Measuring substance-related disorders using Canadian administrative health databanks: interprovincial comparisons of recorded diagnostic rates, incidence proportions and mortality rate ratios

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ABSTRACT

Context: Assessing temporal changes in the recorded diagnostic rates, incidence proportions and health outcomes of substance-related disorders (SRD) can inform public health policymakers in reducing harms associated with alcohol and other drugs. **Objective:** To report the annual and cumulative recorded diagnostic rates and incidence proportions of SRD, as well as mortality rate ratios (MRR) by cause of death among this group in Canada, according to their province of residence. **Methods:** Analyses were performed on linked administrative health databases (physician claims, hospitalizations, vital statistics) in five Canadian provinces (Alberta, Manitoba, Ontario, Québec, and Nova Scotia). Canadians 12 years and older and registered for their provincial healthcare coverage were included. The International Classification of Diseases (ICD-9 or -10 codes) was used for case identification of SRD from April 2001 to March 2018. **Results:** During the study period, the annual recorded SRD diagnostic rates increased in Alberta (2001-02: 8.0‰; 2017-18: 12.8‰), Ontario (2001-02: 11.5‰; 2017-18: 14.4‰), and Nova Scotia (2001-02: 6.4‰; 2017-18: 12.7‰), but remained stable in Manitoba (2001-02: 5.5‰; 2017-18: 5.4‰) and Québec (2001-02 and 2017-18: 7.5‰). Cumulative recorded SRD diagnostic rates increased steadily for all provinces. Recorded incidence proportions increased significantly in Alberta (2001-02: 4.5‰; 2017-18: 5.0‰) and Nova Scotia (2001-02: 3.3‰; 2017-18: 3.8‰), but significantly decreased in Ontario (2001-02: 6.2‰; 2017-18: 4.7‰), Québec (2001-02:

4.1‰; 2017-18: 3.2‰) and Manitoba (2001-02: 2.7‰; 2017-18: 2.0‰). For almost all causes of deaths, a higher MRR was found among individuals with recorded SRD than in the general population. The causes of death in 2015-2016 with the highest MRR for SRD individuals were SRD, suicide, and non-suicide trauma in Alberta, Ontario, Manitoba, and Québec. **Discussion:** Linked administrative health databases covering almost the entire population can be useful to monitor medical service trends of SRD and, therefore, guide health services planning in Canadian provinces.

MeSH Keywords: Alcohol-Related Disorders, Substance-Related Disorders, Healthcare Administrative Claims, International Classification of Diseases, Premature Mortality, Canada

INTRODUCTION

In 2017, substance-related problems cost Canadians around \$46 billion, with alcohol being the major contributor at \$16.6 billion per year.¹ Administrative health databases (AHD) are critical to monitor substance-related disorders (SRD) as recorded in the Canadian medical system and to provide information useful for shaping health policy responses.^{2,3} AHD can complement epidemiological surveys because they have the advantages of covering nearly the entire population and are routinely updated.^{2,4}

Substance use encompasses a wide range of phenomena, from use that does not cause harm to SRD.⁵ SRD can further be divided into three categories: substance use disorders (SUD: abuse and dependence), substance-induced disorders (withdrawal, secondary psychoses, alcohol cirrhosis, etc.), and acute intoxication (bad trips, ethylic comas, etc.).⁵ This categorization takes into account the 9th and 10th revision of the International Classification of Diseases (ICD) and the 4th and 5th edition of the Diagnostic and Statistical Manual of Mental Disorders.⁶⁻⁹

The most recent epidemiological survey in 2017 found that 4.1% of Canadians reported some form of non-alcohol substance-related harm, in the previous year. British Columbia had the highest rate (6.6%) and Manitoba (2.1%) the lowest.¹⁰ The most recent national epidemiological data for specific SUD diagnoses (2012) noted that 21.6% of

Canadians met DSM-IV diagnostic criteria for lifetime SUD (alcohol and drugs) and 4.4% for annual SUD. Interprovincial differences were also noted, with the lowest annual (3.9%) and lifetime (17.8%) prevalence rates in Quebec, and the highest in the Prairie provinces (5.2% and 28.5% respectively).¹¹ These interprovincial differences highlight the need for policymakers to obtain specific regional data.

Previous international studies consistently report higher rates of mortality among individuals with SRD compared to the general population, although there are variations in causes of death as a result of differences in the method or timing of data collection.^{12–19} There is less information for Canada, particularly for the mortality rate gaps between individuals with and without recorded SRD. To address this gap, we compared temporal trends of recorded SRD diagnoses, recorded incidence proportions and mortality rate ratios by cause of death among Canadians by their province of residence. While this research could not capture all cases of SRD, the aim was to allow a better understanding of gaps in data availability that might be barriers to a potential strong SRD surveillance system in Canada. These data could be relevant to other jurisdictions with similar AHD in informing public health.

METHODS

Setting

All Canadian residents can receive free inpatient or outpatient treatment within the public health system, managed at the provincial level. Information concerning diagnoses and medical services is routinely compiled in health insurance registries that cover nearly the entire population of each province, and data can be linked using unique personal identifiers.²⁰ As the majority of clinical payments for general practitioners and medical specialists are billed using a fee-for-service system (94% in 2001-2002; 73% in 2017-2018), most medical contacts are therefore captured by AHDs.^{21,22} For instance, about 99% of physicians in Ontario and Québec, 91% in Alberta, 90% in Manitoba and 63% in Nova Scotia received at least one payment through fee-for-service in 2017-2018.²²

Study population

This study included all residents aged 12 years and older of Alberta, Manitoba, Ontario, Québec, and Nova Scotia who were registered for their provincial health insurance plan. This excludes individuals who are not permanent residents of the province (visitors, exchange students) or absent from their residential province for at least half of the year. In some provinces, specific populations (e.g. refugees, inmates, military officers) are also excluded. Five provinces were chosen to represent different regions of Canada (Western

Canada/Prairies: Alberta and Manitoba; Central Canada: Ontario and Québec, Atlantic/Eastern Canada: Nova Scotia). This study, therefore, covered 79.2% of the total population of Canada (35,151,725 inhabitants).²³

Data sources

All administrative data were linked using an encrypted unique identifier. Diagnoses from the physician billing databases were coded using ICD-9-CM in Alberta and Manitoba, and ICD-9 in Ontario, Québec and Nova Scotia.^{24,25} Hospitalization discharge databases were updated from ICD-9 to ICD-10-CA diagnostic codes at a different pace across provinces: 2001 in Nova Scotia, 2002 in Alberta and Ontario, 2004 in Manitoba, and 2006 in Quebec; all allowed a five-digit coding and 25 codes per claim.²⁵ The transition to ICD-10-CA in Canada has not substantially changed coding practices but allowed for provincial variations in the average number of diagnoses recorded per hospitalization.²⁶ All vital statistics data used the four-digit ICD-10-CA coding throughout the study period to record the primary cause of death.²⁵

Case definitions

To be considered a case of SRD, an individual aged 12 years and over had to receive at least one relevant ICD code in the physician claims database or the main diagnosis field in the hospitalization database in the fiscal year (April 1 to March 31) (see Supplementary

Material for specific ICD codes).

Considering that some provinces only use the three-digit ICD-9 coding,^{24,25} an indicator for drug intoxication could not be developed, because these codes were not specific to psychoactive drugs. The use of an overall broad definition of SRD circumvents problems that may arise from changes in specific ICD codes or regional variations in recording practices. Case definitions are based on ICD codes used by previous studies which all used a single code as sufficient to classify an individual as having a SRD.²⁷⁻³¹ These case definitions have been validated previously (specificity over 90%, sensitivity between 47-70%). However, considering that this study does not aim at assessing the overall prevalence of SRD, but rather estimating how many individuals have a recorded diagnosis of SRD, a single code was considered as a valid measure.

The study period spanned 2001-2002 to 2017-2018. For data concerning specific causes of death, the study period ended in 2015-2016 as some provinces had not completed their mortality data compilation beyond that fiscal year.

Analyses

Unless indicated otherwise, all results were age-standardized to the 2011 Canadian Census. Annual recorded diagnostic rates represented the number of individuals per 1,000 (‰ in the text) who met case definition criteria in that year. Cumulative diagnostic rates

represented cases in that and previous years (once a case, always a case). Recorded incidence proportions represent the number of individuals (in %) who became cases in the previous 12 months. Annual mortality rates (also in %), i.e. the number of deaths within a given fiscal year, were calculated among SRD cumulative cases. This outcome was an indicator of long-term burden, which did not always occur within the same year as the diagnosis. An annual mortality rate was also generated for individuals in the general population. Finally, mortality rate ratios (MRR) were calculated between individuals with recorded SRD and individuals without diagnosed SRD for each specific cause of death.^{18,32} When MRR is greater than one, the mortality rate is higher among individuals with recorded SRD compared to the “general population”. MRR indicates an association and that individuals with a recorded SRD diagnosis are more likely to die from a given cause of death than individuals without it, probably because a recorded diagnosis is indicative of better detection due to higher medical needs as well as high comorbidity of SRD with other physical diseases and mental disorders. It should not, therefore, be interpreted as attributable risk or that SRD is a causal factor.

