Substance-attributable Morbidity and Mortality Changes to Canada's Epidemiological Profile

Measurable Differences Over a Ten-year Period

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ABSTRACT

Background: Substance use is responsible for a large burden of disease in Canada, however updated data are needed for health care planning and policy development. This study replicates and makes improvements on 1992 estimates of substance-attributable morbidity and mortality for the year 2002. There are two objectives, the main one being to compare the substance-attributable morbidity and mortality in 1992 with 2002 using the same methods of calculation, and the second, to compare the two different methods of estimating the substance-attributable mortality and morbidity in 2002.

Method: Estimates of substance-attributable burden were made by combining relative risk data with exposure prevalence data and disease-related mortality and morbidity information from national databases. First, identical relative risk estimates for 1992 were used with the 2002 data in order to draw direct comparisons. In a second analysis, updated relative risk and attributable disease information (post-1992) was used to better estimate the mortality and morbidity for Canada in 2002.

Results: Overall, from 1992 to 2002, there were relative increases in substance-attributable mortality estimates for alcohol and illegal drugs, where the latter relatively increased more; and a relative decrease in tobacco-attributable mortality. In terms of absolute numbers in combined risk factors, deaths and hospital days for those under 70 years of age decreased mainly due to tobacco. Comparisons of the two methods showed that the updated method resulted in more conservative numbers than previous calculations.

Interpretation: There is an unacceptably high burden of substance-attributable disease in Canada in the early 2000s. Exposure changes and epidemiological shifts in population and diseases over the last 10 years have affected where the burden lies, but it is still vital to incorporate policy-based initiatives that have proven to be effective in reducing substance-attributable burden in practice.

MeSH terms: Substance-related disorders; mortality; morbidity; epidemiology; Canada

La traduction du résumé se trouve à la fin de l'article.

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Substance use is responsible for a large burden of disease worldwide. Tobacco was the leading risk factor in developed nations like Canada, accounting for 12.2% of the total burden, alcohol was third at 9.2%, and illegal drugs eighth at 1.8%.[1,2] In 1996, a landmark Canadian study was undertaken by Single and colleagues[3] to estimate the economic costs of substance-attributable morbidity and mortality in Canada for the year 1992, which included a comprehensive summary of substance-attributable health indicators. More recently, however, Rehm and colleagues not only estimated these cost estimates and corresponding epidemiological profile for 2002 using identical methods to those used by Single, but also recalculated the numbers using improved and updated methods.[4] Thus, the main aim of this paper is to compare the substance-attributable morbidity and mortality in 1992 with 2002 using the same methods of calculation (those of Single et al., 1996). Second, we compare the two different methods of estimating the substance-attributable mortality and morbidity in 2002.

METHODS

This analysis will contrast and compare 1992 and 2002 estimates of substance-attributable deaths and potential years of life lost (PYLL) and hospital days. Although the methods of Rehm and Single differ in a number of ways, the general method is very similar. For this reason, an overview of the general method in common and separately by studies will be given.

The following steps are necessary to derive substance-attributable fractions (AF):

1. Determine the disease categories attributable to substance use;
2. Determine the distribution of exposure in the general population;
3. Determine exposure-risk relationships;
4. Combine information to determine substance-attributable fractions.

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 in both the studies with specific emphasis on the following:[5-7]

- Consistency across several studies
- Established experimental biological evidence of mediating processes or at least

TABLE I

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[8]
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[9]
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[10]
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[11]
Ischaemic heart disease	I20 - I25	Corrao et al., 2000[12]; 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[13]
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 (maternal use)		
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
Excess alcohol blood level	R78.0	100% AAF per definition
Unintentional injuries		
Motor vehicle collisions	†	Traffic Injury Research Foundation of Canada, 2004;[14] Transport Canada, 2004[15]
Poisonings	X40 - X49	Rehm et al., 2004; adjusted to Canada by AAF for traffic collisions
Accidental poisoning & exposure to alcohol	X45	100% AAF per definition
Falls	W00 - W19	Rehm et al., 2004; adjusted to Canada by AAF for traffic collisions
Fires	X00 - X09	Council of Canadian Fire Marshals and Fire Commissioners, 2003.[16]
Drowning	W65-W74	Rehm et al., 2004; adjusted to Canada by AAF for traffic collisions
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 collisions
Intentional injuries		
Suicide, self-inflicted injuries	X60 - X84, Y87.0	Rehm et al., 2004; adjusted to Canada by AAF for traffic collisions
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 collisions
Other intentional injuries	Y35	Rehm et al., 2004; adjusted to Canada by AAF for traffic collisions
Ethanol and methanol toxicity, undetermined intent	Y15	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†

