseline and all interventions†	**798**	**25,701**	**88,484**
Relative change between baseline and all interventions†	**18.7%**	**17.4%**	**7.1%**

Baseline - aggregate cost (Rehm et al., 2006)

*Avoidable cost

†Privatization was excluded because the estimates present additional burden but not savings

THE AVOIDABLE PORTION OF ALCOHOL-ATTRIBUTABLE CRIME

The avoidable portion of alcohol-attributable crime namely a) drinking and driving; b) homicide and other violent crimes; and c) other alcohol-attributable criminal activities (e.g., property crime) for Canada 2002 by means of implementation of effective population-based interventions was estimated in this study.

Results revealed that the most effective intervention for preventing drinking and driving incidents in Canada was lowering the BAC level which resulted in 19.1% reduction in this type of alcohol-attributable crime compared with the baseline scenario (Rehm et al. 2006).

The Safer Bars program was the most effective measure to avoid homicide and other violent crimes (3.4% reductions were observed). Brief interventions were the most effective measure to avoid other alcohol-attributable criminal activities, and resulted in a 2.6% reduction in these types of crimes.

The results also indicated that substantial ***increases*** in all types of criminality examined in this study would occur if Canadian provinces were to privatize alcohol sales.

AVOIDABLE COSTS

The impact of the six selected interventions was estimated for direct health care costs and criminality problems, as well as indirect costs measured as premature mortality and productivity loses due to short- and long-term disability.

Direct health care costs included cost of alcohol-attributable acute care hospital days, psychiatric hospital days, specialized outpatient and inpatient treatment days, ambulatory care services, physicians' services, and number of prescription drugs used. Direct criminality costs included alcohol-attributable cost for policing, court and corrections (prison cost).

The results revealed that a combination of six interventions related to alcohol policy would result in cost savings of about $1 billion in Canada per year (Table 4). The greatest saving could be achieved by lowering productivity losses i.e. more than $561 million or 58%, followed by health care, almost $230 million or 24%, and criminality, almost $178 million or 18% of the total avoidable cost due to implementation of all six interventions (Figure 1).

The most effective intervention in terms of avoidable cost in health care, criminality and productivity losses was brief interventions (saving almost $602 million per year, 62% of total savings), followed by increasing alcohol taxation (saving more than $211 million per year, 22% of total savings) (Figure 2).

The results also indicated that substantial ***increases*** in direct and indirect costs would occur if Canadian provinces were to privatize alcohol sales: in productivity losses more than $468 million (6.6%), in health care more than $258 million (7.8%), and in criminality about $102 million (3.3%).

Table 4. Net savings of alcohol-attributable cost (based on 2002 in $'000) due to implementation of selected interventions in Canada

Selected Interventions	Health Care	Criminality	Productivity Losses	TOTAL
Increase in taxes by 25%	3,237,096	3,030,023	7,026,371	**13,293,490**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	69,104	42,177	100,029	**211,310**
Relative change between baseline and this intervention	2.1%	1.4%	1.4%	**1.6%**
Lowering BAC from 0.08% to 0.05%: 12% reduction in collisions fatalities	3,302,461	3,049,468	7,083,212	**13,435,141**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	3,739	22,732	43,188	**69,659**
Relative change between baseline and this intervention	0.1%	0.7%	0.6%	**0.5%**
Zero BAC under age 21 years	3,304,581	3,068,925	7,108,137	**13,481,643**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	1,619	3,275	18,263	**23,157**
Relative change between baseline and this intervention	0.0%	0.1%	0.3%	**0.2%**
MLDA 19-21 years	3,304,330	3,059,253	7,097,124	**13,460,707**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	1,870	12,947	29,276	**44,093**
Relative change between baseline and this intervention	0.1%	0.4%	0.4%	**0.3%**
Safer bars: 15% of bar related crimes	3,306,166	3,053,861	7,126,249	**13,486,275**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	34	18,339	151	**18,525**
Relative change between baseline and this intervention	0.0%	0.6%	0.0%	**0.1%**
Brief interventions: 7.7% reductions in alcohol consumption	3,152,893	2,993,916	6,756,009	**12,902,818**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	153,307	78,284	370,391	**601,982**
Relative change between baseline and this intervention	4.6%	2.5%	5.2%	**4.5%**
Privatization: 10% increase in alcohol consumption	3,564,648	3,173,775	7,594,435	**14,332,857**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	-258,448	-101,575	-468,035	**-828,057**
Relative change between baseline and this intervention	-7.8%	-3.3%	-6.6%	**-6.1%**
Difference between baseline and all interventions†	**229,673**	**177,755**	**561,297**	**968,725**
Relative change between baseline and all interventions†	**6.9%**	**5.8%**	**7.9%**	**7.2%**