The large sample sizes and almost complete coverage of studied populations allowed the use of non-overlapping 99% confidence intervals to reduce the possibility that clinically

irrelevant differences between provinces were judged as significant.³³ Separate analyses according to sex are available upon request.

Ethics

The project was approved by the institutional review board of the National Public Health Institute of Quebec and endorsed by the Information Access Commission of Québec. Aggregated data access was further authorized within each province by the appropriate institutional review board.

RESULTS

Annual recorded diagnostic rates

The overall annual recorded age-standardized rate of recorded SRD increased from 2001-2002 to 2017-2018 in Alberta (8.0 ‰ [99%CI=7.9-8.2] to 12.8‰ [12.6-12.9]); Ontario (11.5‰ [11.4-11.6] to 14.4‰ [14.3-14.5]); and Nova Scotia (6.4‰ [6.2-6.7] to 12.7‰ [12.4-13.1]), but remained stable in Manitoba (5.5‰ [5.3-5.7] to 5.4‰ [5.3-5.6]) and Québec (7.5‰ [7.4-7.6] to 7.5‰ [7.4-7.6]). Table 1 provides the annual recorded rates of SRD by sex and province. For all five provinces, males had significantly higher recorded SRD rates than females.

Cumulative recorded diagnostic rates

The cumulative recorded rates of any SRD (Figure 1) increased steadily from 2001-2002 to 2017-2018 in all five provinces. Ontario had the highest rate across the years (45.2‰ [45.0-45.4] in 2001-2002 to 84.0‰ [83.8-84.2] in 2017-2018). Alberta rose from the third-highest recorded rate in 2001-2002 (32.0‰ [31.7-32.2]) to the second-highest in 2017-2018 (65.1‰ [64.8-65.4]), overtaking Nova Scotia (44.8‰ [44.1-45.5] in 2001-2002; 61.0‰ [60.2-61.8] in 2017-2018). Québec (26.7‰ [26.6-26.9] in 2001-2002; 57.0‰ [58.8-57.2] in 2017-2018), followed by Manitoba (24.3‰ [23.9-24.7] in 2001-2002; 41.6‰ [41.1-42.2] in 2017-2018).

[insert Figure 1 here]

Concerning overall alcohol-related disorders (Figure 1, panel B1), Alberta had the highest cumulative rate of recorded diagnosis (41.4‰ [41.1-41.6] in 2017-2018; 20.1‰ [19.0-20.4] in 2001-2002), followed by Ontario (39.1‰ [39.0-39.3] in 2017-2018; 20.6‰ [20.4-20.7] in 2001-2002). The cumulative recorded rates of alcohol-related disorders increased from 18.6‰ [18.2-18.9] in 2001-2002 to 25.9‰ [25.5-26.3] in 2017-2018 in Manitoba, from 18.1‰ [17.9-18.2] in 2001-2002 to 35.0‰ [34.8-35.1] in 2017-2018 in Québec, and from 31.9‰ [31.4-32.5] in 2001-2002 to 37.0‰ [36.4-37.6] in 2017-2018 in Nova Scotia.

As shown in panel B2, Figure 1, the high rate of recorded alcohol-related disorders in Alberta appeared to be attributable to diagnoses other than alcohol use disorders, for which Ontario had the highest recorded rate (34.4‰ [34.3-34.5] in 2017-2018; 19.0‰ [18.8-19.1] in 2001-2002), followed by Nova Scotia (31.4‰ [30.9-32.0] in 2017-2018; 23.5‰ [23.1-24.0] in 2001-2002), by Alberta (26.7‰ [26.5-26.9] in 2017-2018; 14.8‰ [14.6-15.0] in 2001-2002), by Manitoba (22.8‰ [22.4-23.1] in 2017-2018; 16.8‰ [16.4-17.1] in 2001-2002) and by Québec (21.6‰ [21.4-21.7] in 2017-2018; 13.7‰ [13.5-13.8] in 2001-2002).

As presented in figure 1 (panel C1), Ontario had the highest cumulative rate of recorded diagnoses of drug-related disorders with a rate of 58.8‰ [58.6-59.0] in 2017-2018 (29.6‰ [29.5-29.8] in 2001-2002). Alberta had the second-highest cumulative recorded rate in 2017-2018 (36.4‰ [36.2-36.7]; 13.4‰ [13.2-13.6] in 2001-2002), followed closely by Nova Scotia (33.2‰ [32.6-33.8] in 2017-2018; 17.4‰ [16.9-17.8] in 2001-2002), Québec (32.5‰ [32.4-32.7] in 2017-2018; 11.9‰ [11.8-12.0] in 2001-2002), and Manitoba (21.8‰ [21.4-22.1] in 2017-2018; 7.8‰ [7.5-8.0] in 2001-2002).

Recorded incidence proportions

The recorded incidence proportion for overall SRD slightly, but significantly, increased from 2001-2002 to 2017-2018 in Alberta (4.5‰ [4.3-4.6] to 5.0‰ [4.9-5.0]) and Nova Scotia (3.3‰ [3.1-3.5] to 3.8‰ [3.6-3.7]). However, over the same period, a significant

decrease for overall recorded SRD was observed in Ontario (6.2‰ [6.2-6.3] to 4.7‰ [4.6-4.7]), in Québec (4.1‰ [4.1-4.2] to 3.2‰ [3.2-3.3]) and Manitoba, (2.7‰ [2.6-2.8] to 2.0‰ [1.9-2.2]). Figure 2 presents the recorded incidence proportions from 2001-2002 to 2017-2018 for all five provinces for alcohol-related disorders (panel B1), which include alcohol use disorders (panel B2), and for drug-related disorders (panel C1), including drug use disorders (panel C2).

[insert Figure 2 here]

Mortality rates and MRR

As shown in Figure 3 (panel A), the mortality rate in the general population decreased slightly in each province from 2001-2002 to 2017-2018. There was also a similar decrease within the SRD population for the following four provinces: from 28.4‰ [26.9-30.1] to 19.5‰ [18.8-20.2] in Alberta, from 28.0‰ [25.0-31.4] to 21.9‰ [20.1-23.9] in Manitoba, from 20.7‰ [20.1-21.3] to 17.7‰ [17.4-18.0] in Ontario, 31.3‰ [30.2-32.4] to 22.9‰ [22.3-23.4] in Québec. The exception was in Nova Scotia where the mortality rate in the SRD population increased from 10.3‰ [8.7-12.0] to 13.9‰ [12.6-15.3] over the 17 years. In each province, the SRD population presented a significantly higher mortality rate than in the general population. The profile trends for the other SRD categories in Figure 3 (panels B1, B2, C1 and C2) were similar to overall SRD (panel A). Age-adjusted and unadjusted

mortality rates by cause of death are presented in the Supplementary Material.

[insert Figure 3 here]

Interprovincial comparisons of MRR by causes of death in 2015-2016 are presented in Table 2. In Alberta, Ontario, and Québec, individuals with a recorded diagnosis of SRD had a significantly higher MRR for all causes of deaths compared to those without SRD. Findings were similar in Manitoba, except for diseases of the nervous system, where no difference was detected between the two groups. In these four provinces, SRD was the cause of death with the highest mortality gap. Suicide, other trauma and diseases of the digestive system were also among the causes of death with the highest MRR among individuals with recorded SRD. In Nova Scotia, higher MRR were found for diseases of the digestive system and other causes not classified elsewhere while significantly lower MRR were reported for neoplasms, infectious and parasitic diseases, as well as diseases of the nervous system.

DISCUSSION

Changes in substance use patterns following legislation (e.g. cannabis legalization), changes in treatment modalities, and the emergence of substance-related (e.g. opioid crisis) and non-substance-related (COVID-19 pandemic) occurrences necessitate the need to track health service utilization for SRD. In combination with other data sources such as

epidemiological surveys, monitoring these trends may therefore inform service provision and risk factors for preventable mortality help health services better match availability and access to service with needs. These could be included in a Canadian Chronic Disease Surveillance System and may have implications for other countries with similar linked AHD.

Given the public health focus, we used a broad definition of SRD rather than specific diagnoses. Broad categories also increased measurement accuracy by reducing the risk of errors and variability arising from AHD, for example, the use of a broad indicator such as “alcohol-related disorder” increased the chances a person would receive the same ICD code if two different physicians were doing the examination. If fine-grained analyses were performed, one physician might code for “alcohol acute intoxication”, while another for “alcohol dependence”, depending on whether the focus is on immediate care or the underlying condition. Overall annual recorded rates of SRD increased from 2001-2002 to 2017-2018 in Alberta, Ontario, and Nova Scotia, but remained stable in Manitoba and Québec. Like previous studies, emergency department visits related to SRD increased over time in Alberta or to alcohol problems in Ontario.^{34,35} Currently, Canadian epidemiological data on SRD cannot be used to provide consistent temporal trend information as the relevant surveys use different methodologies to assess substance abuse and dependence.³⁶ Our results

thus provide relatively consistent data across time on the recorded diagnosis of SRD in five Canadian provinces.