TABLE II

ICD-10 Codes for Disease Conditions Attributable to Illegal Drug Use 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[17]
Viral hepatitis C	B17.1, B18.2	Remis, 2004[18]
Viral hepatitis B	B16, B18.0-B18.1	Single et al., 1996[3]
Infective (acute and subacute) endocarditis	I33	Single et al., 1996
Conditions arising during the perinatal period (maternal use)		
Pregnancy complications	O44-O46, O67, O35.5, O36.5	Relative risk for low birthweight was taken from English et al., 1995[6]
Foetus and newborn affected by maternal use of drugs of addiction	P04.4	Relative risk for low birthweight 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 birthweight was taken from English et al., 1995
Unintentional injuries		
Cannabis-attributable traffic collisions	Specific codes V01-V89*	MacDonald et al., 2003[19]
Cocaine-attributable traffic collisions	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)[20]
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

physiological plausibility (biological mechanisms)
- Strength of the association (effect size)
- Temporality (i.e., cause before effect).

Tables I-III give an overview of all the diseases that fulfilled the above conditions. Compared with 1996, the following changes were made:
- Alcohol: diseases like unipolar major depression were added in the 2006 study.
- Illegal drugs: in addition to diseases listed in the 1996 study, hepatitis C and traffic collisions attributable to cannabis and cocaine were added in the 2006 study.
- Tobacco: diseases such as anal cancer, penile cancer, vulvar cancer, crohn's disease, ulcerative colitis and chemotherapy were dropped from the 2006 study due to insufficient causal relationship between smoking and above diseases.[31] However, acute myeloid leukemia was added to the current mortality and morbidity estimation in Canada.

All conditions which were by definition attributed to substance abuse (AF = 1.0) were included. AFs for all injuries were directly estimated from the administrative records and adjusted to Canada[10,14] by alcohol-attributable fractions for traffic collision.

The prevalence data for alcohol were based on a linear interpolation of findings from major national surveys conducted in Canada.[32-34] Data on smoking prevalence were taken from the General Social Survey[35] and Canadian Community Health Survey cycle 2.1,[36] and data on prevalence of use of illegal drugs were taken from Popova et al.[37] Further details of the exposure assessment can be taken from the following studies (For 1992: Single et al., 1996[3]. For 2002: for alcohol, see Rehm et al., (2006)[38]; for tobacco, see Baliunas et al.[39]; for illegal drugs; see English et al., 1995[6], Fischer et al., 1999[40], Geduld et al., 2003[17], Moses et al., 2002[41], Remis, 2004[18], and Roy et al., 1999[42]).

The relative risk for each condition was combined with different levels of exposure for each sex and age group and AFs were obtained using the following formula (see Walter, 1976[43], 1980[44]).

TABLE III

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[6]
Oesophageal cancer	C15, D00.1	English et al., 1995
Stomach cancer	C16, D00.2	Tredaniel et al., 1997[21]
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[22]
Cervical cancer	C53, D06	Plummer et al., 2003[23]
Urinary tract cancer	C64-C68	Zeegers et al., 2000[24]
Renal Cell Carcinoma	C64	Hunt, 2005[25]
Bladder cancer	C67, D09.0	Brennan et al., 2000[26]; 2001[27]
Acute myeloid leukaemia	C92.0	Brownson et al., 1993[28]
Cardiovascular diseases		
Ischaemic heart disease	I20-I25	Law, 1997[29] & Law, 2003[30]
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[3]
Ulcers	K25-K28	English et al., 1995
Conditions arising during the perinatal period (maternal use)		
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[16]

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

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 i^{th} category of exposure

RESULTS

Table IV 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 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. It should be noted that these totals of substance-specific consequences are an overestimate and give a rough estimate only because relationships between 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 between substances.[45] However, Collins and Lapsley[46] found that for Australia in 1998-99, 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, which, for some indicators, decreased. There are a number of reasons that contribute to this overall increase in drug-attributable morbidity and mortality. First, increases look bigger for these 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 present study relied on coroners' reports rather than on official Statistics Canada mortality data. Third, in 2002, drug-attributable hepatitis C deaths and traffic collision 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 a natural death.

