

The relative risks and etiologic fractions of different causes of death and disease attributable to alcohol, tobacco and illicit drug use in Canada

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Abstract

Background: In 1996 the number of deaths and admissions to hospital in Canada that could be attributed to the use of alcohol, tobacco and illicit drugs were estimated from 1992 data. In this paper we update these estimates to the year 1995.

Methods: On the basis of pooled estimates of relative risk, etiologic fractions were calculated by age, sex and province for 90 causes of disease or death attributable to alcohol, tobacco or illicit drugs; the etiologic fractions were then applied to national mortality and morbidity data for 1995 to estimate the number of deaths and admissions to hospital attributable to substance abuse.

Results: In 1995, 6507 deaths and 82 014 admissions to hospital were attributed to alcohol, 34 728 deaths and 194 072 admissions to hospital were attributed to tobacco, and 805 deaths and 6940 admissions to hospital were due to illicit drugs.

Interpretation: The use and misuse of alcohol, tobacco and illicit drugs accounted for 20.0% of deaths, 22.2% of years of potential life lost and 9.4% of admissions to hospital in Canada in 1995.

The use of alcohol, tobacco or illicit drugs has been implicated as a sufficient or contributory factor in at least 90 causes of death and disease.^{1,2} In this paper we present the results of a meta-analysis of the relative risks of alcohol, tobacco and illicit drug use for different causes of death and disease in Canada, as well as, for each cause, the “etiologic fractions” (attributable proportions) and estimated numbers of deaths and admissions to hospital that can be causally attributed to alcohol, tobacco and illicit drugs.

There have been relatively few attempts to estimate mortality and morbidity attributable to substance abuse in Canada.³ Before 1996, estimates were generally based on expert opinion concerning the proportion of different major causes of disease that could be reasonably attributed to the use of alcohol, tobacco or illicit drugs.⁴ Such estimates grouped causes of disease into major categories (e.g., all cancers) and failed to control for age or sex.

In 1996 a major study estimating the economic costs attributable to substance abuse in Canada (1992 data) was reported.^{2,5,6} As part of this analysis, the numbers of deaths and admissions to hospital that could be attributed to the use of alcohol, tobacco and illicit drugs were estimated. These estimates, based on the methods described below, considered specific International Classification of Disease (ICD-9) categories⁷ and controlled for age, sex and province. This paper updates the estimates for 1992 to the year 1995 and presents information on the relative risks of alcohol, tobacco and illicit drug use and their etiologic fractions.

Following the lead of Collins and Lapsley,⁸ the term “substance abuse” here encompasses any use that involves a social cost additional to the resource costs of the provision of that drug. Therefore, the consequences of “abuse” are not limited to those associated with heavy use or with dependence or abuse as defined by international classifications such as ICD-9 or the *Diagnostic and Statistical Manual of Mental Disorders*,⁹ and they include mortality and morbidity associated with moderate use if such use incurs social costs to the community.

Research

Recherche

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Methods

Potential causes of death and disease associated with substance abuse have been identified in reviews and meta-analyses of large-scale epidemiological studies for alcohol,^{1,10,11} tobacco^{1,11,12} and illicit drugs.^{1,11,13} Causes include both chronic conditions and acute consequences such as drug overdose and trauma resulting from substance-related accidents. In this study, there were essentially three ways in which the use of alcohol, tobacco or illicit drugs may be implicated as a cause of death or disease. First, we included conditions that are by definition directly related to substance abuse (e.g., alcoholic psychosis or drug dependence). All reported cases of death or admission to hospital from such causes were considered attributable to substance abuse (i.e., etiologic fraction 1.0). Second, for some conditions in which substance abuse is a contributory but not a necessary cause, such as suicide or trauma resulting from impaired driving accidents, etiologic fractions were determined directly from case series (both US¹⁰⁻¹⁴ and Canadian¹⁵⁻¹⁷ sources). Finally, for most chronic disease conditions in which substance abuse is a contributory cause, estimates of the relative risk of particular disorders for alcohol, tobacco or illicit drug use were combined with prevalence data on the number of people consuming the substance to derive the etiologic fraction, according to the following formula:

$$\text{Etiologic fraction} = [P_0 + P_1(RR_1) - 1] / [P_0 + P_1(RR_1)]$$

where P_0 and P_1 are the prevalence rates for non-users and users

respectively, and RR_1 is the relative risk for users relative to non-users. Where the etiologic fraction takes different levels of use into account, as in the case of alcohol consumption, an appropriate alternative computation was used (see formula 1.9 in English and associates¹).