In all provinces, the annual recorded rates of SRD were lower than self-reported SUD diagnoses in the Canadian 2012 epidemiological survey on addiction and mental disorders.¹¹ Epidemiological surveys aim to quantify the prevalence of SRD in the general population, while our data report on the rates of recorded SRD in the public medical system. Not everyone who meets diagnostic criteria for SRD will have immediate contact with medical services, and the interval may vary between provinces. This is particularly relevant for estimates of annual rather than cumulative prevalence. In addition, they may not present to services at all. For instance, according to the 2012 CCHS, only 17.2% of individuals with a single SUD diagnosis and 62.3% with comorbid mood/anxiety disorders had used professional mental health and addiction services in the previous year. Cumulative recorded SRD diagnostic rates also have the advantage of capturing long-term consequences such as cirrhosis or mortality. Cumulative recorded rates can, however, overestimate the long-term burden of diagnosed SRD, because individuals whose SRD has resolved will remain counted. On the other hand, up to 54% of individuals with SRD will be considered as “remitted” after an average follow-up period of 17 years.³⁷ Importantly, this overestimation is also inherent

in the definition of lifetime prevalence, which includes individuals who also no longer fit the case definition.

These descriptive rates are not sufficiently informative to quantify the current disease burden of SRD. However, the data remain useful as they record annual and cumulative SRD diagnoses by physicians, mainly general practitioners. The annual recorded SRD diagnostic rates confirm epidemiological findings that SRD are under-detected and under-treated in primary care. Policies that would support better detection, patient engagement and treatment at the primary care level in collaboration (and support) with specialist addiction services, could result in higher annual recorded SRD diagnoses, and possibly a lower eventual mortality gap.

This study also shows divergent rates and patterns across the five provinces. This observation was also reported in another study of hospitalizations related to alcohol in 2015-2016.⁴¹ Many factors can explain these inter-provincial variations: sociodemographic and socioeconomic composition of the population, different access to psychoactive substances, degree of implementation of various substance prevention programs, as well as availability and access to adequate health and psychosocial interventions.³⁸ Provision of harm reduction strategies such as needle exchange programs and supervised injection sites also vary.³⁹

The apparent decrease in mortality over time within the SRD population may be surprising in light of the opioid crisis. However, this obscures the annual increase in raw numbers of deaths within the SRD population and is explained by the greater increase in cumulative recorded rates of SRD when compared to annual deaths. The MRRs reported in this study were consistent with findings from the United States⁴⁰, Denmark¹⁸ and Norway⁴¹ where accidents, injuries, overdoses, suicides, or homicides were the main causes of death among individuals with SRD, all of which were preventable. These deaths may have lowered the cancer MRR among individuals with SRD, as fatal trauma, suicide and lethal overdose preceded any cancer diagnosis. Otherwise, the decline in mortality rate in the general population over the years was expected and had been previously explained to higher life expectancies due to better management of neoplasms and cardiovascular diseases in Canada.⁴²

Limitations

This study presents some limitations that need consideration when interpreting the results. First, AHD were originally conceived for administrative purposes, not for answering research questions.⁴³ Variables (e.g. socioeconomic status, ethnicity, quality of life, psychosocial characteristics) that may be relevant for research objectives were not always available. Second, coding accuracy even for recorded diagnoses can potentially be impeded

by clerical errors, limited coding possibilities (e.g. number of diagnoses that be recorded, level of precision of a given code [diagnostic clustering], etc.), diagnostic misclassification by physicians or coders, and omission because it was perceived as irrelevant for administrative purposes.^{43,44} Third, only the primary diagnosis is recorded in the physician's claim database in several provinces. If the main reason for consultation was not SRD, this diagnosis will not be recorded. Fourth, we mainly identified individuals who saw a physician remunerated using a service-for-fee system, but not individuals who only consulted physicians receiving alternative forms of payment or who attended exclusively addiction rehabilitation centres, community organizations or psychosocial services. However, there is a high probability that an individual with a SRD will end up using billable medical services given the diverse health consequences of these conditions.^{45,46} The addition of existing databases on psychosocial services would allow better coverage of the SRD treated population. Future research should look at developing surveillance systems for specific communities (inmates, non-permanent residents, etc.) that are both adapted to their needs and can be incorporated into the larger Canadian surveillance system. Fifth, interprovincial variations in SRD definition, data availability and coding practices limit the scope for comparing claims, hospitalizations and vital statistics. For example, the extremely divergent MRRs in Nova Scotia compared to the four other provinces, suggest different procedures in

recording mortality data, rather than a real variation in mortality pattern. To allow future interprovincial comparisons, standardized coding procedures should be considered. Nonetheless, because the purpose of public health surveillance is to make broad comparisons and identify high-level problems, information on general and global trends is preferred to fine-grained details.

Finally, rates were only obtained in five out of ten provinces and did not include the territories. However, the five provinces in this analysis represent 79% of the Canadian population. Linked AHD also have some strengths over other methodologies in that they allow long-term follow-up of cohorts with negligible attrition and give information on co-morbidities, medical treatments and outcomes like trauma. Recording bias is minimized because the provision of billing data is required for physician payment.

CONCLUSION

The ongoing opioid crisis and the legalization of cannabis in Canada, the United States and elsewhere have led to increasing awareness of the need for data to inform health care about detection and treatment of SRD, including alcohol and other drugs. In both the United States and Canada, there is growing interest in establishing a national surveillance system for mental disorders and SRD.⁴⁷ Surveillance of SRD can be developed in Canada

and ultimately help to prevent and control the associated burden. This study demonstrates that provincial data sources allow for monitoring SRD because they do capture the detection and treatment patterns of patients and thus have the potential to evaluate the impact of policies on health outcomes, such as mortality gaps. Analyses of temporal trends of services utilization, interventions and health outcomes would allow assessing the impact of preventive measures that will increase greater awareness, detection, and treatment of SRD in jurisdictions where relevant linked AHD are available.

DATA ACCESS

The data provided by the different health jurisdictions cannot be publicly shared, because they contain confidential information. Individuals can potentially be re-identified through data triangulation if they present sufficient specific or unique sociodemographic and health characteristics.

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CONFLICTS OF INTEREST

None to declare.

DISCLOSURE

The results and conclusions are those of the authors and no official endorsement by the Manitoba Centre for Health Policy, Manitoba Health, or Manitoba Vital Statistics is intended or should be inferred. Data used in this study are from the Manitoba Population Research Data Repository housed at the

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Figure captions

Figure 1. Age-standardized cumulative recorded diagnostic rates of SRD by province, 2001-2002 to 2017-2018

Figure 2. Age-standardized incidence recorded proportions of SRD by province, 2001-2002 to 2017-2018

Figure 3. Annual mortality rates among cumulative cases

Table 1. Age-standardized recorded diagnostic rate (per 1,000) of any substance-related disorder by sex and by province

		Alberta	Manitoba	Ontario	Québec	Nova Scotia
Females	2001-2002	5.9 [5.8 - 6.1] ^a	3.9 [3.7 - 4.1] ^b	8.4 [8.3 - 8.5] ^c	5.0 [4.9 - 5.1] ^d	3.4 [3.2 - 3.7] ^b
	2011-2012	7.4 [7.2 - 7.5] ^a	4.8 [4.5 - 5.0] ^b	9.1 [9.0 - 9.2] ^c	5.7 [5.6 - 5.8] ^d	5.2 [4.9 - 5.5] ^b
	2017-2018	10.1 [9.9 - 10.3] ^a	4.8 [4.6 - 5.1] ^b	10.4 [10.3 - 10.5] ^a	5.2 [5.1 - 5.3] ^b	8.1 [7.7 - 8.5] ^c
Males	2001-2002	10.2 [10.0 - 10.4] ^a	7.1 [6.8 - 7.4] ^b	14.7 [14.5 - 14.8] ^c	10.1 [10.0 - 10.3] ^a	10.3 [9.8 - 10.8] ^a
	2011-2012	12.1 [11.8 - 12.3] ^a	7.0 [6.7 - 7.3] ^b	16.3 [16.2 - 16.4] ^c	11.3 [11.1 - 11.4] ^d	12.8 [12.2 - 13.3] ^a
	2017-2018	15.4 [15.2 - 15.7] ^a	6.1 [5.8 - 6.3] ^b	18.5 [18.4 - 18.7] ^c	9.8 [9.7 - 9.9] ^d	18.6 [18.0 - 19.3] ^c

Note: Significant differences between provinces are indicated by different superscript letters, based on non-overlapping confidence intervals. In other words, when two or more provinces share the same letter, this indicates that there are no significant differences between them. Data for all time points are available in Table S2 (age-standardized rates), and in Tables S3a to S3e (unadjusted rates and raw counts) in the Supplementary Material.