Baseline - aggregate cost (Rehm et al., 2006)

*Avoidable cost

†Privatization was excluded because the estimates present additional costs but not savings

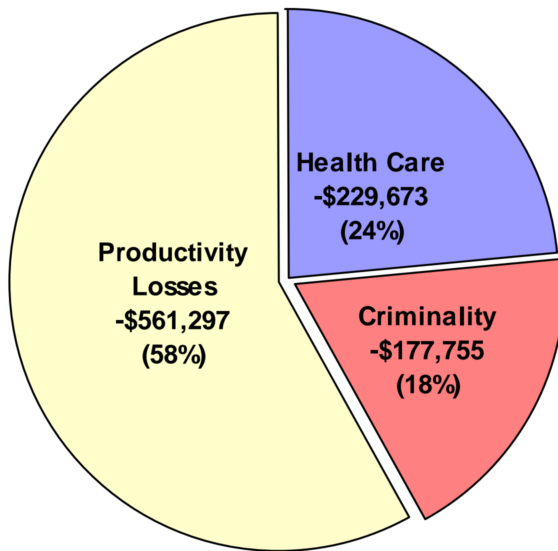
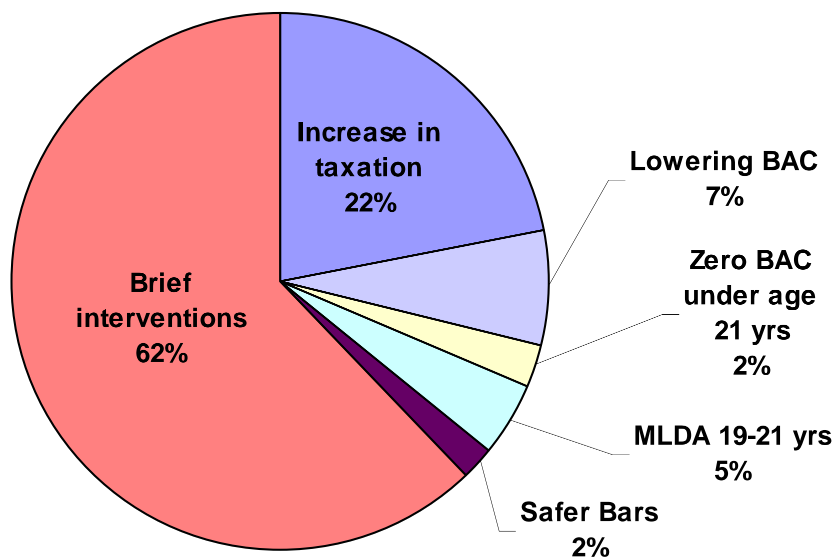


Figure 1. The avoidable alcohol-attributable cost (in '000) due to implementation of the six selected interventions in Canada



BAC- Blood alcohol concentration; MLDA – minimum legal drinking age

Figure 2. Percentage of avoidable alcohol-attributable cost due to implementation of selected interventions in Canada, 2002

SENSITIVITY ANALYSES

Although only the most conservative assumptions were considered in the avoidable burden and costs, several sensitivity analyses were conducted in this study to demonstrate potentially avoidable costs with less conservative assumptions:

LOWERING BAC LEVEL

We modeled three scenarios where the achieved reduction in both fatal crashes and non-fatal traffic accidents was 6% (for results see detailed report), 12% (used as a midpoint) and 18% respectively, based on estimated decrease in total collisions fatalities by 6% to 18% in various jurisdictions (Mann et al. 1998).

SAFER BARS

To model Safer Bars interventions we used 34% reduction in violence and aggressive behavior after implementation of Safer Bars program reported by Graham and colleagues (2004), assuming that there are a) 10% (expert opinion) and b) 15% (sensitivity analysis) of bar related crimes out of all alcohol-attributable crimes in Canada.

BRIEF INTERVENTIONS

We modeled the effect of the brief interventions separately assuming 22% (under ideal circumstances; Chisholm et al., 2004) and 7.7% (estimated for real-world circumstances) decreases in alcohol consumption among hazardous drinkers.

