





# CSUCH **Canadian Substance Use Costs and Harms**

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# Executive Summary

## Acknowledgements

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## Executive Summary

In 2017, substance use cost Canadians almost \$46.0 billion, led to over 275,000 hospitalizations and contributed to the loss of nearly 75,000 lives. This report presents the estimates of the costs of substance use in Canada from 2015 to 2017 using the most reliable, up-to-date data sources and methods according to the following categories:

- Cost type (healthcare costs, lost productivity costs, criminal justice costs and other direct costs);
- Substance (alcohol, tobacco, cannabis, opioids, other CNS depressants, cocaine, other CNS stimulants and other drugs)
- Province and territory

Where data were available for specific costs, costs and harms are presented by health condition, sex and age group.

This report is an update to *Canadian Substance Use Costs and Harms 2007–2014*, released in June 2018 (Canadian Substance Use Costs and Harms Scientific Working Group, 2018). Estimates presented in this report, however, should not be directly compared with estimates presented in the 2007–2014 report as we have improved our methods since the publication of the earlier report.

The estimates in this report give us a picture of the costs and harms associated with substance use in Canada. These estimates are a baseline against which to monitor the impacts of current and future policies related to substance use in Canada. Impacts include the effects of cannabis legalization, outcomes of the opioid crisis, and the likely major impact of the COVID-19 pandemic on patterns of substance use, costs and harms.

The ability to track costs and trends in harms uniquely caused by specific types of substances is valuable to governments, businesses, and advocacy groups working to reduce these harms. A better understanding of the societal costs associated with different substances can help inform policy decision making and resource allocation for law enforcement, prevention, treatment and harm reduction services.

## Overall Costs of Substance Use



In 2017:

- Almost 63% of the total costs of substance use were due to alcohol and tobacco.
- The four substances associated with the largest costs were (in order):
  - Alcohol, accounting for \$16.6 billion or 36.2% of the total costs;
  - Tobacco, accounting for \$12.3 billion or 26.7% of the total costs;
  - Opioids, accounting for \$5.9 billion or 12.9% of the total costs; and
  - Cocaine, accounting for \$3.7 billion or 8.1% of the total costs.

Between 2015 and 2017,<sup>1</sup> the per-person<sup>2</sup> cost of substance use (SU) increased 3.3% in real terms from \$1,218 in 2015 to approximately \$1,258 in 2017. However, the per-person costs varied significantly among the substances assessed. The four substances for which per-person costs increased the most (in order) between 2015 and 2017 were:

- Central nervous system (CNS) stimulants, (including amphetamines and methamphetamine, but excluding cocaine), the costs of which increased 22.1% from \$44 to \$54;
- Opioids, the costs of which increased 20.9% from \$135 to \$163;
- Cocaine, the costs of which increased 10.5% from \$92 to \$102; and
- Alcohol, the costs of which increased 1.6% from \$448 to \$455.

In contrast to these increases, between 2015 and 2017 the per-person cost of tobacco use decreased by 5.1% (\$354 to \$336). In 2015, alcohol and tobacco use combined accounted for 65.8% of the total per-person cost of SU in Canada. In 2017, the costs associated with using these substances decreased to 62.9% of the total per-person cost.



## Healthcare Costs

Healthcare costs include inpatient hospitalizations, day surgeries, emergency department visits, specialized treatment<sup>3</sup> for SU disorders, physician time and prescription drugs.

In 2017:

- Healthcare costs related to SU were \$13.1 billion (28.4% of the total cost of SU) or \$386 per person in Canada.<sup>4</sup> Of these costs, inpatient hospitalizations accounted for 24.5%, physician time accounted for 37.4% and prescription drugs accounted for 28.5%.
- Alcohol (\$5.4 billion) and tobacco (\$6.1 billion) contributed almost 89% of costs.
- After alcohol and tobacco, the use of opioids cost the healthcare system the third-highest amount at \$439 million (3.4%).
- Contributing to these costs were 277,060 SU-attributable hospitalizations of which 141,271 (51.0%) were attributable to tobacco use and 105,065 (37.9%) to alcohol use.
- Per-person healthcare costs related to SU were highest in the territories. This finding reflects higher rates of alcohol and tobacco use in the territories, and high costs associated with health care for territorial residents.

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<sup>1</sup> Throughout this report, costs for all years are presented in 2017 Canadian dollars.

<sup>2</sup> Per-person estimates in this report do not include costs associated with inpatient hospitalizations, day surgeries or emergency department visits in Quebec. This likely led to an underestimation of about \$857 million or 1.9% of total costs. The 2017 per-person estimates do not include costs associated with lost productivity due to premature deaths in Yukon, as these data were not available from Statistics Canada's Vital Statistics database at the time of this report. This likely led to an underestimation of approximately \$103 million or 0.2% of total costs. All estimates are likely conservative by about \$960 million or 2.1%.

<sup>3</sup> Specialized treatment refers to psychosocial services for substance use only, recognizing that these services are one form of treatment within a larger healthcare system. For details on what this treatment includes, see the technical report.

<sup>4</sup> Only some healthcare-related data were available for Quebec. This per-person healthcare cost does not include the costs or population of Quebec.





Between 2015 and 2017, per-person healthcare costs associated with any SU increased 2.7% from \$348 to \$358.<sup>5</sup> Per-person healthcare costs associated with individual substances also increased as follows:

- Alcohol increased 4.8% from \$142 to \$149.
- Cannabis increased 20.8% from \$7 to \$9.
- Opioids increased 11.5% from \$11 to \$12.
- CNS stimulants (excluding cocaine) costs increased 37.3% from \$5 to \$7.



## Lost Productivity Costs

Cost estimates of SU-attributable lost productivity were based on the lost value of work due to premature death, long-term disability and short-term disability (absenteeism and impaired job performance).

In 2017:

- Lost productivity costs attributable to SU in 2017 were \$20.0 billion or \$548 per person.
- Costs associated with the use of alcohol and tobacco were estimated to account for just over 63% of all lost productivity costs associated with SU.
- Contributing to these costs were 23,792 SU-attributable deaths among Canadians under 65 years old and 338,555 potential years of productive life lost. Alcohol use was found to be the leading cause of SU-attributable lost productivity.

Between 2015 and 2017:

- Overall per-person lost productivity costs increased about 4.5% from \$524 in 2015 to \$548 in 2017.
- The largest increase in per-person lost productivity costs was associated with opioid use. These costs increased 34.1% from \$87 per person in 2015 to \$116 per person in 2017. This increase is due to the rising number of premature deaths related to opioid use during this period.
- The number of premature deaths related to opioid use increased by 32.8%, from 3,829 to 5,084.



## Criminal Justice Costs

Criminal justice costs include costs associated with policing, courts and correctional services (admissions to sentenced custody). Our calculations include expenditures for:

- Crimes that are 100% attributable to SU. These refer to impaired driving and drug-related offences that fall under the *Controlled Drugs and Substances Act*; and
- Crimes that are partially attributable to SU. These refer to violent crimes such as homicide or assault, and non-violent crimes such as theft or arson.

In 2017:

- Over \$9.2 billion was spent on criminal justice costs associated with SU, which amounts to \$253 for every Canadian.
- Forty-two percent of crimes (excluding impaired driving and crimes defined under the *Controlled Drugs and Substances Act*) would not have occurred if the perpetrator had not been under the influence of, or seeking, alcohol or other drugs.

<sup>5</sup>Only some healthcare data were available for Quebec. These national per-person trend estimates include the costs and population of Quebec and therefore differ from the \$386 indicated above.

- Almost 20% of all violent crimes were associated with alcohol use alone.
- Alcohol use accounted for the greatest costs to the criminal justice system at \$2.8 billion or 30.2% of all criminal justice costs.
- Cocaine use accounted for the second-highest criminal justice costs related to SU (\$2.6 billion or 27.8%). Only 8.0% of this cost was associated with violations of the *Controlled Drugs and Substances Act* (e.g., trafficking, possession). The other 92.0% was associated with other violent and non-violent crimes.
- Cannabis use accounted for the third-highest criminal justice costs related to SU (\$1.6 billion or 17.5%). Forty percent of these costs were a direct result of this substance's illegality; the costs are for policing, court and correctional services associated with manufacturing, trafficking and possession. Cannabis use for non-medical purposes was not yet legal in Canada in 2017.

Between 2015 and 2017:

- Criminal justice costs increased 1.1% from \$250 per person in 2015 to about \$253 per person in 2017.
- Criminal justice costs associated with cocaine increased 6.8% from \$66 to \$70 per person.
- Criminal justice costs associated with CNS stimulants increased 18.5% from \$18 to \$22 per person.
- Criminal justice costs associated with alcohol decreased 2.7% from \$79 to \$76 per person.
- Costs associated with cannabis decreased 3.4% from \$46 to \$44 per person.



## Other Direct Costs

Other direct costs related to SU include costs across several categories, including research and prevention, fire damage, damage to motor vehicles and workplace costs not already covered in lost productivity (e.g., employee assistance programs, drug testing programs and administrative costs associated with workers' compensation).

In 2017:

- These other direct costs contributed over \$3.6 billion, the equivalent of \$100 per Canadian, to the total cost related to SU.
- Alcohol use accounted for 45.5% of other direct costs, followed by cannabis use at 21.6%.
- Over \$2.4 billion was spent on damage to motor vehicles as a result of collisions related to SU.
- Damage to property due to fires associated with SU was \$745 million.

Between 2015 and 2017, other direct costs increased 4.1% from \$96 per person in 2015 to about \$100 per person in 2017.





## Implications

A substantial proportion (63.0%) of the costs of SU in 2017 were related to the use of alcohol and tobacco. Tobacco was by far the deadliest substance, accounting for 47,707 deaths in 2017. Although tobacco use accounted for more deaths, alcohol use led the way in total costs.