Table 2. Age-adjusted mortality rate ratios by cause of death among cumulative cases, 2015-2016

	Alberta	Manitoba	Ontario	Québec	Nova Scotia
Neoplasms					
<i>(ICD-9: 140-239; ICD-10-CA: C00-C99, D00-D49)</i>	2.0 [1.8 - 2.2]^a	1.9 [1.5 - 2.3]^a	2.0 [2.0 - 2.1]^a	2.5 [2.4 - 2.7]^b	0.3 [0.2 - 0.5]^c
Diseases of the circulatory system					
<i>(ICD-9: 390-459; ICD-10-CA: I00-I99)</i>	2.4 [2.2 - 2.6]^a	1.8 [1.5 - 2.2]^a	2.2 [2.2 - 2.4]^a	2.9 [2.7 - 3.1]^b	0.7 [0.4 - 1.1]^c
Dementia					
<i>(ICD-9: 290, 293, 294, 310; ICD-10-CA: F00-F09)</i>	3.1 [2.6 - 3.7]^a	1.6 [1.0 - 2.4]^b	2.9 [2.6 - 3.1]^a	4.7 [4.2 - 5.2]^c	0.7 [0.4 - 1.2]^b
Diseases of the digestive system					
<i>(ICD-9: 520-579; ICD-10-CA: K00-K99)</i>	5.0 [4.1 - 6.2]^{a,b}	4.0 [2.7 - 6.2]^{a,b}	4.2 [3.8 - 4.6]^a	6.0 [5.3 - 6.8]^b	6.1 [3.5 - 10.7]^{a,b}
Endocrine, nutritional, and metabolic diseases					
<i>(ICD-9: 240-279; ICD-10-CA: E00-E99)</i>	2.6 [2.0 - 3.5]^{a,b}	1.9 [1.2 - 3.1]^{a,c}	2.6 [2.3 - 2.9]^a	3.8 [3.3 - 4.4]^b	0.6 [0.3 - 1.3]^c

Infectious and parasitic diseases

(ICD-9: 0-139; ICD-10-CA: A00-A99, B00-B99, U04) **4.3 [3.2 - 5.8]^a 4.1 [2.3 - 7.2]^a 3.8 [3.3 - 4.3]^a 4.6 [3.8 - 5.5]^a 0.2 [0.1 - 0.7]^b**

Diseases of the nervous system

(ICD-9: 320-389; ICD-10-CA: G00-G99, H00-H99) **2.9 [2.2 - 3.7]^a 1.0 [0.5 - 2.0]^b 2.2 [2.0 - 2.5]^{a,b} 3.1 [2.8 - 3.4]^a 0.2 [0.1 - 0.5]^c**

Diseases of the respiratory system

(ICD-9: 460-519; ICD-10-CA: J00-J99) **3.6 [3.1 - 4.1]^{a,b} 2.7 [2.0 - 3.7]^a 3.0 [2.8 - 3.2]^a 4.2 [3.9 - 4.6]^b 0.8 [0.5 - 1.4]^c**

Substance-related disorders

(see Table S1) **86.4 [59.2 - 126.1]^{a,b} 37.4 [22.3 - 62.5]^a 90.1 [68.7 - 118.1]^b 169.1 [105.6 - 270.8]^b Data not available**

Suicide

(ICD-10-CA: X60-X85) **9.6 [7.7 - 12.1]^a 8.3 [5.1 - 13.5]^{a,b} 6.1 [5.2 - 7.2]^b 8.9 [7.4 - 10.6]^a 1.2 [0.5 - 3.0]^c**

Trauma (excluding suicide)

(ICD-9: 800-899; ICD-10-CA: S00-S99, T00-T99, W00-W99, X00-X99) **9.1 [7.9 - 10.4]^a 7.8 [6.0 - 10.3]^{a,c} 5.2 [4.8 - 5.6]^b 5.8 [5.1 - 6.6]^{b,c} 1.3 [0.6 - 3.0]^d**

Other causes (all remaining codes not listed above)	2.5 [2.0 - 3.3]^{a,b}	2.3 [1.6 - 3.3]^{a,b}	2.8 [2.6 - 3.1]^{a,b}	3.6 [3.2 - 4.1]^b	2.4 [1.2 - 5.0]^{a,b}
Unknown causes	3.8 [2.8 - 5.1]^a	Data not available	2.2 [2.0 - 2.5]^b	3.1 [2.6 - 3.7]^a	0.8 [0.4 - 1.8] ^c

Note: Data in bold indicates that the death rate for this specific cause is significantly lower or higher among SRD cases compared to individuals without a recorded SRD diagnosis. Significant differences between provinces are indicated by different superscript letters, based on non-overlapping confidence intervals. In other words, when two or more provinces share the same letter, this indicates that there are no significant differences between them. Data for raw counts and age-adjusted and unadjusted mortality rates by cause of death and by year for both groups (recorded SRD cases vs cases with no recorded SRD diagnoses) are available in Tables S4a to S4e in the Supplementary Material.

SUPPLEMENTARY MATERIAL

Table S1. ICD codes to define substance-related disorders cases

Category by substance	Category by type of disorder and by substance	ICD-9	ICD-10-CA
Alcohol related disorders	Alcohol use disorders	303	F101 F102
	Alcohol induced disorders	291	F103 F104 F105 F106 F107 F108 F109 E244 G312 G621 G721 I426 K292 K700 K701 K702 K703 K704 K709 K852 K860 O354
	Alcohol intoxication	980	F100 T510 T511 T518 T519
Drug related disorders <i>Cannabis, opioids, cocaine, other psychostimulants, hallucinogens, sedatives and hypnotics, inhalants, other substances or combined substances</i>	Drug use disorders	304	F111 F112 F121 F122 F131 F132 F141 F142 F151 F152 F161 F162 F181 F182 F191 F192 F55
	Drug induced disorders	292	F113 F123 F133 F143 F153 F163 F183 F193 F114 F124 F134 F144 F154 F164 F184 F194 F115 F125 F135 F145 F155 F165 F185 F195 F116 F126 F136 F146 F156 F166 F186 F196 F117 F127 F137 F147 F157 F167 F187 F197 F118 F128 F138 F148 F158 F168 F188 F198 F119 F129 F139 F149 F159 F169 F189 F199

Table S2. Age-adjusted annual recorded SRD diagnostic rates, 2001-2002 to 2017-2018, by sex and by province