It is important to note that the etiologic fractions are based on pooled estimates of relative risk rather than on single studies. For some causes of death and disease, where there were sufficient data, separate estimates of the relative risks of mortality and morbidity were calculated. The etiologic fractions represent gross rather than net estimates of the proportion of deaths and admissions to hospital caused by substance abuse. Where it has been established that the use of a psychoactive substance actually prevents rather than causes certain disorders (e.g., the protective effect of low-level alcohol consumption against coronary heart disease), the numbers of deaths and admissions to hospital prevented were calculated; these data have been previously reported.⁵ However, the cases prevented were not subtracted from the numbers of deaths and admissions to hospital caused by the use of these substances, because our primary aim was to estimate total mortality and morbidity caused by substance abuse. Hence the etiologic fractions reported in Tables 1–3 refer only to events caused by, and do not adjust for events prevented by, substance abuse.

Prevalence data for the 1992 estimates of etiologic fractions for alcohol were based on a linear interpolation of findings from the 1990 Health Promotion Survey¹⁸ and the 1994 Canada's Alcohol and Other Drugs Survey (CADS),¹⁹ adjusted to correspond to the normal quantity and frequency measures used in epidemiologic

Table 1: Relative risks and etiologic fractions for some conditions partially attributable to alcohol use in Canada, 1992*

Condition†	Drinking level;‡ sex; relative risk						Outcome; sex; etiologic fraction				Age range, yr
	Low		Hazardous		Harmful		Mortality		Morbidity		
	M	F	M	F	M	F	M	F	M	F	
Chronic											
Esophageal cancer (150, 230.1)	1.80	1.80	2.37	2.37	4.26	4.26	0.379	0.216	0.381	0.220	≥ 15
Liver cancer (155, 230.8)	1.45	1.45	3.03	3.03	3.60	3.60	0.289	0.161	0.294	0.172	≥ 15
Lip and oropharyngeal cancer (140, 141, 143–146, 148, 149, 230.0)	1.45	1.45	1.85	1.85	5.39	5.39	0.295	0.152	0.297	0.163	≥ 15
Breast cancer (174, 233.0)	NA	1.09	NA	1.31	NA	1.68	NA	0.039	NA	0.042	≥ 15
Laryngeal cancer (161, 231.0)	1.83	1.83	3.90	3.90	4.93	4.93	0.411	0.256	0.415	0.273	≥ 15
Acute											
Motor vehicle accidents (E810–E825)	NA	NA	NA	NA	NA	NA	0.430	0.430	0.301	0.301	All ages
Suicide, self-inflicted injury (E950–E959)	1.40	1.40	2.32	2.32	2.52	2.52	0.272	0.168	0.277	0.172	≥ 15
Victim of assault (E960–E966, E968–E969)	NA	NA	NA	NA	NA	NA	0.270	0.270	0.270	0.270	All ages
Victim of child abuse (E967)	NA	NA	NA	NA	NA	NA	0.160	0.160	0.160	0.160	0–19

Note: Provincial breakdowns are presented in Single and associates.² M = males; F = females; NA appears for one of the following reasons: the etiologic fraction was determined directly and the relative risk was thus not required, or the condition applied only to the other sex (e.g., breast cancer for men). Where the relative risk is shown, the etiologic fraction has been calculated by dividing the total attributable incidents estimated for Canada (from age-, sex- and province-specific prevalence data and the relative risk estimates) by the total incidents reported in Canada in 1992.

*Conditions that are fully attributable to alcohol (e.g., alcohol dependence categories) are not presented in this table, since the etiologic fraction for such conditions is 1.0. This table highlights a few selected conditions; the relative risks and etiologic fractions for other specific conditions are available from the corresponding author. †Codes are from the *International Classification of Diseases* (ICD-9-CM). Where more than one set of codes is given, the E codes were applied to mortality data and the N codes to morbidity data.