STATE MONOPOLY ON ALCOHOL SALES (PRIVATIZATION)

We used two scenarios; a 10% and 20% increase in alcohol consumption estimated for Ontario by Her et al. (1998) if the government controlled alcohol systems were to be fully privatized.

SENSITIVITY ANALYSES ON RESULTS OF AVOIDABLE BURDEN AND COST

Sensitivity analyses resulted in almost doubled savings in mortality and morbidity (Table 5).

Similarly, doubled savings were observed for health care, criminality and productivity losses resulted in total cost of almost $2 billion (Table 6).

LIMITATIONS

Although we tried to estimate avoidable costs as best as possible, the current study has some limitations. The time aspect of change due to interventions was not well captured. Over what periods of time would these benefits in burden and cost be achievable? In this study all effects were modeled as if they occurred instantaneously. While this modeling is reasonable for most effects on acute disease conditions and criminality, it overestimates the effect on chronic health conditions (except liver cirrhosis) attributable to alcohol. For example, if some drastic intervention could reduce alcohol consumption to zero at a certain point in time, alcohol-related disease burden would not be zero immediately thereafter. Instead, some burden of disease would persist due to previous alcohol consumption. For instance, there will be some people already having alcohol-attributable mouth cancer and some people may even develop new mouth or other cancer in future based on their past alcohol exposure.

In our aggregate costs estimates (baseline; Rehm et al., 2006), protective effect of low or moderate consumption of alcohol on cardio-vascular diseases and diabetes was taken into account and was, therefore, incorporated in current avoidable cost estimates. However, policies aimed at minimizing

the costs of alcohol abuse, such as increasing taxes on alcohol, may reduce the number of low or moderate alcohol consumers and thus reduce the total protective effect of low or moderate alcohol consumption. This effect of interventions on possible reduction of protective effect of alcohol over time was not captured in avoidable estimates.

Table 5. Net savings of alcohol-attributable mortality, years of life lost (YLLs) and morbidity due to implementation of selected interventions in Canada (based on 2002; sensitivity analysis)

Selected Interventions	Mortality	YLLs	Acute care hospital days
Increase in taxes by 25%	4,143	144,833	1,217,872
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	115	2,737	29,073
Relative change between baseline and this intervention	2.7%	1.9%	2.3%
Lowering BAC from 0.08% to 0.05%: 18% reduction in collisions fatalities	4,005	136,843	1,244,124
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	253	10,728	2,821
Relative change between baseline and this intervention	5.9%	7.3%	0.2%
Zero BAC under age 21 years	4,228	145,925	1,246,130
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	30	1,646	814
Relative change between baseline and this intervention	0.7%	1.1%	0.1%
MLDA 19-21 years	4,140	142,597	1,246,004
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	117	4,974	940
Relative change between baseline and this intervention	2.8%	3.4%	0.1%
Safer bars: 10% of bar related crimes	4,252	147,331	1,246,778
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	6	239	166
Relative change between baseline and this intervention	0.1%	0.2%	0.0%
Brief interventions: 22% reductions in alcohol consumption	3,273	127,476	1,103,269
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	984	20,094	143,675
Relative change between baseline and this intervention	23.1%	13.6%	11.5%
Privatization: 20% increase in alcohol consumption	5,404	164,529	1,450,599
Baseline	*4,258*	*147,571*	*1,246,945*
Difference between baseline and this intervention*	-1,146	-16,958	-203,654
Relative change between baseline and this intervention	-26.9%	-11.5%	-16.3%
Difference between baseline and all interventions†	**1,505**	**40,418**	**177,489**
Relative change between baseline and all interventions†	**35.3%**	**27.4%**	**14.2%**

Baseline - aggregate cost (Rehm et al., 2006)

Sensitivity analysis was not conducted for increase in taxes, zero BAC, and MLDA

*Avoidable cost

†Privatization was excluded because the estimates present additional burden but not savings

Table 6. Net savings of alcohol-attributable cost (based on 2002 in $'000) due to implementation of selected interventions in Canada (sensitivity analyses)