	Alberta			Manitoba			Ontario			Québec			Nova Scotia		
	Females	Males	Total	Females	Males	Total	Females	Males	Total	Females	Males	Total	Females	Males	Total
2001-2002	5.9 [5.8 - 6.1]	10.2 [10.0 - 10.4]	8.0 [7.9 - 8.2]	3.9 [3.7 - 4.1]	7.1 [6.8 - 7.4]	5.5 [5.3 - 5.7]	8.4 [8.3 - 8.5]	14.7 [14.5 - 14.8]	11.5 [11.4 - 11.6]	5.0 [4.9 - 5.1]	10.1 [10.0 - 10.3]	7.5 [7.4 - 7.6]	3.4 [3.2 - 3.7]	10.3 [9.8 - 10.8]	6.4 [6.2 - 6.7]
2002-2003	6.1 [5.9 - 6.2]	10.3 [10.1 - 10.6]	8.2 [8.0 - 8.3]	4.0 [3.8 - 4.3]	7.4 [7.0 - 7.7]	5.7 [5.5 - 5.9]	8.4 [8.3 - 8.5]	14.5 [14.3 - 14.6]	11.4 [11.3 - 11.4]	4.9 [4.8 - 5.0]	9.7 [9.6 - 9.9]	7.2 [7.1 - 7.3]	3.4 [3.2 - 3.7]	9.7 [9.2 - 10.2]	6.2 [5.9 - 6.4]
2003-2004	5.8 [5.6 - 6.0]	9.7 [9.5 - 10.0]	7.8 [7.6 - 7.9]	4.1 [3.8 - 4.3]	7.4 [7.1 - 7.7]	5.7 [5.5 - 5.9]	7.6 [7.5 - 7.7]	13.7 [13.6 - 13.8]	10.6 [10.5 - 10.7]	5.0 [4.9 - 5.1]	9.9 [9.8 - 10.1]	7.4 [7.3 - 7.4]	3.2 [3.0 - 3.4]	9.0 [8.6 - 9.5]	5.8 [5.5 - 6.0]
2004-2005	6.1 [5.9 - 6.3]	10.4 [10.2 - 10.6]	8.2 [8.1 - 8.4]	4.3 [4.1 - 4.6]	7.5 [7.2 - 7.8]	5.9 [5.7 - 6.1]	7.4 [7.3 - 7.5]	13.7 [13.5 - 13.8]	10.5 [10.4 - 10.6]	4.9 [4.8 - 5.0]	10.1 [9.9 - 10.2]	7.4 [7.3 - 7.5]	3.4 [3.2 - 3.7]	9.3 [8.8 - 9.7]	6.0 [5.8 - 6.3]
2005-2006	6.4 [6.2 - 6.6]	10.7 [10.5 - 10.9]	8.5 [8.4 - 8.7]	4.5 [4.3 - 4.8]	8.2 [7.9 - 8.6]	6.3 [6.1 - 6.6]	7.7 [7.6 - 7.8]	14.2 [14.0 - 14.3]	10.9 [10.8 - 10.9]	5.2 [5.1 - 5.3]	10.5 [10.4 - 10.7]	7.8 [7.7 - 7.8]	3.6 [3.3 - 3.8]	9.7 [9.2 - 10.1]	6.3 [6.0 - 6.5]
2006-2007	7.0 [6.8 - 7.2]	11.0 [10.8 - 11.2]	9.0 [8.8 - 9.1]	4.6 [4.3 - 4.8]	7.9 [7.6 - 8.3]	6.2 [6.0 - 6.4]	8.0 [7.9 - 8.1]	14.3 [14.2 - 14.5]	11.1 [11.0 - 11.2]	5.4 [5.3 - 5.5]	11.0 [10.8 - 11.1]	8.1 [8.0 - 8.2]	4.0 [3.8 - 4.3]	10.2 [9.7 - 10.6]	6.7 [6.5 - 7.0]
2007-2008	7.6 [7.5 - 7.8]	11.4 [11.2 - 11.7]	9.5 [9.4 - 9.7]	4.0 [3.8 - 4.2]	6.5 [6.2 - 6.8]	5.2 [5.0 - 5.4]	8.5 [8.4 - 8.6]	14.8 [14.7 - 15.0]	11.6 [11.5 - 11.7]	5.6 [5.5 - 5.7]	11.2 [11.0 - 11.3]	8.3 [8.2 - 8.4]	4.4 [4.1 - 4.7]	11.0 [10.5 - 11.5]	7.3 [7.0 - 7.6]
2008-2009	7.1 [6.9 - 7.3]	11.6 [11.4 - 11.9]	9.4 [9.2 - 9.5]	4.3 [4.1 - 4.6]	6.8 [6.5 - 7.1]	5.5 [5.3 - 5.7]	9.0 [8.9 - 9.1]	15.6 [15.5 - 15.8]	12.2 [12.2 - 12.3]	5.7 [5.6 - 5.8]	11.3 [11.1 - 11.4]	8.4 [8.3 - 8.5]	4.3 [4.1 - 4.6]	11.3 [10.8 - 11.8]	7.4 [7.2 - 7.7]
2009-2010	7.1 [6.9 - 7.3]	11.8 [11.6 - 12.0]	9.4 [9.3 - 9.6]	4.2 [4.0 - 4.5]	6.7 [6.4 - 7.0]	5.4 [5.3 - 5.6]	8.8 [8.7 - 8.9]	15.5 [15.4 - 15.6]	12.1 [12.0 - 12.2]	5.7 [5.6 - 5.8]	11.3 [11.2 - 11.5]	8.4 [8.3 - 8.5]	4.5 [4.3 - 4.8]	11.7 [11.2 - 12.2]	7.7 [7.5 - 8.0]
2010-2011	7.2 [7.0 - 7.3]	11.8 [11.6 - 12.0]	9.5 [9.3 - 9.6]	4.4 [4.2 - 4.6]	6.7 [6.4 - 7.0]	5.5 [5.4 - 5.7]	8.9 [8.8 - 9.0]	15.9 [15.7 - 16.0]	12.3 [12.2 - 12.4]	5.6 [5.5 - 5.7]	11.1 [11.0 - 11.3]	8.3 [8.2 - 8.4]	4.9 [4.6 - 5.2]	12.4 [11.9 - 12.9]	8.2 [7.9 - 8.5]
2011-2012	7.4 [7.2 - 7.5]	12.1 [11.8 - 12.3]	9.7 [9.6 - 9.8]	4.8 [4.5 - 5.0]	7.0 [6.7 - 7.3]	5.8 [5.7 - 6.0]	9.1 [9.0 - 9.2]	16.3 [16.2 - 16.4]	12.7 [12.6 - 12.7]	5.7 [5.6 - 5.8]	11.3 [11.1 - 11.4]	8.4 [8.3 - 8.5]	5.2 [4.9 - 5.5]	12.8 [12.2 - 13.3]	8.6 [8.3 - 8.9]
2012-2013	7.5 [7.3 - 7.6]	12.1 [11.9 - 12.3]	9.8 [9.7 - 9.9]	4.8 [4.6 - 5.1]	6.9 [6.6 - 7.2]	5.8 [5.7 - 6.0]	9.1 [9.0 - 9.2]	16.0 [15.9 - 16.2]	12.5 [12.4 - 12.6]	5.8 [5.7 - 6.0]	11.3 [11.2 - 11.5]	8.5 [8.4 - 8.6]	5.6 [5.3 - 5.9]	13.1 [12.5 - 13.6]	8.9 [8.6 - 9.2]
2013-2014	8.0 [7.8 - 8.2]	12.7 [12.5 - 12.9]	10.4 [10.2 - 10.5]	4.8 [4.6 - 5.0]	6.6 [6.3 - 6.8]	5.7 [5.5 - 5.8]	9.3 [9.2 - 9.4]	16.5 [16.4 - 16.7]	12.9 [12.8 - 13.0]	5.8 [5.7 - 5.9]	11.1 [11.0 - 11.2]	8.4 [8.3 - 8.5]	6.0 [5.6 - 6.3]	14.2 [13.6 - 14.8]	9.6 [9.3 - 9.9]
2014-2015	8.1 [8.0 - 8.3]	13.1 [12.8 - 13.3]	10.6 [10.5 - 10.8]	4.7 [4.5 - 4.9]	6.2 [6.0 - 6.5]	5.5 [5.3 - 5.6]	9.5 [9.4 - 9.6]	16.9 [16.7 - 17.0]	13.1 [13.0 - 13.2]	5.8 [5.7 - 5.9]	11.0 [10.9 - 11.1]	8.4 [8.3 - 8.4]	5.8 [5.5 - 6.2]	14.0 [13.4 - 14.6]	9.4 [9.1 - 9.7]
2015-2016	8.8 [8.6 - 8.9]	14.1 [13.9 - 14.3]	11.5 [11.3 - 11.6]	4.6 [4.3 - 4.8]	6.0 [5.7 - 6.2]	5.3 [5.1 - 5.4]	9.8 [9.7 - 9.9]	17.4 [17.3 - 17.6]	13.5 [13.5 - 13.6]	5.7 [5.6 - 5.8]	10.9 [10.7 - 11.0]	8.2 [8.2 - 8.3]	6.5 [6.2 - 6.9]	14.9 [14.4 - 15.5]	10.2 [9.9 - 10.6]
2016-2017	9.5 [9.3 - 9.7]	14.9 [14.7 - 15.1]	12.2 [12.1 - 12.4]	4.7 [4.5 - 4.9]	6.2 [5.9 - 6.4]	5.4 [5.2 - 5.6]	10.1 [10.0 - 10.2]	17.9 [17.8 - 18.1]	13.9 [13.9 - 14.0]	5.8 [5.7 - 5.9]	10.7 [10.5 - 10.8]	8.2 [8.1 - 8.3]	8.0 [7.6 - 8.4]	17.9 [17.3 - 18.6]	12.4 [12.0 - 12.7]
2017-2018	10.1 [9.9 - 10.3]	15.4 [15.2 - 15.7]	12.8 [12.6 - 12.9]	4.8 [4.6 - 5.1]	6.1 [5.8 - 6.3]	5.4 [5.3 - 5.6]	10.4 [10.3 - 10.5]	18.5 [18.4 - 18.7]	14.4 [14.3 - 14.5]	5.2 [5.1 - 5.3]	9.8 [9.7 - 9.9]	7.5 [7.4 - 7.6]	8.1 [7.7 - 8.5]	18.6 [18.0 - 19.3]	12.7 [12.4 - 13.1]

**Table S3a. Unadjusted annual recorded SRD diagnostic rates and raw counts, Alberta,
2001-2002 to 2017-2018**

	Females		Males		Total	
	N	Unadjusted rate	N	Unadjusted rate	N	Unadjusted rate
2001-2002	8080	6.1 [6.0 - 6.3]	13470	10.3 [10.0 - 10.5]	21550	8.2 [8.1 - 8.3]
2002-2003	8420	6.2 [6.1 - 6.4]	14075	10.5 [10.3 - 10.7]	22490	8.4 [8.2 - 8.5]
2003-2004	8180	6.0 [5.8 - 6.1]	13555	9.9 [9.7 - 10.2]	21735	7.9 [7.8 - 8.1]
2004-2005	8790	6.3 [6.1 - 6.5]	14720	10.6 [10.4 - 10.9]	23510	8.5 [8.3 - 8.6]
2005-2006	9430	6.6 [6.4 - 6.8]	15370	10.9 [10.7 - 11.1]	24800	8.7 [8.6 - 8.9]
2006-2007	10665	7.2 [7.1 - 7.4]	16390	11.2 [11.0 - 11.5]	27055	9.2 [9.1 - 9.4]
2007-2008	11860	7.8 [7.7 - 8.0]	17565	11.7 [11.4 - 11.9]	29425	9.8 [9.6 - 9.9]
2008-2009	11345	7.3 [7.1 - 7.5]	18350	11.9 [11.6 - 12.1]	29695	9.6 [9.4 - 9.7]
2009-2010	11610	7.3 [7.1 - 7.5]	19045	12.0 [11.8 - 12.2]	30650	9.7 [9.5 - 9.8]
2010-2011	11950	7.3 [7.2 - 7.5]	19570	12.0 [11.8 - 12.2]	31515	9.7 [9.5 - 9.8]
2011-2012	12570	7.5 [7.3 - 7.7]	20640	12.3 [12.1 - 12.5]	33210	9.9 [9.8 - 10.0]
2012-2013	13220	7.6 [7.5 - 7.8]	21620	12.3 [12.1 - 12.6]	34840	10.0 [9.9 - 10.1]
2013-2014	14610	8.1 [8.0 - 8.3]	23740	13.0 [12.8 - 13.2]	38345	10.6 [10.5 - 10.7]
2014-2015	15310	8.3 [8.1 - 8.4]	25260	13.4 [13.1 - 13.6]	40575	10.8 [10.7 - 11.0]
2015-2016	16940	8.9 [8.8 - 9.1]	28025	14.5 [14.3 - 14.7]	44970	11.7 [11.6 - 11.9]
2016-2017	18605	9.7 [9.5 - 9.8]	29910	15.3 [15.0 - 15.5]	48515	12.5 [12.3 - 12.6]
2017-2018	20080	10.3 [10.1 - 10.4]	31495	15.8 [15.6 - 16.1]	51575	13.1 [12.9 - 13.2]