The higher costs associated with alcohol use can be attributed to injuries and deaths of people at a younger age, and was therefore responsible for more lost years of productive life. In contrast to tobacco, costs related to alcohol use are rising. This rise in alcohol-related costs and decrease in tobacco-related costs is hardly surprising. While we have been reaping the benefits of strong public-health policies designed to curb tobacco use, this has not been the case for alcohol. It is well established that increased availability of alcohol is associated with increased consumption. Yet some provincial and territorial governments have substantially loosened restrictions on the sale and availability of alcohol. Furthermore, our national advertising codes have not been updated in a quarter of a century. Of particular concern is that these codes do not apply to modern digital media, which many young people use to communicate. These factors may be contributing to rising costs and harms related to alcohol use. With the arrival of COVID-19, there are signs that alcohol consumption is increasing due to a lack of regular schedule, stress and boredom (Nanos Research, 2020). These findings suggest there will likely be more alcohol-attributable harms in future estimates.

In 2017, Canada was in the midst of the opioid epidemic. As expected, the increase in opioid-related harms was accompanied by a substantial increase in the associated costs of opioid use. Given that the number of opioid-related deaths increased in Canada between 2017 and 2018 (Special Advisory Committee on the Epidemic of Opioid Overdoses, 2020), we expect an increase in opioid-related costs and harms in future estimates.

Another key emerging finding is the rapid rise in harms associated with the use of cocaine and other CNS stimulants. These increases are thought to be largely attributable to increases in methamphetamine use and harms (Canadian Centre on Substance Use and Addiction, 2018; Canadian Community Epidemiology Network on Drug Use, 2019). These harms may be exacerbated by the intentional or unintentional use of stimulants with other harmful substances, such as fentanyl and its analogues, benzodiazepines or synthetic cannabinoids found in the illegal, unregulated and toxic drug supply (Canadian Community Epidemiology Network on Drug Use, 2019; Payer et al, 2020).

## Conclusions

The estimates in this report give us a picture of the costs and harms associated with SU in Canada. They are a baseline against which to monitor the impacts of current and future policies designed to limit harms from SU in Canada.

We are in a critical period for Canadian policy making about SU. Researchers and lawmakers are assessing the impacts of legal, non-medical cannabis. The nation is still in the midst of an opioid epidemic, many regions are experiencing increases in methamphetamine-related harms, and in the early months of 2020, the world was hit by a pandemic that significantly changed our social landscape. It is unclear what the full impact of these major social changes will be on SU in Canada.

Throughout this crucial time, Canadian policy makers must prioritize policies to reduce harms from the legal substances that we take for granted yet have disproportionately large negative impacts on public health. We need to take a long, hard look at the varying impacts of different types of psychoactive substances on health, crime and productivity, and design regulatory systems that create appropriate access to substances while limiting harms. This report provides evidence upon which to base SU policies and against which to measure their success.

The image is a vertical collage. On the left, there is a 3D bar chart with three bars of increasing height in yellow, orange, and blue. Below it is a thick orange vertical bar. The background is a blurred image of a calculator and a pen pointing at a candlestick chart with various colored lines (green, red, blue) overlaid. The word 'Introduction' is centered in a blue, sans-serif font.

# Introduction



## Introduction

This report presents estimates of the overall costs of substance use (SU) in Canada. These estimates are based on the most reliable, up-to-date data sources and methods available for the years 2015 to 2017, the most recent year for which comprehensive data were available. This report is intended for policy makers, researchers and all Canadians who want to better understand the costs and harms of SU in Canada.

Though this report is an update to *Canadian Substance Use Costs and Harms 2007–2014*, which was released in June 2018 (Canadian Substance Use Costs and Harms Scientific Working Group, 2018), estimates presented in this report should not be directly compared with estimates presented in the 2007–2014 report. As we developed the 2015–2017 estimates, we improved our methodology in several ways. Most notably, we refined the methods we use to estimate the prevalence of SU and calculate poisoning deaths attributable to SU.

The data included in this report, as well as the 2007–2014 data, are available in our online data visualization tool (<https://csuch.ca/explore-the-data>). Policy makers, researchers and interested Canadians can use the tool to explore the results by province and territory, year, substance, type of harm, cost type, sex, age group and health condition. As we apply new methods to derive updated estimates for 2007 to 2014, they will be made available in this tool.

As in the previous report, this report presents estimates of the costs associated with a broad range of substances, including alcohol, tobacco, cannabis, opioids, central nervous system (CNS) depressants (excluding alcohol and opioids)<sup>6</sup> such as benzodiazepines and barbiturates, cocaine, CNS stimulants (excluding cocaine)<sup>7</sup> such as amphetamine and methamphetamine, and other substances (e.g., hallucinogens, inhalants). Estimates are also presented by province or territory and cost type (i.e., healthcare, productivity, criminal justice and other direct costs).

Detailed methods are provided in the *Canadian Substance Use Costs and Harms: Technical Report*, available on the project website.

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<sup>6</sup> Referred to in this report as other CNS depressants.

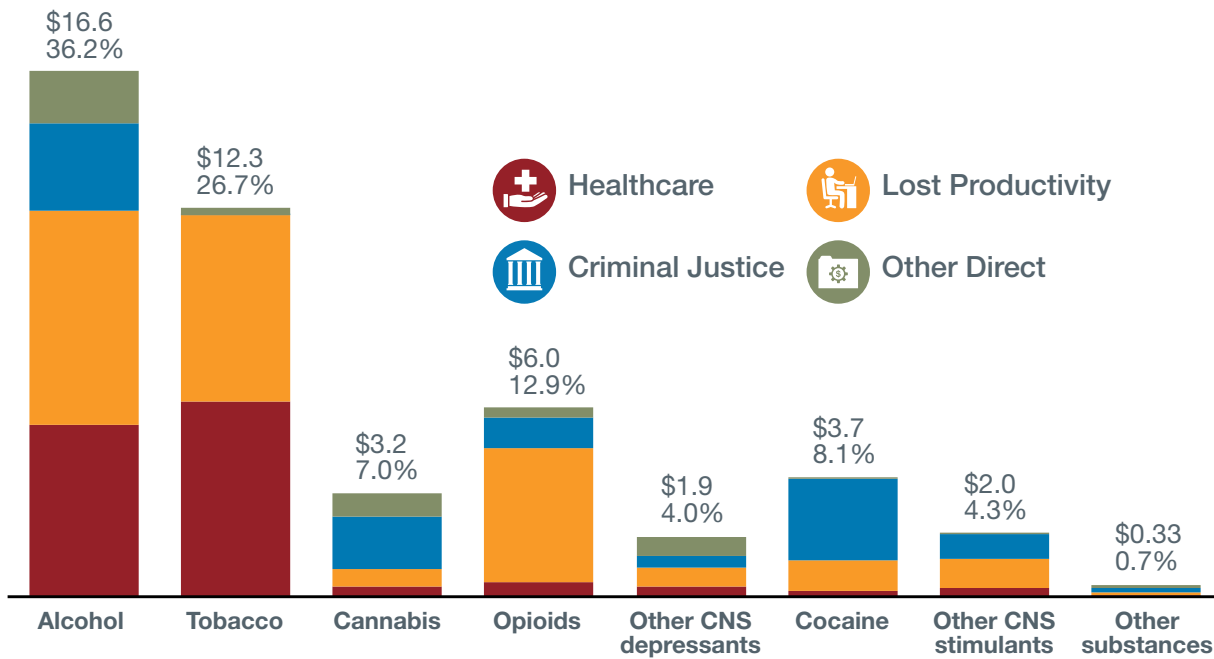
<sup>7</sup> Referred to in this report as other CNS stimulants.



## Overall Costs of Substance Use in Canada

In 2017, the overall cost of SU in Canada was estimated to be \$46.0 billion.<sup>8</sup> This estimate represents a cost of about \$1,258 per person in Canada. In 2017, the legally available<sup>9</sup> and most widely used psychoactive substances — alcohol and tobacco — accounted for almost 63% of these costs. Alcohol accounted for about \$16.6 billion (36.2%), tobacco accounted for about \$12.3 billion (26.7%) and other substances accounted for about \$17.1 billion (37%). Among the other substances studied, opioids accounted for the highest costs, followed by cocaine (see Figure 1 and Table 1).

**Figure 1.** Costs (in billions) and percentage of total costs attributable to substance use in Canada by substance and cost type, 2017







**Note:** These estimates do not include costs associated with inpatient hospitalizations, day surgeries or emergency department visits in Quebec, nor costs associated with lost productivity due to premature deaths in Yukon.

<sup>8</sup>This number does not include costs associated with inpatient hospitalizations, day surgeries or emergency department visits in Quebec. A rough calculation based on per-person costs in Ontario across these three cost types indicates that these costs account for about \$857 million or 1.9%. The 2017 estimates do not include costs associated with lost productivity due to premature deaths in Yukon territory. This led to an underestimation of approximately \$103 million or 0.2% of total cost based on a similar calculation using Northwest Territories per person premature death costs. All estimates as well as per-person estimates should be considered conservative by this margin (\$960 million or 2.1% in total).