Looking at the mortality data only, there was a net increase in alcohol deaths of approximately 20% and illegal drug-attributable deaths increased almost 76% 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 (-2.4%), even though the actual number of deaths increased by about 3,400. 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 in this period, reflecting a 6.5% relative decrease. In terms of PYLLs, the alcohol and drug trend is similar (relative increases of 11.8% and 89.7%, 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 under age 70, i.e., a decrease of approximately 47,000 compared to 1992, with tobacco accounting for an overall decrease of more than 708,000 days. However, tobacco-attributable hospital days increased by 47.8% relative to 1992

TABLE IV

Comparison of Mortality and Morbidity Indicators Using Single et al., 1996 Methods

	All Deaths Caused			% of all Deaths		
	1992	2002	Difference	1992	2002	Relative Difference
Alcohol*	6701	9100	2399	3.41%	4.07%	19.35%
Illegal drugs	732	1455	723	0.37%	0.65%	75.87%
Tobacco	33,498	37,208	3710	17.05%	16.64%	-2.40%
	All deaths caused under age 70 years			**% of all deaths under age 70**		
Alcohol*	4913	5500	587	6.64%	8.22%	23.89%
Illegal drugs	719	1441	722	0.97%	2.15%	121.81%
Tobacco	16,077	13,579	-2498	21.72%	20.30%	-6.52%
Total	21,709	20,520	-1189			
	PYLL†			**% of all PYLL**		
Alcohol*	186,257	209,096	22,839	6.05%	6.76%	11.79%
Illegal drugs	31,147	59,220	28,073	1.01%	1.92%	89.66%
Tobacco	495,640	504,609	8969	16.09%	16.32%	1.44%
Total	713,044	772,925	59,881			
	Acute hospital days			**% of all hospital days**		
Alcohol*	1,149,106	1,550,554	401,448	2.78%	7.23%	160.12%
Illegal drugs	58,571	318,409	259,838	0.14%	1.48%	960.71%
Tobacco	3024,265	2,316,166	-708,099	7.31%	10.80%	47.77%
Total	4,231,942	4,185,129	-46,813			

* Please note that the numbers for alcohol are gross numbers, i.e., they only account for mortality and morbidity caused and not mortality and morbidity prevented by alcohol.
† Potential Years of Life Lost (PYLL), an indicator of premature mortality, meaning people dying due to substance abuse would have lived longer had they not used those substances.

TABLE V

Overview of Comparison of Mortality and Morbidity Using Single et al., 1996 and Rehm et al., 2006 Methods

	All Deaths Caused			
	1992 Single et al., 1996	2002 Single et al., 1996	2002 Rehm et al., 2006	1992 vs. 2002 Relative Difference†
Alcohol*	6701	9100	8103	6.27%
Illegal drugs	732	1455	1695	104.88%
Tobacco	33,498	37,208	37,209	-2.40%
Total	40,931	47,763	47,007	
		All deaths caused under age 70 years		
Alcohol*	4913	5500	5061	14.01%
Illegal drugs	719	1441	1599	146.13%
Tobacco	16,077	13,579	14,249	-1.91%
Total	21,709	20,520	20,909	
		All potential years of life lost (PYLL)		
Alcohol*	186,257	209,096	191,136	2.19%
Illegal drugs	31,147	59,220	62,110	98.91%
Tobacco	495,640	504,609	515,607	3.65%
Total	713,044	772,925	768,853	
		Acute hospital days		
Alcohol*	1,149,106	1,550,554	1,587,054	166.25%
Illegal drugs	58,571	318,409	351,121	1073.01%
Tobacco	3,024,265	2,316,166	2,210,155	41.01%
Total	4,231,942	4,185,129	4,149,330	

* Please note that the numbers for alcohol are gross numbers, i.e., they only account for mortality and morbidity caused and not mortality and morbidity caused by alcohol.
† Relative difference is adjusted for trends in all-cause level of respective health indicators, i.e., all-cause mortality, PYLL, and acute care hospital days.

data when looking at the proportion of the overall hospital days. The largest relative increase was in drug-attributable hospital days: almost 10-fold from 1992 to 2002, with alcohol increasing by about 160%.

Table V shows the comparison of Single et al.[3] method and Rehm et al.[4] method using the 2002 data. 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. Illegal drug-attributable outcomes increased by using the Rehm method compared to the Single method, which was mainly due to the large increase in overdose deaths[37] and, to a lesser extent, the inclusion estimates for cannabis- and cocaine-attributable traffic accidents.

DISCUSSION

Using the Single et al.[3] method to compare 1992 and 2002 data found overall relative increases in 2002 for all mortality and morbidity-attributable 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. In comparing the two methods, the Rehm et al.[4] method was found to result in more conservative estimates overall, except for deaths under the age of 70 years.