Table S3b. Unadjusted annual recorded SRD diagnostic rates and raw counts, Manitoba, 2001-2002 to 2017-2018

	Females		Males		Total	
	N	Unadjusted rate	N	Unadjusted rate	N	Unadjusted rate
2001-2002	1960	3.9 [3.7 - 4.1]	3445	7.1 [6.8 - 7.4]	5405	5.5 [5.3 - 5.7]
2002-2003	2075	4.1 [3.9 - 4.3]	3590	7.3 [7.0 - 7.7]	5665	5.7 [5.5 - 5.9]
2003-2004	2085	4.1 [3.9 - 4.3]	3655	7.4 [7.1 - 7.7]	5740	5.7 [5.5 - 5.9]
2004-2005	2245	4.4 [4.1 - 4.6]	3765	7.6 [7.2 - 7.9]	6015	5.9 [5.7 - 6.1]
2005-2006	2350	4.5 [4.3 - 4.8]	4170	8.3 [8.0 - 8.6]	6520	6.4 [6.2 - 6.6]
2006-2007	2380	4.6 [4.3 - 4.8]	4010	7.9 [7.6 - 8.3]	6390	6.2 [6.0 - 6.4]
2007-2008	2110	4.0 [3.8 - 4.2]	3285	6.4 [6.2 - 6.7]	5400	5.2 [5.0 - 5.4]
2008-2009	2300	4.3 [4.1 - 4.5]	3475	6.7 [6.4 - 7.0]	5780	5.5 [5.3 - 5.7]
2009-2010	2265	4.2 [4.0 - 4.4]	3500	6.7 [6.4 - 7.0]	5765	5.4 [5.3 - 5.6]
2010-2011	2385	4.4 [4.1 - 4.6]	3570	6.7 [6.4 - 7.0]	5955	5.5 [5.3 - 5.7]
2011-2012	2620	4.7 [4.5 - 5.0]	3760	7.0 [6.7 - 7.3]	6385	5.8 [5.7 - 6.0]
2012-2013	2710	4.8 [4.6 - 5.1]	3790	6.9 [6.6 - 7.2]	6495	5.8 [5.6 - 6.0]
2013-2014	2705	4.7 [4.5 - 5.0]	3660	6.5 [6.3 - 6.8]	6375	5.6 [5.5 - 5.8]
2014-2015	2695	4.7 [4.4 - 4.9]	3535	6.2 [6.0 - 6.5]	6230	5.4 [5.3 - 5.6]
2015-2016	2640	4.5 [4.3 - 4.8]	3425	6.0 [5.7 - 6.2]	6065	5.2 [5.1 - 5.4]
2016-2017	2745	4.6 [4.4 - 4.9]	3600	6.2 [5.9 - 6.5]	6345	5.4 [5.2 - 5.6]
2017-2018	2855	4.8 [4.5 - 5.0]	3575	6.1 [5.8 - 6.3]	6425	5.4 [5.2 - 5.6]

**Table S3c. Unadjusted annual recorded SRD diagnostic rates and raw counts, Ontario,
2001-2002 to 2017-2018**

	Females		Males		Total	
	N	Unadjusted rate	N	Unadjusted rate	N	Unadjusted rate
2001-2002	46090	8.5 [8.4 - 8.6]	76990	14.7 [14.6 - 14.9]	123080	11.6 [11.5 - 11.7]
2002-2003	46665	8.5 [8.4 - 8.6]	77615	14.6 [14.4 - 14.7]	124280	11.5 [11.4 - 11.5]
2003-2004	43130	7.7 [7.6 - 7.8]	74925	13.8 [13.7 - 13.9]	118055	10.7 [10.6 - 10.8]
2004-2005	42840	7.5 [7.4 - 7.6]	76020	13.7 [13.6 - 13.9]	118865	10.6 [10.5 - 10.6]
2005-2006	45095	7.8 [7.7 - 7.8]	80360	14.3 [14.2 - 14.4]	125460	11.0 [10.9 - 11.0]
2006-2007	46980	8.1 [8.0 - 8.2]	81155	14.4 [14.3 - 14.6]	128125	11.2 [11.1 - 11.3]
2007-2008	49715	8.5 [8.4 - 8.6]	84020	14.9 [14.8 - 15.0]	133740	11.6 [11.6 - 11.7]
2008-2009	53405	9.0 [8.9 - 9.1]	89135	15.7 [15.5 - 15.8]	142540	12.3 [12.2 - 12.4]
2009-2010	52740	8.8 [8.7 - 8.9]	89990	15.6 [15.5 - 15.7]	142730	12.1 [12.0 - 12.2]
2010-2011	54390	8.9 [8.8 - 9.0]	93550	16.0 [15.8 - 16.1]	147940	12.4 [12.3 - 12.5]
2011-2012	56350	9.1 [9.0 - 9.2]	97585	16.4 [16.3 - 16.6]	153930	12.7 [12.6 - 12.8]
2012-2013	57035	9.1 [9.0 - 9.2]	97130	16.1 [16.0 - 16.2]	154170	12.5 [12.5 - 12.6]
2013-2014	59135	9.3 [9.2 - 9.4]	101475	16.6 [16.5 - 16.8]	160610	12.9 [12.8 - 13.0]
2014-2015	60330	9.5 [9.4 - 9.6]	104035	16.9 [16.8 - 17.1]	164370	13.1 [13.0 - 13.2]
2015-2016	62860	9.7 [9.6 - 9.8]	108855	17.5 [17.4 - 17.6]	171720	13.6 [13.5 - 13.6]
2016-2017	65590	10.0 [9.9 - 10.1]	113650	18.0 [17.9 - 18.1]	179240	13.9 [13.9 - 14.0]
2017-2018	68905	10.4 [10.3 - 10.5]	118920	18.6 [18.4 - 18.7]	187825	14.4 [14.3 - 14.5]

**Table S3d. Unadjusted annual recorded SRD diagnostic rates and raw counts, Québec,
2001-2002 to 2017-2018**

	Females		Males		Total	
	N	Unadjusted rate	N	Unadjusted rate	N	Unadjusted rate
2001-2002	16535	5.1 [5.0 - 5.2]	31185	10.0 [9.9 - 10.1]	47720	7.5 [7.4 - 7.6]
2002-2003	16180	4.9 [4.8 - 5.0]	30220	9.6 [9.5 - 9.7]	46400	7.2 [7.1 - 7.3]
2003-2004	16725	5.0 [4.9 - 5.1]	31215	9.8 [9.7 - 10.0]	47940	7.4 [7.3 - 7.5]
2004-2005	16615	5.0 [4.9 - 5.1]	32080	10.0 [9.8 - 10.1]	48690	7.4 [7.3 - 7.5]
2005-2006	17555	5.2 [5.1 - 5.3]	33900	10.4 [10.3 - 10.6]	51455	7.8 [7.7 - 7.9]
2006-2007	18640	5.5 [5.4 - 5.6]	35815	10.9 [10.8 - 11.1]	54450	8.1 [8.1 - 8.2]
2007-2008	19410	5.6 [5.5 - 5.8]	36805	11.2 [11.0 - 11.3]	56220	8.3 [8.3 - 8.4]
2008-2009	19730	5.7 [5.6 - 5.8]	37400	11.3 [11.1 - 11.4]	57135	8.4 [8.3 - 8.5]
2009-2010	19930	5.7 [5.6 - 5.8]	37885	11.3 [11.1 - 11.4]	57810	8.4 [8.4 - 8.5]
2010-2011	20000	5.7 [5.6 - 5.8]	37615	11.1 [11.0 - 11.3]	57615	8.4 [8.3 - 8.4]
2011-2012	20550	5.8 [5.7 - 5.9]	38475	11.3 [11.1 - 11.4]	59025	8.5 [8.4 - 8.6]
2012-2013	21125	5.9 [5.8 - 6.0]	39095	11.4 [11.2 - 11.5]	60220	8.6 [8.5 - 8.7]
2013-2014	21125	5.9 [5.8 - 6.0]	38670	11.2 [11.0 - 11.3]	59790	8.5 [8.4 - 8.6]
2014-2015	21360	5.9 [5.8 - 6.0]	38675	11.1 [11.0 - 11.3]	60040	8.5 [8.4 - 8.6]
2015-2016	21080	5.8 [5.7 - 5.9]	38450	11.0 [10.8 - 11.1]	59530	8.4 [8.3 - 8.4]
2016-2017	21395	5.9 [5.8 - 6.0]	38170	10.8 [10.7 - 11.0]	59565	8.3 [8.2 - 8.4]
2017-2018	19610	5.4 [5.3 - 5.5]	35395	10.0 [9.8 - 10.1]	55010	7.6 [7.5 - 7.7]