‡Low, hazardous and harmful drinking are defined as 2.6–40, 41–60 and > 61 g ethanol per day for men and 2.6–20, 21–40 and > 41 g ethanol per day for women.¹

studies of relative risk.²⁰ Prevalence data for the 1995 estimates were estimated from the mean of the 1994/95 and the 1996/97 National Population Health Surveys.²¹ Abstinence, low, hazardous and harmful drinking were defined respectively as 2.5 or less, 2.6–40, 41–60, and 61 or more grams of ethanol per day for men and 2.5 or less, 2.6–20, 21–40, and 41 or more grams per day for women.¹ This scale corresponds most closely with the manner in which relative risks are reported in the epidemiologic studies in the meta-analyses. Prevalence estimates for drinking among pregnant women for both the 1992 and 1995 estimates were taken from the 1990 Ontario Health Survey,²² and the proportion of pregnant women who smoke was estimated from the Survey on Smoking in Canada, 1994.²³ For both the 1992 and 1995 estimates, the prevalences of opiate and cocaine use were taken from the 1994 Canada's Alcohol and Other Drugs Survey.¹⁹

In the study estimating mortality and morbidity attributable to substance abuse in 1992,²⁵ estimates of relative risks and etiologic fractions were calculated, and the etiologic fractions were then applied to the reported number of deaths and hospital discharges for each cause of death or disease by age, sex and province to estimate

mortality and morbidity attributable to alcohol, tobacco and illicit drugs in Canada. These estimates have been updated to 1995, using the same relative risk estimates but updating the prevalence estimates and applying the resulting etiologic fractions to 1995 data on deaths and admissions to hospital in that year. In addition, the etiologic fraction for motor vehicle accidents was updated on the basis of a more recent study.²⁴

Results

The relative risks associated with alcohol and tobacco use for selected causes of death and disease are presented Tables 1 and 2; the etiologic fractions indicating the proportion of cases attributable to substance misuse are shown in Tables 1–3 for alcohol, tobacco and illicit drug use. The etiologic fractions given in Tables 1–3 are for 1992 but they are very similar to those for 1995 because they are based on the same relative risk estimates and there were no

Table 2: Relative risks and etiologic fractions for some conditions partially attributable to tobacco use in Canada, 1992*

Condition†	Smoking status; sex; relative risk‡				Outcome; sex; etiologic fraction				Age range, yr
	Ex-smoker		Current smoker		Mortality		Morbidity		
	M	F	M	F	M	F	M	F	
Lung cancer (162, 231.2)	6.75	5.07	13.0	11.4	0.847	0.738	0.849	0.752	≥ 15
Chronic obstructive pulmonary disease (490–492, 496)	6.70	6.70	9.80	9.80	0.824	0.694	0.827	0.730	≥ 15
Ischemic heart disease (410–414)									
< 65 years	1.59	1.59	2.58	2.58	0.415	0.368	0.472	0.449	15–64
	1.32	1.32	3.51	3.51					
≥ 65 years	1.12	1.12	1.54	1.54	0.133	0.076	0.200	0.148	≥ 65
	1.08	1.08	2.16	2.16					
Stroke (430–438)									
< 65 years	1.30	1.30	3.12	3.12	0.430	0.415	0.430	0.414	15–64
≥ 65 years	1.15	1.15	1.65	1.65	0.153	0.087	0.162	0.099	≥ 65
Arterial disease (440–448)	1.82	1.82	2.54	2.54	0.420	0.245	0.432	0.317	≥ 15
Pneumonia and influenza (480–487)	1.29	1.29	1.47	1.47	0.191	0.094	0.194	0.129	≥ 15
Heart failure, ill-defined (428, 429)	NA	NA	NA	NA	0.146	0.074	0.209	0.135	≥ 15
Esophageal cancer (150, 230.1)	1.79	1.79	4.01	4.01	0.512	0.387	0.517	0.394	≥ 15
Pancreatic cancer (157, 230.9)	1.15	1.15	1.86	1.86	0.205	0.145	0.208	0.157	≥ 15
Cardiac dysrhythmias (427)									
< 65 years	1.59	1.59	2.58	2.58	0.414	0.376	0.472	0.454	15–64
	1.32	1.32	3.51	3.51					
≥ 65 years	1.12	1.12	1.54	1.54	0.131	0.074	0.194	0.143	≥ 65
	1.08	1.08	2.16	2.16					
Lip and oropharyngeal cancer (140, 141, 143–146, 148, 149, 230.0)	1.76	1.76	4.55	4.55	0.544	0.430	0.551	0.464	≥ 15