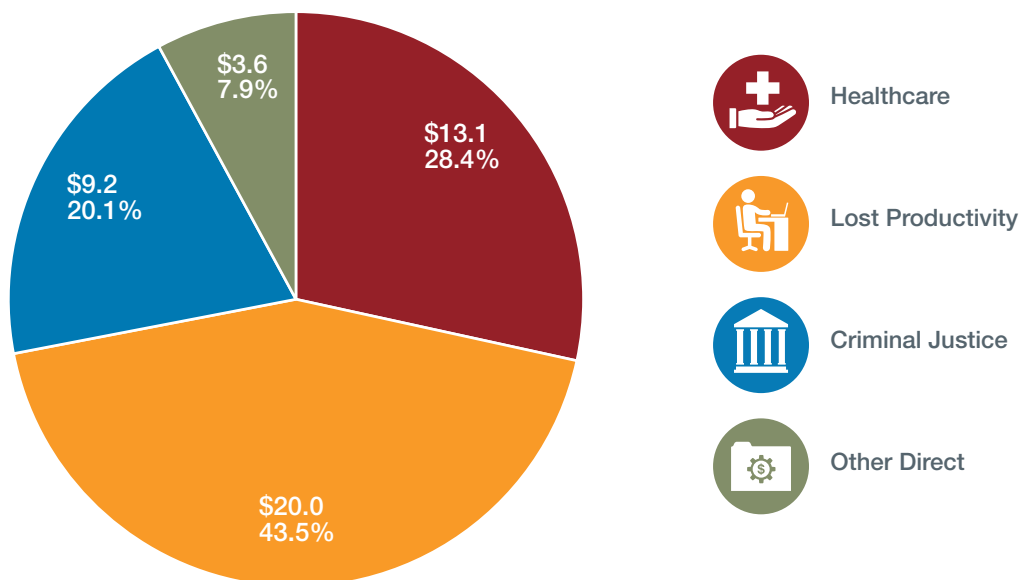
<sup>9</sup>For the purposes of this report, legal substances refer to substances that were legally available for recreational use during the reporting period (alcohol and tobacco). Costs and harms associated with other substances could be linked to legal use (e.g., an individual taking opioid medication as prescribed may still experience harm).

Cost estimates included in this report are broken down into four major cost types:

- 
**Healthcare costs** associated with inpatient hospitalizations, day surgeries, emergency department visits, specialized treatment for SU disorders, physician time and prescription drugs;
- 
**Lost productivity costs** associated with SU-attributable premature deaths, long-term disability and short-term disability (absenteeism and impaired performance on the job, or “presenteeism”);
- 
**Criminal justice costs** associated with policing, courts and correctional services (admissions to sentenced custody) attributable to SU, including costs associated with the enforcement of current drug and impaired-driving laws, as well as the impact of violent and non-violent crimes that would not have occurred without some SU; and
- 
**Other direct costs**, a mixed category that includes costs associated with the federal funding of research and prevention programs, fire damage and motor vehicle damage attributable to SU, drug testing in the workplace, employee-assistance programs and workers’ compensation.

The costs of SU in Canada in 2017 by cost type are presented in Figure 2 and Table 1. Productivity losses were \$20.0 billion or 43.5% of the total costs, while healthcare costs were \$13.1 billion (28.4%). The third-highest contributor to the total costs related to SU were criminal justice costs, which were \$9.2 billion or 20.1% of the total.

**Figure 2.** Overall costs (in billions) and percentage of total overall costs attributable to substance use in Canada by cost type, 2017



**Table 1.** Costs attributable to substance use in Canada (in millions of dollars), 2017

	Alcohol	Tobacco	Cannabis	Opioids	Other CNS Depressants	Cocaine	Other CNS Stimulants	Other Substances	Total
<b>Healthcare costs</b>	<b>5,432.5</b>	<b>6,149.9</b>	<b>322.0</b>	<b>438.6</b>	<b>308.9</b>	<b>150.3</b>	<b>241.1</b>	<b>22.7</b>	<b>13,066.1</b>
Inpatient hospitalizations	1,343.9	1,561.2	63.9	91.7	71.4	31.6	38.5	4.5	3,206.6
Day surgery	63.2	58.4	1.1	0.3	0.5	0.3	0.2	0.0	124.1
Emergency department visits	234.9	115.2	16.2	21.8	14.7	8.6	11.4	1.5	424.3
Specialized SU treatment	488.1	0.0	61.7	48.5	10.1	24.2	67.5	2.3	702.3
Physician time	1,908.6	2,457.4	105.6	162.2	123.7	50.8	73.3	8.6	4,890.1
Prescription drugs	1,393.7	1,957.8	73.4	114.1	88.5	34.8	50.3	5.9	3,718.6
<b>Lost productivity costs</b>	<b>6,740.1</b>	<b>5,893.3</b>	<b>547.2</b>	<b>4,246.6</b>	<b>590.7</b>	<b>983.5</b>	<b>916.4</b>	<b>100.5</b>	<b>20,018.3</b>
Premature death	4,632.1	2,836.7	362.6	3,913.1	320.1	905.0	802.8	48.7	13,821.2
Long-term disability	1,445.7	1,786.4	91.0	156.2	120.0	54.3	75.2	7.3	3,736.2
Short-term disability (absenteeism and presenteeism)	662.3	1,270.2	93.6	177.3	150.6	24.2	38.5	44.4	2,460.9
<b>Criminal justice costs</b>	<b>2,792.4</b>	<b>5.4</b>	<b>1,620.3</b>	<b>944.9</b>	<b>360.9</b>	<b>2,565.9</b>	<b>800.1</b>	<b>152.1</b>	<b>9,242.0</b>
Policing	1,489.8	0.0	844.5	551.1	204.4	1,507.7	458.4	90.2	5,146.1
Courts	575.5	0.0	308.7	173.5	66.4	471.4	146.2	25.7	1,767.4
Correctional services	727.1	0.0	467.1	220.3	90.1	586.8	195.5	36.2	2,323.0
<b>Other direct costs</b>	<b>1,659.9</b>	<b>234.9</b>	<b>750.9</b>	<b>320.3</b>	<b>599.5</b>	<b>13.4</b>	<b>20.5</b>	<b>50.4</b>	<b>3,649.9</b>
Research and prevention	101.5	58.7	20.0	21.2	16.2	3.2	4.3	25.1	250.1
Fire damage	553.4	176.2	15.4	0.0	0.0	0.0	0.0	0.0	745.0
Motor vehicle damage	867.5	0.0	672.5	272.3	551.7	8.6	12.1	23.6	2,408.4
Workplace drug testing	8.7	0.0	7.4	7.9	5.7	0.6	1.0	0.6	31.8
Employee-assistance programs	54.5	0.0	4.2	5.3	0.9	0.5	2.6	0.1	68.1
Workers' compensation administrative costs	74.3	0.0	31.4	13.7	25.0	0.4	0.6	1.1	146.5
<b>Total</b>	<b>16,625.0</b>	<b>12,283.5</b>	<b>3,240.4</b>	<b>5,950.4</b>	<b>1,859.9</b>	<b>3,713.0</b>	<b>1,978.1</b>	<b>325.7</b>	<b>45,976.2</b>
<b>Total cost per person (in dollars)</b>	<b>454.86</b>	<b>336.14</b>	<b>88.64</b>	<b>162.81</b>	<b>50.89</b>	<b>101.55</b>	<b>54.12</b>	<b>8.91</b>	<b>1,257.92</b>
<b>% of all SU-related costs</b>	<b>36.2%</b>	<b>26.7%</b>	<b>7.0%</b>	<b>12.9%</b>	<b>4.0%</b>	<b>8.1%</b>	<b>4.3%</b>	<b>0.7%</b>	<b>100%</b>

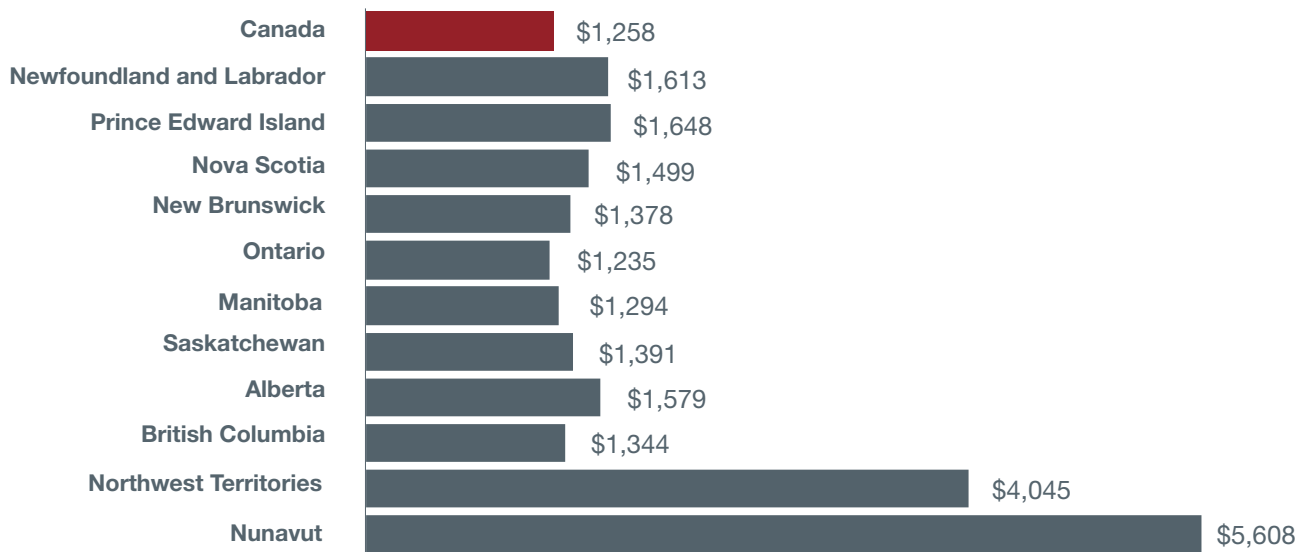
**Note:** These estimates do not include costs associated with inpatient hospitalizations, day surgeries or emergency department visits in Quebec. At the time of this report, the data on premature deaths in Yukon (2017 only) required to calculate costs of potential years of productive life lost were not available from Statistics Canada's Vital Statistics database





In 2017, the per-person costs of SU were highest in the territories. This finding reflects higher rates of alcohol and tobacco use in the territories, as well as the higher costs of healthcare for territorial residents (see Figure 3).