Table S3e. Unadjusted annual recorded SRD diagnostic rates and raw counts, Nova Scotia, 2001-2002 to 2017-2018

	Females		Males		Total	
	N	Unadjusted rate	N	Unadjusted rate	N	Unadjusted rate
2001-2002	1310	3.4 [3.2 - 3.7]	3060	10.2 [9.8 - 10.7]	4370	6.4 [6.2 - 6.7]
2002-2003	1320	3.4 [3.2 - 3.7]	2915	9.6 [9.1 - 10.1]	4230	6.2 [5.9 - 6.4]
2003-2004	1220	3.2 [2.9 - 3.4]	2755	9.0 [8.5 - 9.4]	3975	5.7 [5.5 - 6.0]
2004-2005	1320	3.4 [3.2 - 3.6]	2840	9.1 [8.7 - 9.6]	4160	6.0 [5.7 - 6.2]
2005-2006	1390	3.6 [3.3 - 3.8]	3000	9.5 [9.1 - 10.0]	4385	6.2 [6.0 - 6.5]
2006-2007	1555	4.0 [3.7 - 4.2]	3130	9.9 [9.5 - 10.4]	4690	6.6 [6.4 - 6.9]
2007-2008	1675	4.3 [4.0 - 4.6]	3350	10.7 [10.2 - 11.2]	5025	7.1 [6.9 - 7.4]
2008-2009	1665	4.2 [4.0 - 4.5]	3480	11.0 [10.5 - 11.5]	5145	7.2 [7.0 - 7.5]
2009-2010	1745	4.4 [4.1 - 4.7]	3655	11.3 [10.8 - 11.8]	5395	7.5 [7.2 - 7.8]
2010-2011	1870	4.7 [4.4 - 5.0]	3830	11.9 [11.4 - 12.4]	5695	7.9 [7.7 - 8.2]
2011-2012	1990	5.0 [4.7 - 5.3]	3925	12.1 [11.6 - 12.6]	5915	8.2 [7.9 - 8.5]
2012-2013	2095	5.3 [5.0 - 5.6]	3975	12.3 [11.8 - 12.8]	6070	8.4 [8.1 - 8.7]
2013-2014	2230	5.6 [5.3 - 6.0]	4270	13.2 [12.7 - 13.7]	6495	9.0 [8.8 - 9.3]
2014-2015	2165	5.5 [5.2 - 5.8]	4190	13.0 [12.4 - 13.5]	6355	8.8 [8.6 - 9.1]
2015-2016	2420	6.1 [5.8 - 6.4]	4530	13.9 [13.4 - 14.4]	6950	9.6 [9.3 - 9.9]
2016-2017	2910	7.3 [7.0 - 7.7]	5390	16.4 [15.9 - 17.0]	8300	11.4 [11.1 - 11.7]
2017-2018	2945	7.4 [7.0 - 7.7]	5550	16.8 [16.3 - 17.4]	8500	11.6 [11.3 - 12.0]

Table S4a. Age-adjusted and unadjusted mortality rates among cumulative recorded SRD diagnosed cases and non-recorded SRD cases, Alberta, 2015-2016, by cause of death

	N	Recorded SRD diagnosis		N	No recorded SRD diagnosis	
		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)
Neoplasms	740	375.7 [340.3 - 413.9]	317.8 [288.5 - 349.1]	5650	186.9 [180.6 - 193.5]	157.2 [151.8 - 162.6]
Diseases of the circulatory system	905	472.8 [432.5 - 515.8]	388.6 [356.2 - 423.2]	5880	198.0 [191.4 - 204.8]	163.6 [158.1 - 169.1]
Dementia	245	141.9 [119.5 - 167.4]	105.2 [88.7 - 123.8]	1335	45.8 [42.6 - 49.1]	37.1 [34.6 - 39.8]
Diseases of the digestive system	215	100.1 [82.9 - 120.0]	92.3 [76.9 - 109.8]	585	19.9 [17.9 - 22.1]	16.3 [14.6 - 18.1]
Endocrine, nutritional, and metabolic diseases	110	53.7 [41.0 - 69.2]	47.2 [36.4 - 60.1]	610	20.3 [18.2 - 22.5]	17.0 [15.3 - 18.8]
Infectious and parasitic diseases	95	46.6 [35.1 - 61.0]	40.8 [30.8 - 52.9]	325	10.9 [9.4 - 12.5]	9.0 [7.8 - 10.4]
Diseases of the nervous system	130	68.7 [53.9 - 86.5]	55.8 [44.0 - 69.7]	720	24.1 [21.8 - 26.5]	20.0 [18.2 - 22.0]
Diseases of the respiratory system	390	200.8 [175.1 - 229.4]	167.5 [146.4 - 190.6]	1660	56.2 [52.7 - 59.9]	46.2 [43.3 - 49.2]
Substance-related disorders	335	142.2 [122.5 - 164.5]	143.9 [124.4 - 165.4]	55	1.6 [1.1 - 2.3]	1.5 [1.1 - 2.1]
Suicide	230	98.8 [82.2 - 118.1]	98.8 [82.8 - 116.8]	360	10.2 [8.9 - 11.7]	10.0 [8.7 - 11.5]
Trauma (excluding suicide)	600	251.7 [224.9 - 281.1]	257.7 [231.4 - 286.0]	930	27.7 [25.4 - 30.2]	25.9 [23.7 - 28.1]
Other causes	115	63.2 [48.9 - 80.6]	49.4 [38.3 - 62.5]	745	25.0 [22.7 - 27.4]	20.7 [18.8 - 22.8]
Unknown causes	105	45.7 [34.8 - 59.3]	45.1 [34.6 - 57.7]	380	12.1 [10.5 - 13.8]	10.6 [9.2 - 12.0]

Table S4b. Age-adjusted and unadjusted mortality rates among cumulative recorded SRD diagnosed cases and non-recorded SRD cases, Manitoba, 2015-2016, by cause of death

	N	Recorded SRD diagnosis		N	No recorded SRD diagnosis	
		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)
Neoplasms	185	438.2 [358.3 - 534.1]	399.7 [328.1 - 481.8]	2605	232.8 [221.2 - 244.8]	234.4 [222.7 - 246.5]
Diseases of the circulatory system	175	421.7 [343.0 - 516.4]	378.1 [308.5 - 458.1]	2665	235.3 [223.7 - 247.3]	239.8 [228.0 - 252.0]
Dementia	40	99.6 [62.6 - 154.4]	86.4 [55.3 - 128.2]	725	63.2 [57.3 - 69.5]	65.2 [59.2 - 71.7]
Diseases of the digestive system	45	101.5 [66.1 - 153.9]	97.2 [63.9 - 141.2]	285	25.1 [21.4 - 29.2]	25.6 [21.9 - 29.8]
Endocrine, nutritional, and metabolic diseases	30	69.5 [41.0 - 115.5]	64.8 [38.4 - 102.0]	410	36.5 [32.0 - 41.4]	36.9 [32.4 - 41.8]
Infectious and parasitic diseases	25	48.9 [27.0 - 88.1]	54.0 [30.2 - 88.6]	135	12.0 [9.5 - 14.9]	12.1 [9.6 - 15.1]
Diseases of the nervous system	15	31.3 [14.1 - 67.2]	32.4 [14.9 - 60.8]	355	31.5 [27.4 - 36.1]	31.9 [27.7 - 36.6]
Diseases of the respiratory system	80	191.3 [139.8 - 259.4]	172.8 [127.1 - 229.1]	800	70.7 [64.4 - 77.4]	72.0 [65.6 - 78.8]
Substance-related disorders	70	136.8 [97.7 - 191.4]	151.2 [108.7 - 204.3]	40	3.7 [2.3 - 5.4]	3.6 [2.3 - 5.3]
Suicide	40	104.9 [65.1 - 163.5]	86.4 [55.3 - 128.3]	140	12.6 [10.0 - 15.6]	12.6 [10.0 - 15.6]
Trauma (excluding suicide)	140	320.1 [247.4 - 410.4]	302.5 [240.7 - 374.8]	460	40.8 [36.1 - 46.0]	41.4 [36.6 - 46.6]
Other causes	60	131.5 [90.4 - 189.2]	129.6 [90.6 - 179.3]	650	57.4 [51.7 - 63.5]	58.5 [52.7 - 64.7]