Note: Provincial breakdowns are presented in Single and associates.² M = males; F = females; NA appears for ill-defined heart conditions because, following the method used by English and associates,¹ the etiologic fractions are derived from the proportion of all specified heart conditions that are attributable to smoking. Where the relative risk is shown, the etiologic fraction has been calculated by dividing the total attributable incidents estimated for Canada (from age-, sex- and province-specific prevalence data and the relative risk estimates) by the total incidents reported in Canada in 1992.

*Conditions that are fully attributable to tobacco abuse are not presented in this table, since the etiologic fraction for such conditions is 1.0. This table highlights a few selected conditions; the relative risks and etiologic fractions for other specific conditions are available from the corresponding author.

†Codes are from the *International Classification of Diseases* (ICD-9-CM).

‡Where two relative risks are shown, the first applies to mortality and the second to morbidity.

Table 3: Etiologic fractions for some conditions partially attributable to use of illicit drugs in Canada, 1992*

Condition†	Associated drug	Outcome; sex; etiologic fraction				Age range, yr
		Mortality		Morbidity		
		M	F	M	F	
Suicide and self-inflicted injury (E950–E959)	Various	0.14	0.03	NA	NA	15–49
AIDS (042–044)						
< 15 years	IV	0.13	0.13	0.13	0.13	< 15
≥ 15 years	IV	0.04	0.13	0.04	0.13	≥ 15
Victim of assault (E960–E969)	Various	0.14	0.03	0.08	0.03	15–49
Motor vehicle accidents (E810–E819)	Various	0.02	0.00	0.02	0.00	15–49

Note: Provincial breakdowns are presented in Single and associates.² M = males; F = females; NA appears for the following reason: the etiologic fraction was determined directly and the relative risk was thus not required. Since all etiologic fractions were determined from case series, the relative risk is not applicable. *Conditions that are fully attributable to illicit drug use are not presented in this table, since the etiologic fraction for such conditions is 1.0. This table highlights a few selected conditions; the relative risks and etiologic fractions for other specific conditions are available from the corresponding author. †Codes are from the *International Classification of Diseases*⁷ (ICD-9-CM). Where more than one set of codes is given, the E codes were applied to mortality data and the N codes to morbidity data.

Table 4: Number of deaths, potential years of life lost and number of hospitalizations due to alcohol, tobacco and illicit drugs in Canada, 1995 (continued on page 1673)

Causes*	No. of deaths			Potential years of life lost			No. of hospital separations		
	M	F	Total†	M	F	Total†	M	F	Total†
Alcohol-related causes									
<i>Chronic conditions</i>									
Alcoholic liver cirrhosis (571.0–571.3)	780	257	1 037	15 390	6 238	21 626	3 954	1 453	5 407
Alcoholic psychoses, alcohol dependence syndrome, alcohol abuse (291, 303, 305.0)	521	171	692	10 408	4 333	14 739	14 107	5 639	19 744
Esophageal cancer (150, 230.1)	305	68	373	4 559	1 047	5 606	540	117	657
Liver cancer (155, 230.8)	184	67	251	3 104	1 185	4 289	300	93	393
Lip and oropharyngeal cancer (140–141, 143–146, 148–149, 230.0)	163	38	201	2 713	700	3 413	604	131	735
Breast cancer (174, 233.0)	0	192	192	0	4 259	4 259	0	813	813
Laryngeal cancer (161, 231.0)	165	25	190	2 630	463	3 092	544	80	624
Other chronic conditions	339	169	507	5 184	2 362	7 548	10 196	6 050	16 246
<i>Acute conditions</i>									
Motor vehicle accidents (E810–E819, E820–E825)	787	357	1 144	31 814	14 962	46 776	6 082	3 509	9 591
Suicide, self-inflicted injury (E950–E959)	821	134	955	30 610	5 349	35 959	2 636	2 469	5 105
Accidents other than motor vehicle accidents (E826, E829–E845, E880–E888, E890–E899, E901, E910, E911, E917–E920, E922)	507	290	796	12 964	5 044	18 008	11 145	8 267	19 412
Victim of assault (E960–E967)	89	43	132	3 608	1 972	5 580	2 132	571	2 703
Other acute conditions, including excess blood alcohol and alcohol toxicity (790.3, [980.0, 980.1] or [E860.0–E860.2], ‡ V70.4)	24	13	37	750	481	1 231	363	221	584
Total attributed to alcohol	4 685	1 824	6 507	123 734	48 395	172 126	52 603	29 413	82 014
Rate per 100 000 population	32.3	12.4	22.2	853.7	327.9	588.4	362.9	199.3	281.1
Alcohol as percentage of all causes	4.2	1.8	3.1	7.1	3.3	5.4	3.9	1.6	2.7
Tobacco-related causes									
Lung cancer (162, 231.2)	8 281	3 870	12 151	115 082	73 182	188 264	14 058	7 154	21 212
Chronic obstructive pulmonary disease (490–492, 496)	4 357	2 315	6 671	40 338	28 646	68 984	21 602	15 904	37 506