**Figure 3.** Per-person costs attributable to substance use by province and territory, 2017



**Note:** Meaningful per-person costs for Quebec and Yukon could not be calculated. The estimated per-person costs in Canada should be considered an underestimate, as they do not include costs associated with inpatient hospitalizations, day surgeries or emergency department visits in Quebec, nor costs associated with lost productivity due to premature deaths in Yukon.

### Cost Trends from 2015 to 2017

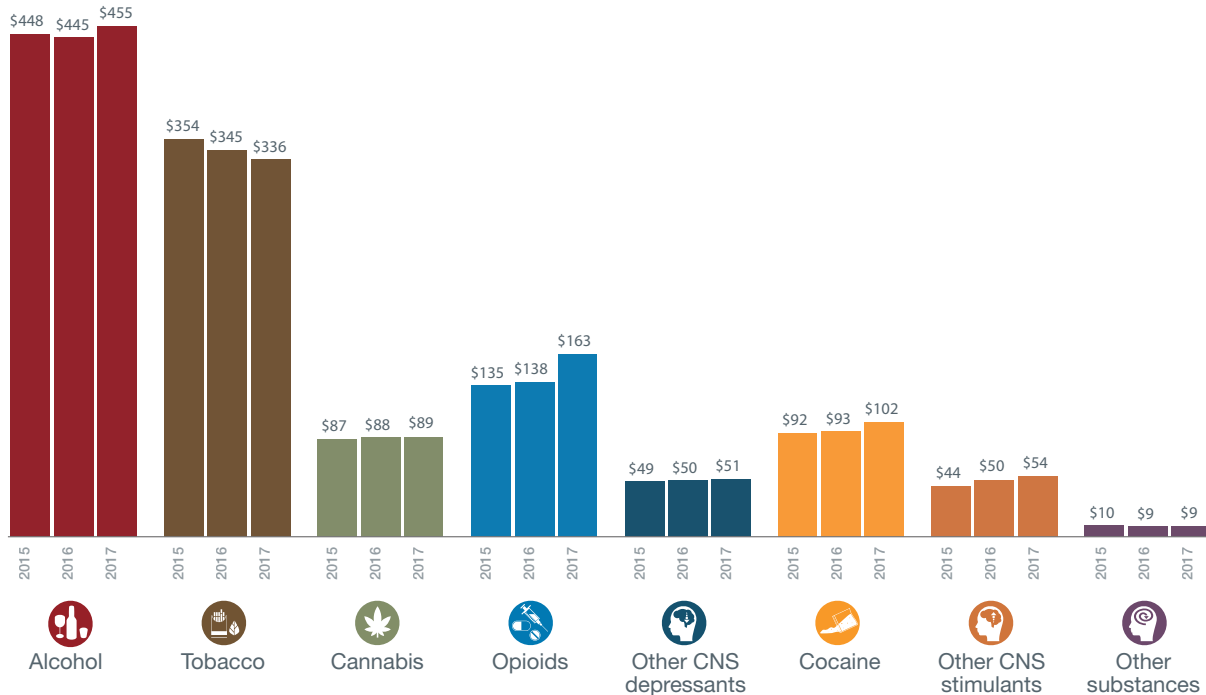
The cost of SU in Canada increased almost 6% from \$43.5 billion in 2015 to \$46.0 billion in 2017. However, the Canadian population also increased over that time. The per-person costs of SU in Canada increased by 3.3% from \$1,218 per person in 2015 to \$1,258 in 2017 (in 2017 inflation-adjusted Canadian dollars).

From 2015 to 2017, the largest per-person increases in cost were associated with the use of opioids and CNS stimulants (excluding cocaine). Costs associated with opioid use grew by 20.9% from \$135 to \$163, while costs associated with CNS stimulants increased by 22.1% from \$44 to \$54 (see Figure 4).

In addition to these large increases, the per-person costs associated with alcohol use increased 1.6% from \$448 per person in 2015 to \$455 per person in 2017. Other per-person cost increases were associated with cocaine (10.5%), CNS depressants (4.1%) and cannabis (2.4%). The sizeable increases in costs associated with both opioids and CNS stimulants were expected given the opioid crisis in most parts of Canada and the more recent increase in harms related to the use of methamphetamines. The costs associated with tobacco use decreased (5.1%) from \$354 per person in 2015 to \$336 per person in 2017. These decreases are largely a result of fewer hospitalizations and deaths related to tobacco use.



**Figure 4.** Per-person costs attributable to substance use in Canada by substance, 2015–2017



**Note:** These estimates do not include costs associated with inpatient hospitalizations, day surgeries or visits to emergency departments in Quebec, nor costs (for 2017 only) associated with lost productivity due to premature deaths in Yukon. Therefore, costs are likely 2.1% higher than what is reported here.

### Overview of Methods

The methods we used in this project were based on the approaches applied in other Canadian and international cost studies on SU (e.g., Rehm et al., 2006; Collins & Lapsley, 2008). However, the availability of additional datasets and analytic resources enabled us to significantly improve and refine our methods across a number of key areas. As a result, **the estimates presented in this report should not be directly compared to those made in earlier Canadian cost studies.**

All dollar estimates are presented in 2017 Canadian dollars. The national Consumer Price Index was used to adjust costs from earlier years to 2017 dollars (Statistics Canada, 2018e). Results presented in this report are also presented by calendar year. When data were only available by fiscal year (FY), we converted them into calendar year by allocating 25.0% of the costs and counts to the following year. For example, when converting FY 2016–2017 to calendar years 2016 and 2017, we added 25.0% of FY 2015–2016 to 2016, 25.0% of FY 2016–2017 to 2017, and so on.



Wherever possible, we used current data and data specific to the provinces and territories first to estimate relevant harms from SU that might generate costs. For example, many hospitalizations caused by SU are clearly identified in official diagnostic records (e.g., opioid overdose, SU disorder, alcoholic psychosis). We were able to access individual-level data on the costs of different types of hospitalizations and then combine these data to calculate accurate costs for hospitalizations that are 100% attributable to SU. However, many health conditions and crimes are only partially attributable to SU. Healthcare and crime records cannot always reliably record the contributions of SU and so an indirect **attributable fraction approach** was used to estimate the proportions of health and crime outcomes that could be considered caused by alcohol or other SU.

### The Attributable Fraction Approach

There are some health conditions and crimes that, by definition, can be fully attributed to SU. For example, all hospital stays associated with an International Statistical Classification of Diseases and Related Health Problems (ICD) code of “mental and behavioural disorders attributed to the use of alcohol”<sup>10</sup> are caused by alcohol use. Similarly, all charges associated with a violation of the *Controlled Drugs and Substances Act* for cocaine possession can be fully attributed to cocaine use. However, healthcare and crime records do not always record the contributions of SU.

For example, an association between specific levels of alcohol consumption and colorectal cancer has been established (World Health Organization, 2014). However, not all cases of colorectal cancer are caused by alcohol use. The attributable fraction approach allows us to estimate the number of cases of colorectal cancer in the population that can be attributed to alcohol use. To do so, we assess the risk of developing a condition (in this case, colorectal cancer) that is associated with various quantities of alcohol consumption and the proportion of people in a population consuming alcohol at those quantities. Using this information, we can estimate the proportion of all cases of colorectal cancer attributable to alcohol use. Multiplying this proportion by the total number of colorectal cancer cases allows us to calculate the number of alcohol-attributable cases of colorectal cancer and the costs associated with treating them. This procedure can then be conducted for all the conditions for which alcohol is causally associated.

The causal associations for all included conditions were based on analyses by the U.S.-based Centers for Disease Control and Prevention (2008) and the World Health Organization (2014). First, we found that there are 46 alcohol-attributable conditions (see Table 2). We then conducted a similar exercise for other substances. A list of substances, as well as the health conditions considered fully and partially attributable, are included in Table 2.

The healthcare and lost productivity estimates were mostly completed using a condition-based, epidemiological attributable fraction approach. In this approach, the proportion of each condition related to SU that would be eliminated in the absence of SU was calculated. These proportions were used to estimate the healthcare and lost productivity costs incurred within a given year.

For more details about the attributable fraction approach and how it was applied in estimating the different costs, see the technical report.

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<sup>10</sup>When patients are discharged from hospitals in Canada, they are assigned a code indicating the main reason for their hospital stay. The coding systems used differ depending on the database. The Discharge Abstract Database and Hospital Morbidity Database use the Canadian enhancement of the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10-CA; Canadian Institute for Health Information, 2001) to code the diagnosis of the hospital stay.