It is important to identify any major differences between the two time points that may potentially confound the interpretation of the results before attempting to explain some of the major findings. Overall in Canada, there have been three major epidemiological shifts that may have had an effect. The first of these is that the Canadian population is getting larger.[47] This means that there were greater numbers of deaths as a whole (increase of 13.5%, from almost 197,000 deaths in 1992 to 223,600 in 2002) and in substance-attributable categories; therefore for this comparison, all comparisons were drawn against the 2002 population, and hence were *relative* increases or decreases. 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. This was not really adjusted for, but the differences between the full population and the population under 70 years of age gives some indication of the difference this makes. A third shift is much harder to capture, and is related to trends in rates of disease and subsequent changes in distributions between diseases. For example, the standardized death rate of cardiovascular deaths has been declining for more than

four decades (1960: 617 deaths per 100,000; 1999: 233 deaths)[48] and at a higher rate than other mortality categories.

In addition, dealing with changes over a 10-year period, given the varying data sources and their varying qualities, some observed change could simply be due to the changes in data collection protocol.

Over the last 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 hazardous and harmful drinking categories has increased.[39,49,50] 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 that is based on current exposure. Therefore, tobacco-related indicators with high chronic disease contributions like PYLL and older age deaths are due to exposure prior to 2002, whereas reductions in hospital days and in younger deaths may reflect the decreasing prevalence of smoking. For alcohol, relative and actual increases may reflect the increasing prevalence of heavy drinking occasions and the related impact in more acute categories.

There are a number of strengths to this study that lend weight to the findings. 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 relative risks for 1992 were kept the same for the 2002 calculations, so theoretically the only methodological difference between the 1992 and 2002 data is exposure measurement. The differences seen between 1992 and 2002 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 volume of alcohol) (for more information, see Rehm et al., 2001,[51] 2004[10]) in addition to epidemiological shifts, not accounted for in the calculations.

As a limitation of the study, it can be noted that the growing aggregate disparities in income inequality in the recent time might be attributable to some of the increases found in most substances. The burden of substance-related morbidity and mortality is disproportionately experienced by the poor, and the rise in inequality in Canada in the last 10 years may have led to some of the observed change.

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RÉSUMÉ

Contexte : La consommation de substances toxiques (alcool, drogue ou tabac) contribue beaucoup au fardeau des maladies au Canada, mais on manque de données à jour pour la planification et l'élaboration des politiques de santé. Cette étude reprend, en les améliorant, des estimations de 1992 portant sur la morbidité et la mortalité attribuables aux substances toxiques pour l'année 2002. Nous avions deux objectifs, le principal étant de comparer la morbidité et la mortalité attribuables à ces substances en 1992 et en 2002 à l'aide des mêmes méthodes de calcul, et le second, de comparer les deux méthodes utilisées pour estimer la mortalité et la morbidité attribuables aux substances en 2002.

Méthode : Nous avons estimé le fardeau des maladies attribuables aux substances toxiques en combinant les données sur le risque relatif, les données sur la prévalence de l'exposition et les données sur la mortalité et la morbidité liées aux maladies, tirées des bases de données nationales. Pour commencer, nous avons utilisé des estimations identiques du risque relatif pour 1992 et pour 2002 afin de pouvoir faire des comparaisons directes. Dans un deuxième temps, nous avons utilisé des données mises à jour sur le risque relatif et les données sur la mortalité et la morbidité liées aux maladies (après 1992) pour mieux estimer la mortalité et la morbidité au Canada en 2002.

Résultats : Globalement, entre 1992 et 2002, il y a eu des augmentations relatives dans les estimations de la mortalité attribuable à l'alcool et à la drogue (ces augmentations étaient relativement plus fortes dans le cas de la drogue), et une diminution relative de la mortalité attribuable au tabac. En chiffres absolus combinant tous les facteurs de risque, les décès et les jours d'hospitalisation chez les personnes de moins de 70 ans ont principalement diminué en raison du tabac. Nos comparaisons des deux méthodes montrent que la nouvelle méthode de calcul donne des estimations plus prudentes que la méthode antérieure.

Interprétation : Le fardeau des maladies attribuables aux substances toxiques était intolérablement élevé au Canada au début des années 2000. Les variations dans les niveaux d'exposition et les changements épidémiologiques dans la population et les maladies au cours des 10 dernières années ont contribué à repositionner ce fardeau, mais il est encore crucial d'adopter des initiatives stratégiques éprouvées pour le réduire dans la pratique.