major changes in prevalence over the years. The table does not include causes fully attributable to substance use (i.e., alcohol or drug dependence categories), for which the etiologic fraction is 1.0.

Mortality and morbidity attributable to substance abuse in 1992, based on these relative risks and etiologic fractions, have been reported elsewhere.^{2,5} Table 4 presents the number of deaths, the potential years of life lost (the difference between age of death and life expectancy, with age and sex taken into account), the number of hospital separations and the length of hospital stay attributable to alcohol, tobacco and illicit drug use, updated to 1995.

Alcohol

We estimated that 6507 Canadians died in 1995 because of alcohol consumption. The largest number of alcohol-

related deaths stemmed from impaired-driving accidents. We estimated that 787 men and 357 women died in motor vehicle accidents caused by alcohol impairment. Alcoholic liver cirrhosis accounted for 1037 deaths, and there were 955 alcohol-related suicides.

The findings regarding years of potential life lost indicate that many of these deaths involved relatively young people. Because of the high number of alcohol-related accidental deaths and suicides, the total potential years of life lost is relatively high, at 172 126. This represents 26.4 years of potential life lost per alcohol-related death. Motor vehicle accidents accounted for 17.6% of all alcohol-related deaths and 27.2% of potential years of life lost, data that indicate the relatively young age of people killed in alcohol-related traffic accidents.

We estimated that 82 014 Canadians were admitted to hospital because of alcohol misuse in 1995. The greatest

Table 4 (continued from page 1672)