Table 2. Health conditions that can be wholly (indicated with [W]) and partially attributable to substance use

Health condition category	Alcohol	Tobacco	Cannabis	Cocaine	Other CNS Stimulants	Opioids	Other CNS Depressants	Other Substances
Cancer	Oral cavity and pharynx, esophageal, colorectal, liver, pancreatic, laryngeal, breast	Oral cavity and pharynx, esophageal, stomach, colorectal, pancreatic, laryngeal, tracheal, lung, cervical, kidney and renal pelvic, bladder, acute myeloid leukemia	Lung, tracheal					
Cardiovascular conditions	Alcoholic cardiomyopathy (W), hypertension, ischemic heart disease, cardiac arrhythmias, hemorrhagic stroke, ischemic stroke, esophageal varices	Other heart disease, ischemic heart disease, cerebrovascular disease, other vascular diseases						
Communicable diseases	HIV			Viral hepatitis B, viral hepatitis C, HIV	Viral hepatitis B, viral hepatitis C, HIV	Viral hepatitis B, viral hepatitis C, HIV		
Conditions arising during pregnancy	Complication of pregnancy by maternal use of alcohol (W), fetal alcohol syndrome (W), low birth weight	Prenatal conditions, sudden infant death syndrome						
Digestive conditions	Alcoholic gastritis (W), alcohol-induced pancreatitis (W), liver cirrhosis, acute pancreatitis, chronic pancreatitis	Diabetes (Type 2)						
Endocrine conditions	Alcohol-induced pseudo-Cushing's syndrome (W), diabetes (Type 2)							
Motor vehicle collisions	Motor vehicle collisions	Motor vehicle collisions	Motor vehicle collisions	Motor vehicle collisions	Motor vehicle collisions	Motor vehicle collisions	Motor vehicle collisions	Motor vehicle collisions
Neuropsychiatric conditions	Alcoholic psychoses (W), alcohol abuse (W), alcohol dependence (W), degeneration of nervous system due to alcohol (W), alcoholic polyneuropathy (W), alcoholic myopathy (W), epilepsy	Mental and behavioural disorders due to use of tobacco (W)	Mental and behavioural disorders due to the use of cannabinoids (W)	Mental and behavioural disorders due to use of cocaine (W)	Mental and behavioural disorders due to other stimulants and amphetamines (W)	Mental and behavioural disorders due to use of opioids (W)	Mental and behavioural disorders due to use of other CNS depressants (W)	Mental and behavioural disorders due to use of all other psychoactive drugs (W)
Unintentional injuries	Accidental poisoning by alcohol (W), falls, drowning, fires, other unintentional injuries, accidental poisoning by substances other than alcohol	Accidental poisoning by tobacco or nicotine (W), fires	Accidental poisoning by cannabis (W), fires	Accidental poisoning by cocaine (W)	Accidental poisoning by other stimulants and amphetamines (W)	Accidental poisoning by opioids (W)	Accidental poisoning by all other CNS depressants (W)	Accidental poisoning by all other psychoactive drugs (W)
Intentional injuries	Intentional self-poisoning by alcohol (W), assault/homicide, other intentional self-harm, other intentional injuries, intentional self-poisoning by substances other than alcohol	Intentional self-poisoning by cannabis (W), assault/homicide (W), assault/homicide self-harm	Intentional self-poisoning by cocaine (W), assault/homicide, other intentional self-harm	Intentional self-poisoning by cocaine (W), assault/homicide, other intentional self-harm	Intentional self-poisoning by other stimulants and amphetamines (W), assault/homicide, other intentional self-harm	Intentional self-poisoning by opioids (W), assault/homicide, other intentional self-harm	Intentional self-poisoning by other CNS depressants (W), assault/homicide	Intentional self-poisoning by all other psychoactive drugs (W), assault/homicide
Respiratory conditions	Tuberculosis, lower respiratory tract infections	Pneumonia, influenza and tuberculosis, chronic obstructive pulmonary disease						

**Note:** Most conditions listed here have a corresponding ICD-10-CA code. These codes are used to calculate costs associated with hospitalizations, deaths and other healthcare costs and harms related to SU. Tuberculosis was classified as a communicable disease related to alcohol in 2007–2014. For 2015–2017, it was reclassified as a respiratory disease to align with the classification for tobacco. This table excludes conditions that are 100% attributable to all drugs (excluding alcohol and tobacco): mental and behavioural disorders due to multiple drug use and complications of pregnancy and birth due to maternal use of drugs.



## *Methodological Differences from CSUCH 2007–2014*

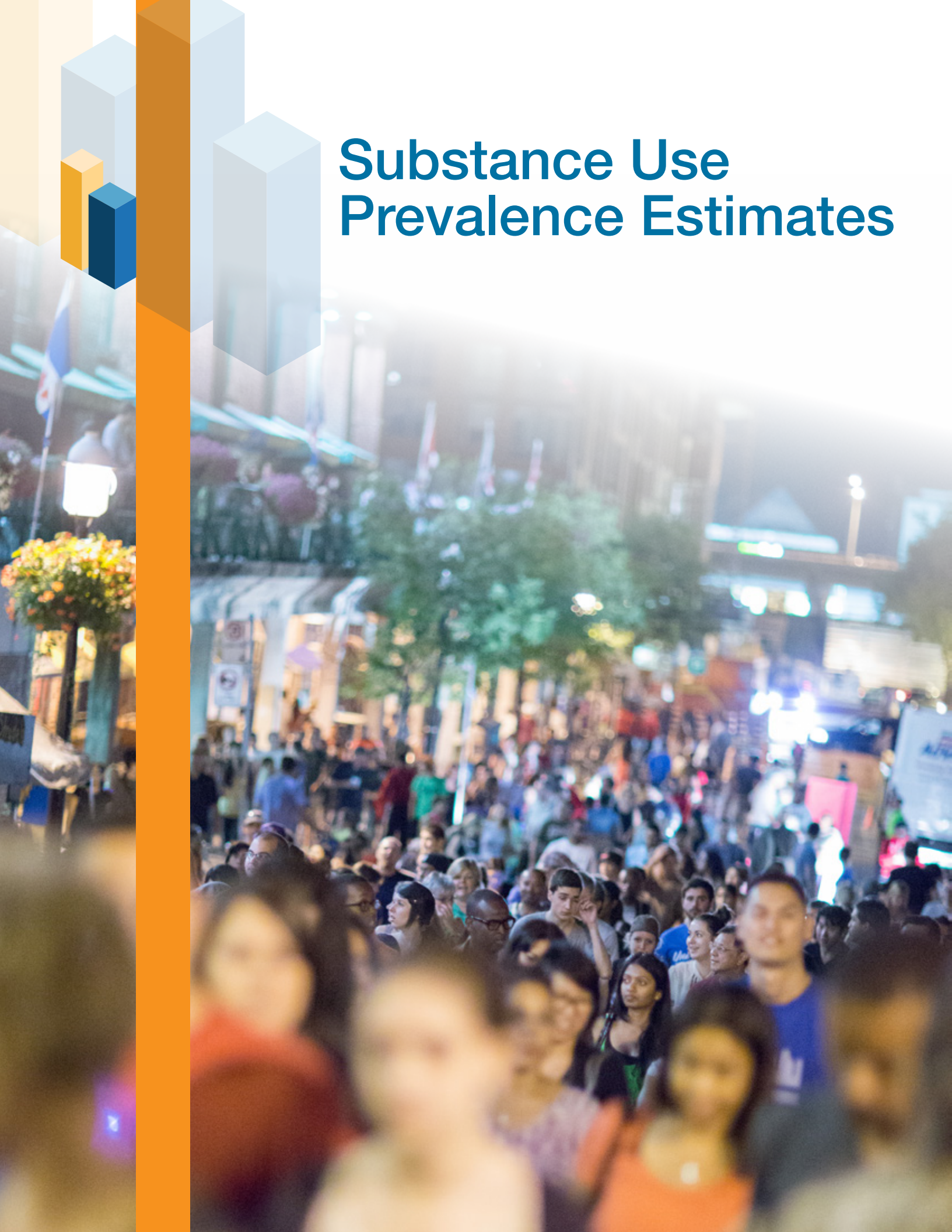
The methods we used to calculate the costs of SU in Canada from 2015 to 2017 are almost the same as the ones we used in our 2007–2014 report. These methods are described in detail in the technical report.

However, in calculating our estimates for 2015 to 2017, we improved our methods to model SU prevalence and to estimate SU-attributable poisoning deaths. As a result, estimates presented in this report should not be directly compared with estimates in the 2007–2014 report. The cost and harm estimates described in this report, as well those from 2007 to 2014, are available in our online data visualization tool (<https://csuch.ca/explore-the-data>). As we apply new methods to update the estimates for 2007 to 2014, we will make them available in this tool. Specific changes to the methods are described in the relevant sections below.





# Substance Use Prevalence Estimates







## Substance Use Prevalence Estimates

Most of the methods we used to calculate the estimates in this report required estimates of the prevalence of SU in Canada by province or territory, age, sex, year and type of substance. We drew upon multiple national, provincial and territorial surveys that included questions on SU (see Table 3). Some of the required data elements had either insufficient or missing data. Fortunately, we were able to find predictable trends by province or territory, age, sex, year and type of substance within the very large survey datasets available. These consistent trends helped us model and accurately estimate the prevalence of SU where direct survey estimates were unavailable.

More detailed descriptions of the methods used to model these detailed prevalence estimates are included in the technical report. For estimates related to alcohol and tobacco use, survey data were complemented with retail sales data by province, territory and year. For all the substances, survey data were complemented with counts of hospitalizations by province, territory and year that are wholly attributable to each substance category.<sup>11</sup>

### *Methodological Differences from CSUCH 2007–2014*

When we modelled the prevalence estimates for 2007 to 2014, we did not use data from the Discharge Abstract Database that includes the number of hospitalizations for mental and behavioural disorders wholly attributable to each substance and the number of hospitalizations due to SU poisonings. The addition of these new data added substantial power to our analytic estimates as they harness relatively large, routinely collected sets of data from each province and territory, for each SU category, each year and by age and sex.