Selected Interventions	Health Care	Criminality	Productivity Losses	TOTAL
Increase in taxes by 25%	3,237,096	3,030,023	7,026,371	**13,293,490**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	69,104	42,177	100,029	**211,310**
Relative change between baseline and this intervention	2.1%	1.4%	1.4%	**1.6%**
Lowering BAC from 0.08% to 0.05%: 18% reduction in collisions fatalities	3,300,591	3,038,991	7,063,252	13,402,834
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	5,609	33,209	63,148	**101,966**
Relative change between baseline and this intervention	0.2%	1.1%	0.9%	**0.8%**
Zero BAC under age 21 years	3,304,581	3,068,925	7,108,137	**13,481,643**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	1,619	3,275	18,263	**23,157**
Relative change between baseline and this intervention	0.0%	0.1%	0.3%	**0.2%**
MLDA 19-21 years	3,304,330	3,059,253	7,097,124	**13,460,707**
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	1,870	12,947	29,276	**44,093**
Relative change between baseline and this intervention	0.1%	0.4%	0.4%	**0.3%**
Safer bars: 10% of bar related crimes	3,305,870	3,052,782	7,124,957	13,483,609
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	330	19,418	1,443	**21,191**
Relative change between baseline and this intervention	0.0%	0.6%	0.0%	**0.2%**
Brief interventions: 22% reductions in alcohol consumption	2,899,270	2,904,686	6,115,363	11,919,319
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	406,930	167,514	1,011,037	**1,585,481**
Relative change between baseline and this intervention	12.3%	5.5%	14.2%	**11.7%**
Privatization: 20% increase in alcohol consumption	3,821,359	3,275,290	8,018,356	15,115,005
Baseline	*3,306,200*	*3,072,200*	*7,126,400*	***13,504,800***
Difference between baseline and this intervention*	-515,159	-203,090	-891,956	**-1,610,205**
Relative change between baseline and this intervention	-15.6%	-6.6%	-12.5%	**-11.9%**
Difference between baseline and all interventions†	**485,462**	**278,542**	**1,223,196**	**1,987,199**
Relative change between baseline and all interventions†	**14.7%**	**9.1%**	**17.2%**	**14.7%**

Baseline - aggregate cost (Rehm et al., 2006)

Sensitivity analysis was not conducted for increase in taxes, zero BAC, and MLDA

*Avoidable cost

†Privatization was excluded because the estimates present additional costs but not savings

Due to data unavailability, the impact of selected interventions for prescription drugs, ambulatory care and physicians' services was assumed to be the same as for acute care hospitals.

Also, the impact of some interventions was not modeled stratified by sex and age. For example, economic theory would predict, that impact of taxation would be stronger for people with less disposable income such as young adults.

Avoidable productivity costs due to the interventions were calculated by using the modified Human Capital (HC) approach, introduced in the Canadian cost of substance abuse study (Rehm et al., 2006, 2007). However, to facilitate comparisons with other research, we also calculated avoidable productivity costs using the traditional HC and the Friction Cost (FC) methods. The magnitude of the avoidable indirect cost estimates varied substantially depending upon the method and underlying labor market assumptions, with the FC method producing the smallest figures. This is because FC method is more sensitive to changes in number of deaths, while the HC method is responsive to changes in potential years of life lost.

These presented estimates of avoidable cost of alcohol abuse do not reflect the rates of return that the society might achieve. To compute the potential rates of return on expenditure it is necessarily to conduct a cost benefit analysis. Our first estimates of avoidable cost of alcohol abuse in Canada might serve as a basis for conducting a meaningful cost benefit analysis, which would facilitate a complete evaluation and comparison of the most effective and cost effective interventions.

CONCLUSION

Alcohol causes considerable health and criminal burden on Canadian society. However, by implementing cost-effective policies some portion of alcohol-attributable burden and its costs could be avoided. Even under conservative assumptions and using interventions, generally supported by public opinion, one billion dollars per year could be saved in Canada.

The potential gains to Canadian society may be even higher, as sensitivity analyses on three of the six interventions resulted in a doubling of the avoidable alcohol-attributable burden and cost.

The largest impact would come from comprehensive interventions affecting the overall level of drinking such as brief interventions and increasing alcohol taxation. However, the greatest cost avoidance would be achieved when multiple rather than single effective and cost-effective alcohol policies are implemented. Thus, the results clearly indicate that substantial decreases in alcohol-attributable harm and costs to society can only be made if an alcohol strategy is implemented that comprises several policies. The recommendations for a National Alcohol Strategy, as laid out by the National Alcohol Strategy Working Group about one year ago (http://www.ccsa.ca/NR/rdonlyres/AB35A74F-2491-4CD0-8CD7 31F3897BDBBD/0/ccsa0238762007.pdf), would outline the right direction. However, substantial decreases in alcohol-attributable costs will only be possible if such a strategy is seen as a priority, and if it includes several broad areas of action, including measures to reduce the availability of alcohol.

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