Causes*	No. of deaths			Potential years of life lost			No. of hospital separations		
	M	F	Total†	M	F	Total†	M	F	Total†
Ischemic heart disease (410–414)	4 700	1 842	6 542	75 490	28 749	104 239	38 614	13 683	52 297
Stroke (430–438)	1 216	932	2 148	16 357	14 506	30 863	8 520	5 151	13 671
Arterial disease (440–448)	1 070	581	1 651	11 355	6 634	17 989	7 614	3 361	10 975
Pneumonia and influenza (480–487)	659	378	1 038	6 085	4 120	10 205	5 921	3 767	9 688
Heart failure, ill-defined (428, 429)	342	215	557	4 113	2 535	6 648	6 435	3 675	10 110
Esophageal cancer (150, 230.1)	429	118	546	6 419	1 868	8 287	756	206	962
Pancreatic cancer (157, 230.9)	287	191	478	4 472	3 402	7 874	445	300	745
Cardiac dysrhythmias (427)	276	161	437	4 386	2 645	7 031	6 546	1 079	7 625
Lip and oropharyngeal cancer (140, 141, 143–146, 148, 149, 230.0)	318	106	423	5 278	1 965	7 243	1 164	371	1 535
Other cancers	1 072	424	1 496	15 091	7 991	23 082	5 651	2 196	7 847
Other conditions	345	246	590	10 691	8 950	19 641	7 913	11 687	19 599
Total attributed to tobacco	23 352	11 379	34 728	315 157	185 193	500 350	125 239	68 534	193 772
Rate per 100 000 population	161.1	77.1	118.7	2 174.3	1 254.9	1 710.5	864.0	464.4	665.2
Tobacco as percentage of all causes	21.0	11.5	16.5	18.2	12.6	15.7	9.3	3.7	6.5
Causes related to illicit drug use									
Suicide, self-inflicted injury (E950–E959)	313	15	329	13 591	768	14 359	NA	NA	NA
Opiate poisoning (965.0, E850.0, E850.1, E935.1‡)	129	31	160	4 908	1378	6 286	266	245	511
AIDS (042–044)	66	17	83	2 485	733	3 213	140	54	194
Cocaine poisoning (968.5, E855.2‡)	65	13	78	2 718	654	3 372	124	62	186
Poisoning, intent unknown (E980)	34	23	57	1 109	801	1 910	0	0	0
Victim of assault (E960–E969)	34	3	37	1 469	152	1 621	922	53	975
Motor vehicle accidents (E810–E819)	29	0	29	1 349	0	1 349	257	0	257
Other conditions	21	7	32	1 081	471	1 552	2 827	1 980	4 817
Total attributed to illicit drugs	691	109	805	28 710	4 957	33 662	4 536	2 394	6 940
Rate per 100 000 population	48	0.7	2.7	198.1	33.6	115.1	31.3	16.2	23.7
Illicit drugs as percentage of all causes	0.6	0.1	0.4	1.7	0.3	1.1	0.3	0.1	0.2

Note: Hospitalizations are measured at the time of separation rather than admission because diagnoses are most complete at the time of separation. M = males; F = females; NA = not applicable.

*Codes are from the *International Classification of Diseases*² (ICD-9-CM). The mortality and morbidity estimates for conditions in the categories "other conditions" are available from the corresponding author.

†Value given as total may differ from the sum of values for men and women because of rounding.

‡E codes were used for mortality data; the corresponding N codes (not shown) were used for data on number of admissions to hospital.

number of separations attributed to alcohol were for alcoholic psychosis, alcohol dependence syndrome or alcohol abuse (19 744 in total), accidents other than motor vehicle accidents (19 412) and motor vehicle accidents (9591). Although accidents other than motor vehicle accidents accounted for only 12.2% of alcohol-related deaths, they accounted for 23.7% of admissions to hospital attributed to alcohol. These figures include victims who were killed or injured as a result of others' intoxication. In contrast, motor vehicle accidents accounted for 17.6% of alcohol-attributed deaths but only 11.7% of admissions due to alcohol.

These estimates of alcohol-attributable mortality and morbidity represent 3.1% of total mortality, 5.4% of total years of potential life lost and 2.7% of all admissions to hospital for any cause in Canada for 1995.

It should be noted that the 1992 estimates included an estimate of the number of deaths and admissions to hospital *prevented* by low-level alcohol use.⁵ In 1992 alcohol prevented more deaths (7401) than were caused by alcohol misuse (6701). However, alcohol-related mortality frequently involves relatively young people, whereas the benefits apply mainly to older adults; therefore, the number of potential years of life lost due to alcohol was much greater than the potential years of life saved by alcohol use (186 257 v. 88 656). Furthermore, the number of admissions to hospital averted by alcohol use (45 414) was much lower than the number caused by alcohol (86 076).

Tobacco

The number of tobacco-related deaths in Canada was estimated at 34 728 for 1995. Smoking-related lung cancer accounted for the largest number of deaths (12 151), which represented 35.0% of all deaths attributed to tobacco use. Tobacco-related chronic obstructive pulmonary disease (COPD) accounted for 6671 deaths and ischemic heart disease for 6542 deaths. More than two-thirds of those who died from tobacco-related causes in Canada were men. An estimated 194 072 admissions to hospital were due to tobacco use. The largest number of smoking-related admissions were for ischemic heart disease (52 297), COPD (37 506) and lung cancer (21 212). Tobacco-attributed mortality and morbidity accounted for 16.5% of total mortality, 15.7% of total potential years of life lost and 6.5% of all admissions to hospital for any cause in Canada in 1995.