**Table 3.** Data sources used to model prevalence estimates

Substance	Data Sources
Alcohol	Canadian Alcohol and Drug Use Monitoring Survey (CADUMS) 2008–2012 (Statistics Canada, 2017a, 2017b, 2017c, 2017d, 2017e); CTADS 2013, 2015 and 2017 (Statistics Canada, 2017o, 2017p, 2019d); Canadian Community Health Survey (CCHS) 2005 and 2007–2014 (Statistics Canada, 2017f, 2017g, 2017h, 2017i, 2017j, 2017k, 2017l, 2017m, 2017n); official sales from Statistics Canada 2006–2017 (Statistics Canada, 2019k)
Tobacco	CADUMS 2008–2012 (Statistics Canada, 2017a, 2017b, 2017c, 2017d, 2017e); Canadian Tobacco, Alcohol and Drugs Survey (CTADS) 2013, 2015 and 2017 (Statistics Canada, 2017o, 2017p, 2019d); CCHS 2005 and 2007–2014 (2017f, 2017g, 2017h, 2017i, 2017j, 2017k, 2017l, 2017m, 2017n); official sales from Statistics Canada 2006–2017 (Statistics Canada, 2019h)

<sup>11</sup> ICD-10 codes F10–F15 and T40 codes



Cannabis, opioids, other CNS depressants, cocaine, other CNS stimulants and other substances	CADUMS 2008–2012 (Statistics Canada, 2017a, 2017b, 2017c, 2017d, 2017e); CTADS 2013, 2015 and 2017 (Statistics Canada, 2017o, 2017p, 2019d); Northwest Territories Substance Use and Addictions Survey 2012 (Northwest Territories Health and Social Services, 2017)
All substances	CIHI: Discharge Abstract Database 2006–2007 to 2017–2018 (Canadian Institute for Health Information, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g, 2017h, 2017i, 2019a, 2019b, 2019c)

## Results

The prevalence of Canadians using tobacco decreased by 1.3% between 2015 and 2017 (see Table 4). We also observed a steady decline in the use of opioids over the past 12 months during the project period (almost a 2.0% decrease), while the use of other CNS depressants increased by 1.5%. Cannabis use increased from 11.8% in 2015 to 13.8% in 2017. The use of CNS stimulants grew marginally overall, with greater increases among people of different ages, sexes and regions. For instance, in 2015, 5.3% of males aged 15 to 34 reported using CNS stimulants (excluding cocaine) in the past year, increasing to 10.9% in 2017.

**Table 4.** Estimates of substance use prevalence in Canada by substance, 2015–2017 (percent of population using substance in past year)

Substance	2015	2016	2017
Alcohol	76.9	77.0	77.1
Tobacco	14.3	13.7	13.0
Cannabis	11.8	13.2	13.8
Opioids	13.6	12.6	11.7
Other CNS depressants	10.8	11.6	12.3
Cocaine	1.9	1.9	2.0
Other CNS stimulants	2.7	3.1	3.1
Other substances	2.3	2.1	2.1

**Note:** Estimates for alcohol and tobacco refer to the prevalence of people who currently drink (individuals who have consumed at least one standard drink of alcohol in the past year) and people who currently smoke (individuals who have smoked at least 100 cigarettes in their lifetime and at least one in last year). The estimates presented above are aggregated across age and sex groups and regions. The more detailed data show greater variation in prevalence between age and sex groups. For prevalence estimates by region, age and sex groups, see the technical report.



## *Limitations*

There are limited data available to supplement the survey data. This is particularly true for illegal and “other substances” categories, which might have affected the reliability of the exposure estimates. The inclusion of the hospitalization data for 100% SU-attributable conditions has improved the accuracy of the 2015–2017 estimates compared to the 2007–2014 estimates (Canadian Substance Use Costs and Harms Scientific Working Group, 2018).

We continue to model prevalence estimates for substances other than alcohol, tobacco and cannabis for the territories with limited territory-specific survey data. We used population data from the territories and highly consistent patterns in the survey data from the provinces to estimate the extent of SU in the territories. Counts of conditions that are 100% attributable to SU were used to improve the accuracy of territorial and provincial estimates.

To estimate the instances of HIV, viral hepatitis B and viral hepatitis C attributable to substance use requires a unique methodology, as the causal pathway for these conditions is through injection drug use (IDU) only, and not any substance use. The survey sources used in this report do not separate IDU into substance categories. Because of this lack of information, the relative weighting between substances that can be injected (opioids, cocaine and other CNS stimulants) was used to divide the overall attributable fraction derived from IDU prevalence in each region, year, gender and age group.

The prevalence of heroin use was used to represent the opioid portion of IDU. We note that this may have resulted in a significant underestimation of the number of instances of HIV, viral hepatitis B and viral hepatitis C attributable to opioids, and misallocation of the remaining weights to other substances. A post hoc sensitivity analysis showed that this methodological approach resulted in a maximum underestimation of 0.28% of total inpatient hospitalizations attributable to opioids in 2015, with smaller impacts across other study years and substances. The overall impact of these three conditions, as compared to the total aggregations in this report, is small. The estimates for these health conditions should be treated with caution, and opioid prevalence will be used in the place of heroin prevalence in the next iteration of this report.



# Healthcare Costs





## Healthcare Costs

Cost estimates are provided for inpatient hospitalizations, day surgeries, emergency department visits, specialized treatment for SU disorders, physician time and prescription drugs. Fundamental to these estimates is the use of the attributable fraction approach for estimating the proportions of different types of illness or injury that can be attributed to the use of a particular substance. Attributable fractions were calculated using the latest World Health Organization methodologies to assess burden of disease (Degenhardt et al., 2016) and a new international open-access resource, the International Model of Alcohol Harms and Policies, for alcohol-attributable fractions (Sherk et al., 2017, Sherk et al., 2020).

The diagnostic information available for hospitalizations is the most reliable and detailed. We were able to access individual-level data on the costs of different types of hospital admissions for conditions that are 100% attributable to SU and conditions that are partially attributable to SU. We then combined these data to come up with accurate cost estimates for all health conditions related to SU. This information was used as a basis for estimating SU-attributable healthcare costs in other domains as well. A list of health conditions considered either 100% or partially attributable to SU are displayed in Table 2. The data sources used to develop the healthcare cost estimates are listed in Table 5.

### *Methodological Differences from CSUCH 2007–2014*

The methods we used to calculate healthcare costs and harms for 2015 to 2017 were largely the same as the ones we used for 2007 to 2014, with the exception of one minor improvement: a change to the ICD-10 codes included in the “other substances” category. For the 2015–2017 update, we only included discharges that had a T-code (injury, poisoning, certain other consequences of external causes) associated with one of the substance categories. This change reduced the count of inpatient hospitalizations, day surgeries and emergency department visits attributed to the “other substances” category.

For full details of the methods used, see the technical report.

**Table 5.** Data sources used to calculate costs of healthcare related to substance use

Costs/Harm	Data Source
SU attributable fractions	<p>Alcohol: Calculated using the International Model of Alcohol Harms and Policies (Sherk et al., 2017; Sherk et al., 2020)</p> <p>Tobacco: Relative risks taken from the U.S. Surgeon General's report (National Center for Chronic Disease Prevention and Health Promotion, 2014)</p> <p>Other substances: Various relative risks taken from the literature on specific conditions (see technical report)</p>
Inpatient hospitalizations	<p>CIHI: Discharge Abstract Database 2006–2007 to 2017–2018 (Canadian Institute for Health Information, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g, 2017h, 2017i, 2019a, 2019b, 2019c)</p> <p>CIHI: Cost of a Standard Hospital Stay (indicator) (Canadian Institute for Health Information, 2019d)</p>



Day surgeries	<p>CIHI: Discharge Abstract Database 2006–2007 to 2017–2018 (Canadian Institute for Health Information, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g, 2017h, 2017i, 2019a, 2019b, 2019c) and National Ambulatory Care Reporting System (NACRS) 2006–2007 to 2017–2018 (Canadian Institute for Health Information, 2017j, 2017k, 2017l, 2017m, 2017n, 2017o, 2017p, 2017q, 2017r, 2019e, 2019f, 2019g)</p> <p>CIHI: Cost of a Standard Hospital Stay (indicator) (Canadian Institute for Health Information, 2019d)</p>
Emergency department visits	<p>CIHI: NACRS 2006–2007 to 2017–2018 (counts) (Canadian Institute for Health Information, 2017j, 2017k, 2017l, 2017m, 2017n, 2017o, 2017p, 2017q, 2017r, 2019e, 2019f, 2019g)</p> <p>CIHI: Cost of a Standard Hospital Stay (indicator) (Canadian Institute for Health Information, 2019d)</p>
Specialized treatment for SU disorders	<p>National Treatment Indicator (NTI) Working Group data 2009–2010 to 2015–2016 (counts) (Beasley, Jesseman, Patton, &amp; National Treatment Indicators Working Group, 2012; McQuaid, Di Gioacchino, &amp; National Treatment Indicators Working Group, 2017; Meister, Maloney-Hall, Urbanoski, &amp; National Treatment Indicators Working Group, 2018; Pirie, Jesseman, Di Gioacchino, &amp; National Treatment Indicators Working Group, 2014; Pirie, Jesseman, &amp; National Treatment Indicators Working Group, 2013; Pirie &amp; National Treatment Indicators Working Group, 2015; Pirie, Wallingford, Di Gioacchino, McQuaid, &amp; National Treatment Indicators Working Group, 2016)</p> <p>CIHI: Discharge Abstract Database 2006–2007 to 2017–2018 (Canadian Institute for Health Information, 2017a, 2017b, 2017c, 2017d, 2017e, 2017f, 2017g, 2017h, 2017i, 2019a, 2019b, 2019c) and Cost of a Standard Hospital Stay (costs) (Canadian Institute for Health Information, 2019d)</p> <p>Literature: <i>Comorbid mental disorders among clients in addiction treatment: the costs of care</i> (costs) (Urbanoski, Rehm, Lange, &amp; Popova, 2014)</p>
Physician time	<p>CIHI: National Physician Database 2006–2007 to 2017–2018 (Canadian Institute for Health Information, 2019h) and Quick Stats Inpatient Hospitalizations 2007–2017 (Canadian Institute for Health Information, 2018)</p>
Prescription drugs	<p>CIHI: National Health Expenditure Trends 2007–2017 (Canadian Institute for Health Information, 2019i)</p>