Unknown causes	0	-	-	110	9.7 [7.5 - 12.4]	9.9 [7.6 - 12.6]
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Table S4c. Age-adjusted and unadjusted mortality rates among cumulative recorded SRD diagnosed cases and non-recorded SRD cases, Ontario, 2015-2016, by cause of death

	N	Recorded SRD diagnosis		N	No recorded SRD diagnosis	
		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)
Neoplasms	4240	364.0 [349.7 - 378.9]	407.4 [391.4 - 423.8]	21865	177.6 [174.5 - 180.7]	188.0 [184.7 - 191.3]
Diseases of the circulatory system	4075	355.2 [340.9 - 370.1]	391.5 [375.9 - 407.6]	19730	157.9 [155.0 - 160.8]	169.6 [166.5 - 172.8]
Dementia	1110	100.3 [92.7 - 108.5]	106.6 [98.6 - 115.2]	4440	35.1 [33.7 - 36.4]	38.2 [36.7 - 39.7]
Diseases of the digestive system	940	79.8 [73.3 - 87.0]	90.3 [82.9 - 98.2]	2385	19.1 [18.1 - 20.2]	20.5 [19.4 - 21.6]
Endocrine, nutritional, and metabolic diseases	565	48.5 [43.4 - 54.2]	54.3 [48.6 - 60.4]	2300	18.6 [17.6 - 19.6]	19.8 [18.7 - 20.9]
Infectious and parasitic diseases	520	43.9 [39.1 - 49.3]	50.0 [44.5 - 55.9]	1445	11.6 [10.8 - 12.4]	12.4 [11.6 - 13.3]
Diseases of the nervous system	590	52.2 [46.8 - 58.2]	56.7 [50.9 - 63.0]	2960	23.7 [22.6 - 24.9]	25.4 [24.3 - 26.7]
Diseases of the respiratory system	2085	182.7 [172.5 - 193.4]	200.3 [189.2 - 211.9]	7550	60.1 [58.4 - 62.0]	64.9 [63.0 - 66.9]
Substance-related disorders	920	76.6 [70.1 - 83.7]	88.4 [81.1 - 96.2]	100	0.9 [0.6 - 1.1]	0.9 [0.7 - 1.1]
Suicide	445	44.3 [38.6 - 50.8]	42.8 [37.7 - 48.3]	845	7.2 [6.6 - 7.9]	7.3 [6.6 - 7.9]
Trauma (excluding suicide)	1530	141.6 [131.9 - 151.9]	147.0 [137.5 - 157.0]	3355	27.3 [26.1 - 28.5]	28.8 [27.6 - 30.2]

Other causes	1600	141.6 [132.5 - 151.3]	153.7 [144.0 - 163.9]	6210	49.7 [48.1 - 51.4]	53.4 [51.7 - 55.2]
Unknown causes	580	50.1 [44.9 - 56.0]	55.7 [49.9 - 62.0]	2815	22.7 [21.6 - 23.8]	24.2 [23.0 - 25.4]

Table S4d. Age-adjusted and unadjusted mortality rates among cumulative recorded SRD diagnosed cases and non-recorded SRD cases, Québec, 2015-2016, by cause of death

	N	Recorded SRD diagnosis		N	No recorded SRD diagnosis	
		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)
Neoplasms	2945	585.9 [558.4 - 614.8]	744.3 [709.4 - 780.3]	18035	231.8 [227.4 - 236.3]	268.2 [263.1 - 273.4]
Diseases of the circulatory system	2320	459.2 [435.0 - 484.8]	586.3 [555.4 - 618.4]	12620	158.8 [155.1 - 162.5]	187.7 [183.4 - 192.0]
Dementia	735	143.2 [130.0 - 157.8]	185.8 [168.6 - 204.1]	2465	30.5 [28.9 - 32.1]	36.7 [34.8 - 38.6]
Diseases of the digestive system	600	120.3 [108.0 - 134.1]	151.6 [136.2 - 168.3]	1580	19.9 [18.6 - 21.2]	23.5 [22.0 - 25.1]
Endocrine, nutritional, and metabolic diseases	370	74.6 [64.8 - 85.9]	93.5 [81.5 - 106.8]	1555	19.7 [18.4 - 21.0]	23.1 [21.6 - 24.7]
Infectious and parasitic diseases	255	51.3 [43.3 - 60.7]	64.4 [54.5 - 75.6]	885	11.2 [10.2 - 12.2]	13.2 [12.0 - 14.3]
Diseases of the nervous system	675	133.2 [120.3 - 147.5]	170.6 [154.2 - 188.2]	3445	43.4 [41.5 - 45.3]	51.2 [49.0 - 53.5]
Diseases of the respiratory system	1235	242.5 [225.1 - 261.4]	312.1 [289.7 - 335.7]	4600	57.5 [55.3 - 59.7]	68.4 [65.8 - 71.0]
Substance-related disorders	350	71.8 [62.2 - 82.8]	88.5 [76.8 - 101.4]	35	0.4 [0.3 - 0.7]	0.5 [0.3 - 0.8]
Suicide	350	88.5 [76.1 - 102.6]	88.5 [76.8 - 101.4]	680	10.0 [9.0 - 11.0]	10.1 [9.1 - 11.2]

Trauma (excluding suicide)	600	134.9 [120.6 - 150.8]	151.6 [136.2 - 168.3]	1755	23.3 [21.9 - 24.8]	26.1 [24.5 - 27.7]
Other causes	490	97.6 [86.6 - 110.1]	123.8 [109.9 - 139.0]	2130	26.9 [25.4 - 28.5]	31.7 [29.9 - 33.5]
Unknown causes	270	59.0 [49.8 - 69.7]	68.2 [58.0 - 79.7]	1475	19.1 [17.9 - 20.5]	21.9 [20.5 - 23.4]

Table S4e. Age-adjusted and unadjusted mortality rates among cumulative recorded SRD diagnosed cases and non-recorded SRD cases, Nova Scotia, 2015-2016, by cause of death

	N	Recorded SRD diagnosis		N	No recorded SRD diagnosis	
		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)		Age-adjusted mortality rate (per 100,000)	Unadjusted mortality rate (per 100,000)
Neoplasms	150	2530.1 [1803.0 - 4816.9]	4189.9 [3361.2 - 5154.4]	1745	7267.4 [5857.1 - 9037.1]	6097.1 [5727.7 - 6483.3]
Diseases of the circulatory system	125	1930.0 [1270.6 - 4230.8]	3486.8 [2735.9 - 4373.4]	1325	2831.9 [2237.0 - 3751.2]	4629.6 [4308.6 - 4967.4]
Dementia	25	217.6 [124.8 - 2718.0]	698.3 [390.9 - 1145.3]	440	311.4 [274.5 - 892.0]	1537.4 [1355.2 - 1736.4]
Diseases of the digestive system	75	1572.1 [938.3 - 3910.8]	2092.1 [1522.2 - 2798.6]	195	257.7 [184.2 - 859.4]	681.3 [562.2 - 817.4]
Endocrine, nutritional, and metabolic diseases	25	344.5 [173.6 - 2775.7]	697.4 [390.4 - 1143.7]	210	586.1 [337.4 - 1268.0]	733.8 [609.9 - 874.5]
Infectious and parasitic diseases	10	225.2 [83.7 - 2735.4]	278.9 [103.7 - 596.9]	100	1069.4 [410.0 - 2326.1]	349.4 [266.0 - 449.9]
Diseases of the nervous system	20	265.7 [134.1 - 2738.4]	558.7 [289.2 - 968.4]	310	1256.4 [568.4 - 2489.0]	1083.2 [931.3 - 1251.9]
Diseases of the respiratory system	55	612.0 [404.0 - 2921.0]	1536.3 [1055.2 - 2155.0]	450	733.2 [477.0 - 1400.9]	1572.3 [1388.0 - 1773.5]

Substance-related disorders	-	-	-	-	-	-
Suicide	30	1516.6 [741.4 - 4022.6]	838.0 [496.3 - 1318.7]	25	1301.1 [573.3 - 2598.3]	87.4 [48.9 - 143.3]
Trauma (excluding suicide)	45	1948.1 [1047.2 - 4496.0]	1257.0 [826.8 - 1825.2]	225	1473.1 [728.6 - 2744.0]	786.3 [657.8 - 931.7]
Other causes	55	2100.0 [1159.5 - 4662.8]	1534.2 [1053.7 - 2151.9]	225	876.4 [497.5 - 1674.4]	786.2 [657.7 - 931.5]
Unknown causes	15	238.2 [104.2 - 2733.8]	419.0 [192.6 - 786.7]	180	290.3 [206.4 - 889.0]	629.0 [514.8 - 760.2]

A. Substance-related disorders

B1. Alcohol-related disorders

B2. Alcohol use disorders only

C1. Drug-related disorders

C2. Drug use disorders only

A. Substance-related disorders

B1. Alcohol-related disorders

B2. Alcohol use disorders

C1. Drug-related disorder

C2. Drug use disorders

A. Substance-related disorders

B1. Alcohol-related disorders

B2. Alcohol use disorders

C1. Drug-related disorders

C2. Drug use disorders

— SRD — No SRD