Illicit drugs

The number of deaths related to illicit drug use in 1995 was estimated at 805, which represents 0.4% of all deaths. Most of these deaths (691 or 85.8%) affected males. Suicide accounted for 329 (40.9%) of deaths related to illicit drug use; opiate and cocaine poisoning accounted for 160 (19.9%) and 78 (9.7%) respectively. Death from AIDS acquired through illicit drug use has been increasing, accounting for 61 (8.3%) of the 762 deaths related to illicit

drug use in 1992 and for 83 (10.3%) of the 805 deaths related to illicit drug use in 1995.² Although deaths caused by illicit drug use were less common than deaths attributable to alcohol and tobacco use, the people who died were younger. The 805 deaths resulted in 33 662 potential years of life lost or 41.8 years per death and 1.1% of total years of life lost through any cause in 1995. In addition, 6940 admissions to hospital (0.2% of all admissions) were attributable to illicit drug use in 1995. Drug psychosis (1777), cocaine abuse (980) and assaults (975) were the most common causes of admission related to illicit drug use.

Interpretation

These estimates of mortality and morbidity attributable to substance abuse are generally lower on a per capita basis than estimates for the United States^{13,25} and those obtained in prior Canadian studies.^{4,26} In particular, the estimate of tobacco-related deaths for 1995 is 15% lower than a Canadian estimate for 1991.²⁶ Although part of the discrepancy in these estimates may be due to different reference years, most of the difference is probably due to differences in the methods used to estimate relative risk. Whereas the 1991 report relied on a single study for estimates of relative risk,²⁷ we used pooled estimates of relative risk from several studies. For example, the prior study estimated that the relative risk of lung cancer for male smokers relative to those who had never smoked was 22, but the corresponding estimate in our study (based on pooled estimates from 11 studies, including the one used for the 1991 estimate) was only 13. Pooled estimates of relative risk for COPD and ischemic heart disease in our study were similarly lower.

Our estimates of alcohol-attributed mortality and morbidity were also lower than prior estimates. The number of deaths attributed to alcohol in 1995 (6507) was much lower than the estimate for 1991 (19 163), which was based on expert opinion.²⁸ This and similar differences for morbidity are largely due to several differences in methodology. For the current estimates, we were able to exploit much more precise estimates of relative risk from a growing body of epidemiologic studies,¹ many of which were not available for earlier estimates. For the estimates presented here, we used specific rather than broad disease categories. For example, prior estimates applied a single etiologic fraction to all forms of cancer, including many types for which there is no evidence of a causal connection to alcohol use, but for this paper the estimates were based on separate calculations of relative risks and etiologic fractions for each type of cancer. Finally, we controlled for age, sex and province, whereas prior estimates did not take these variables into account. For example, the earlier estimates attributed 10% of all cancers to alcohol use. Thus, 1 in 10 deaths from childhood leukemia were attributed to alcohol use, despite the fact that they involved nondrinkers (i.e., children) and the fact that there is insufficient evidence to conclude that any alcohol consumption is causally connected to leukemia. Us-

ing more precise methods, we found that only 2% of all cancer deaths are attributable to alcohol use.

Not only are our estimates of alcohol-attributed mortality and morbidity lower than prior estimates, but they also indicate that the relative contribution of accidents to overall alcohol-related mortality and morbidity is much greater than previously thought.²⁹ In the prior estimates, most (62%) alcohol-attributed deaths were accounted for by three broad chronic disease categories — diseases of the respiratory system, diseases of the circulatory system and cancer. The new estimates indicate that less than one-fifth of alcohol-related deaths in 1995 (1207/6507 or 18.5%) were due to these chronic conditions. In contrast, accidents and other acute causes accounted for nearly half (3064/6507 or 47.1%) of all alcohol-attributed deaths and well over half (107 554/172 126 or 62.5%) of potential years of life lost. These findings have important implications for alcohol policy and programming.^{30,31}

Although the estimates are lower than in prior studies, they nevertheless indicate that alcohol, tobacco and illicit drug use represent a major source of death and illness in Canada. In 1995 substance abuse accounted for 20.0% of total deaths, 22.2% of total potential years of life lost and 9.4% of total admissions to hospital for any cause.

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