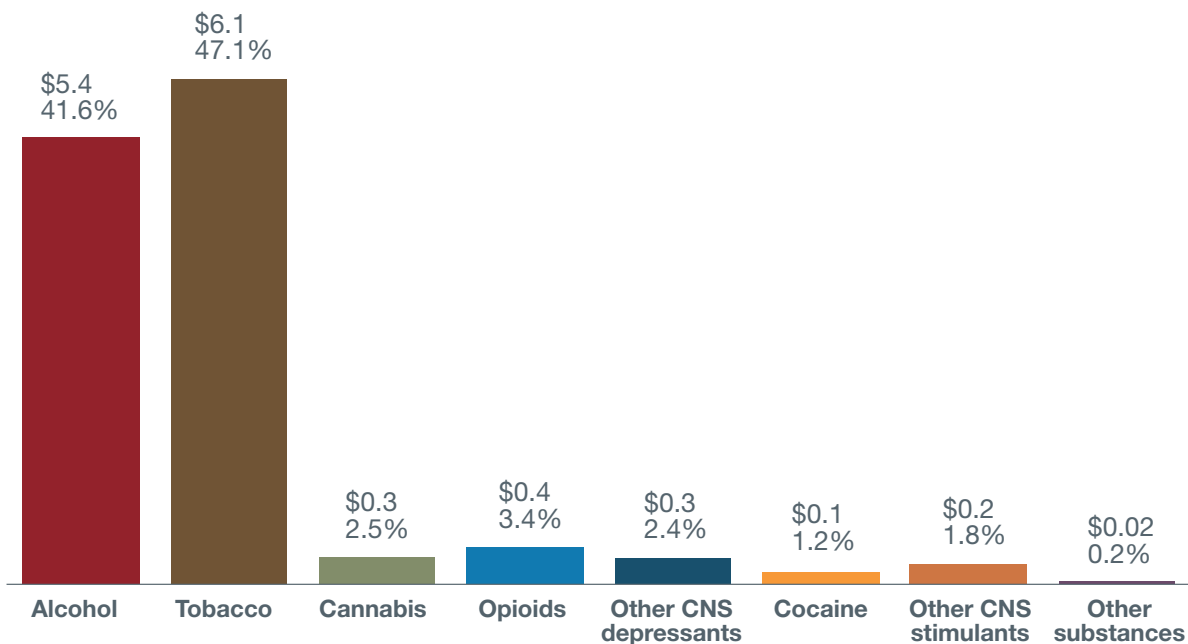




## Results

In 2017, SU-attributable healthcare costs were \$13.1 billion. Costs associated with the use of alcohol and tobacco (the substances legally available at the time) were estimated to account for about 89% of all SU-attributable healthcare costs (see Figure 5). These costs are broken down by cost type and by substance (see Table 1).

**Figure 5.** Costs (in billions) of healthcare related to substance use in Canada by substance, 2017

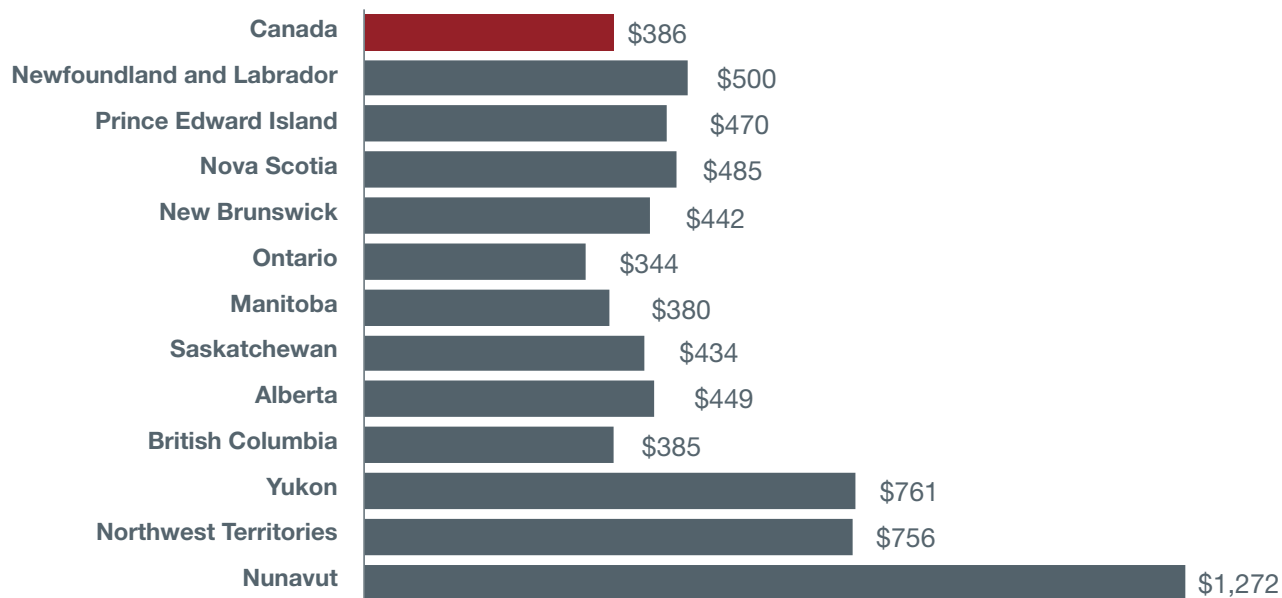


**Note:** These estimates do not include costs associated with inpatient hospitalizations, day surgeries and emergency department visits in Quebec. A rough calculation based on Ontario per-person costs and data available from Quebec suggests that these per-person costs are likely conservative by about 8%.

Estimated costs by province or territory are largely driven by population size; the smaller the population, the higher the costs. Direct comparisons can be made from the data in Figure 6, which presents estimated healthcare costs attributable to SU per person. These estimates show that for all of Canada (excluding Quebec), healthcare costs attributable to SU were \$386 per person in 2017. Per-person costs were highest in the territories and relatively high in Atlantic Canada.



**Figure 6.** Per-person costs of healthcare related to substance use in Canada (except Quebec) by province and territory, 2017



**Note:** Meaningful per-person costs for Quebec could not be calculated.

As shown in Table 6, contributing to these costs were the estimated 277,060 hospitalizations attributable to SU, of which 141,271 were from tobacco use and 105,065 from alcohol. By comparison, opioid-attributable hospitalizations were estimated to be the next-highest category with almost 9,327 hospital stays.

**Table 6.** Hospitalizations in Canada (not including Quebec) attributable to substance use in 2017 by type of substance

Substance	2017
Alcohol	105,065
Tobacco	141,271
Cannabis	6,099
Opioids	9,327
Other CNS depressants	6,915
Cocaine	2,965
Other CNS stimulants	4,896
Other substances	522
<b>Total</b>	<b>277,060</b>

Canada's overall per-person healthcare costs related to substance use increased almost 3% from \$348 in 2015 to \$358<sup>12</sup> in 2017. More specifically, over this time period:

- Per-person healthcare costs related to alcohol use increased almost 4.8% from \$142 to \$149, and tobacco use decreased 2.2% from \$172 to \$168 (see Figure 7).
- Costs associated with cannabis use increased 20.8% from about \$7 per person to \$9 per person.

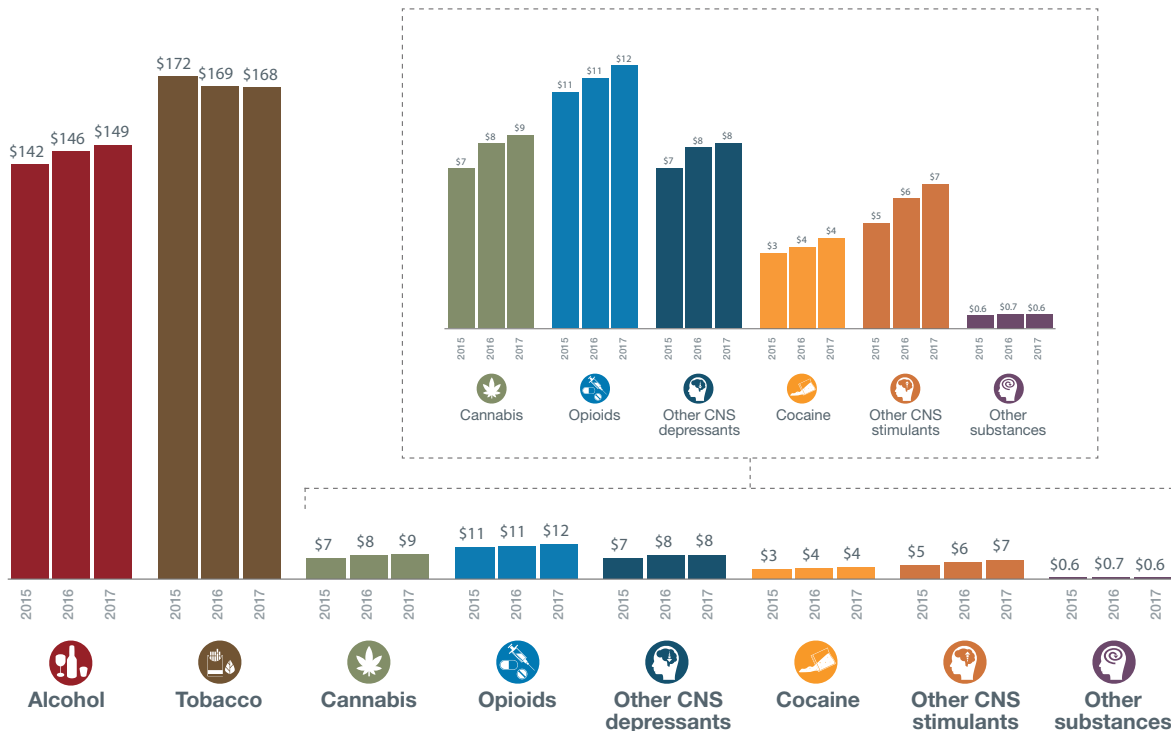
<sup>12</sup> Only some healthcare-related data were available for Quebec. These national per-person trend estimates include Quebec and therefore differ from the \$386 indicated above.



Large increases in per-person costs were also noted across many other substance categories:

- Per-person healthcare costs associated with opioid use increased 11.5% from about \$11 to \$12, and costs associated with the use of other CNS depressants increased 15.8% from about \$7 to \$8.
- Per-person healthcare costs associated with cocaine use increased 19.8% from about \$3 to \$4, and associated with the use of other CNS stimulants increased 37.3% from about \$5 to \$7 (see Figure 7).

**Figure 7.** Per-person healthcare costs related to substance use in Canada by substance, 2015–2017



**Note:** These estimates do not include costs associated with inpatient hospitalizations, day surgeries and emergency department visits in Quebec. A rough calculation based on Ontario per-person costs and data available from Quebec suggests that these per-person costs are likely conservative by about 8%.

## Limitations

The methodology we used to assess the burden of disease assumes that high-quality studies from around the world on the association between exposure to substances in a population and disease and injury are universally applicable. While we used national, provincial and territorial data to assess the prevalence of broad categories of disease and injury and population exposure to SU, we must use international assumptions about the relationship between SU and the risk of some diseases and injuries, as these data rarely exist for a single country. As is standard practice in SU epidemiology, we have relied on the latest systematic reviews and meta-analyses of the international literature to estimate these risk relationships. The evidence base of published studies, however, is stronger in some areas than in others. In general, the published literature is stronger in relation to tobacco and alcohol use, and weaker for most of the other substances.

To estimate inpatient hospitalizations, day surgeries and emergency department visits, we applied attributable fractions to individual-level data. However, to estimate the costs of physician time and prescription drugs, we used an attributable percentage methodology.<sup>13</sup> Using this method, we assume that the proportional contributions of different types of substances to healthcare costs are consistent. We will investigate this assumption and continue to refine our methodologies to improve the accuracy of our estimates.

<sup>13</sup> Attributable percentages are equivalent to the percentage of total inpatient hospitalizations that could be attributed to substance use for each province, territory and year.



# Lost Productivity Costs





## Lost Productivity Costs

Estimates are provided for the indirect costs associated with lost productivity related to SU in terms of foregone earnings. These costs are due to premature death, long-term disability and short-term disability (absenteeism and presenteeism).

To estimate lost productivity costs due to premature death, we primarily used the human capital approach (Single et al., 2003). This approach assumes the deceased individual cannot be replaced in the workforce and that their lost income up to the age of retirement (assumed to be 65 years) is not recoverable. To determine the number of deaths attributable to SU, we used the same condition-based, epidemiological attributable fraction approach we used to assess healthcare costs related to SU. To estimate the cost of long-term disability, we limited our estimates to the year in question as recommended by Schroeder (2012). The methods used to calculate lost production costs are described in detail in (Sorge et al., 2019) and in the technical report.

### *Methods Used to Estimate Deaths Attributable to Substance Use Poisoning*

For our estimates of deaths attributable to substance poisoning, we relied on the Canadian Vital Statistics database and the assistance of and collaboration with Statistics Canada (Centre for Population Health Data unit).

In the Vital Statistics database, each SU-attributable poisoning death is identified as either accidental (with codes beginning with X4\* or Y1\*) or intentional (with codes beginning with X6\*). Also included on the record is a list of codes identifying the substances considered to be contributing to the death. For records in which one substance was identified as contributing to the death, we assigned the record to that substance category. For records in which multiple substances were indicated, we created drug poisoning weights. We used these weights to distribute deaths attributable to polysubstance use<sup>14</sup> based on the relative proportions of SU-attributable deaths in which only one substance was considered a contributor.

For example, if we found 100 deaths to which alcohol and opioids were considered to have contributed, we looked at the ratio of deaths attributable to alcohol use only to deaths attributable to opioid use only and distributed the 100 deaths accordingly. If this ratio were 6:4, we allocated 0.6 of each of the 100 deaths to alcohol use and 0.4 to opioid use. We repeated this procedure for all of the polysubstance combinations in the data. The final poisoning weights were adjusted for age and regional variations using the corresponding inpatient hospitalization proportions for substance poisonings.

### *Methods Used to Assess Long- and Short-Term Disability*

For the 2007–2014 estimates, we used questions in the Canadian Community Health Survey assessing permanent inability to work and interference due to drugs or alcohol to assess the costs associated with long-term disability and short-term disability (absenteeism and presenteeism). However, these questions were not included in the 2015 survey. As a result, we estimated absenteeism and presenteeism costs for 2015–2017 using simple linear regression.

We used an alternative dataset (Canada Pension Plan [CPP] disability beneficiaries) to more accurately estimate long-term disability costs between 2015 and 2017. Given there were two years of overlap (2012 and 2014) between the survey and CPP datasets, we were able to adjust CPP disability counts for 2015 to 2017 to estimate survey counts of permanent disability by applying the average quotient of survey counts divided by CPP counts from the overlap years. The data sources used to develop these estimates are listed in Table 7. For full details on the methods used, see the technical report.

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<sup>14</sup> For the following substance categories: alcohol, opioids, other CNS depressants, cocaine and other CNS stimulants. Cannabis and other psychoactive substances were excluded from this analysis due to evidence suggesting these substance categories cannot directly cause overdose death, or do so very rarely (Hall & Solowij, 1998). In future iterations of this project, we will further investigate the continued validity of excluding these substances.



**Table 7.** Data sources used to calculate lost productivity costs related to substance use

Costs/Harm	Data Sources
Premature death	Vital Statistics – Death Database (Statistics Canada, 2017t, 2019m); General Social Survey (Statistics Canada, 2017q) (counts); Labour Force Survey (Statistics Canada, 2017s, 2019j); Job Vacancy and Wages Survey (Statistics Canada, 2017r; 2019i) (costs)
Long-term disability	Canadian Community Health Survey (Statistics Canada, 2017f, 2017g, 2017h, 2017i, 2017j, 2017k, 2017l, 2017m, 2017n) (counts and costs); Canadian Pension Plan (CPP) Disability Benefits by Class of Diagnosis (Employment and Social Development Canada, 2019) (counts)
Short-term disability (absenteeism and presenteeism)	Canadian Community Health Survey (Statistics Canada, 2017f, 2017g, 2017h, 2017i, 2017j, 2017k, 2017l, 2017m, 2017n) (counts and costs)

### *Methodological Differences from CSUCH 2007–2014*

The methods described above were different than the ones used for the 2007–2014 report. For the 2007–2014 report, we distributed the poisoning deaths into substance categories based on the inpatient hospitalization proportions for substance poisonings. These poisonings deaths were then combined with all partially SU-attributable death counts. The improved methods more accurately distribute the poisoning deaths into the substance categories.

We also expanded the criteria for defining a SU-attributable death by including three new codes<sup>15</sup> and changed the method we used to distribute SU-attributable poisoning deaths that involved more than one substance.

For full details of the methods used, see the technical report.

### *Results*

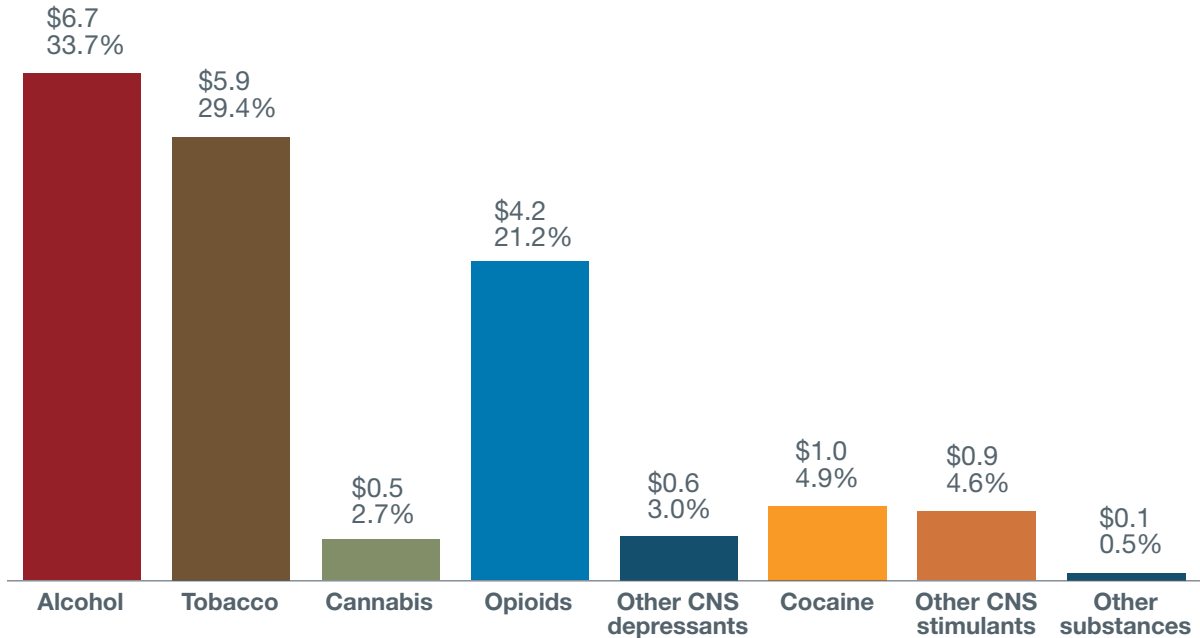
In 2017, lost productivity costs attributable to SU were over \$20 billion. Costs associated with the use of substances legally available at the time (alcohol and tobacco) were estimated to account for slightly more than 63% (\$12.6 billion) of all lost productivity costs (see Figure 8). Of the remaining 36.9% of SU-attributable lost productivity costs, opioids accounted for over 57% (\$4.2 billion) of the costs.

<sup>15</sup> The three new codes are X44, accidental poisoning by and exposure to other and unspecified drugs, medications and biological substances; X64, intentional self-poisoning by and exposure to other and unspecified drugs, medications and biological substances; and Y14, poisoning by and exposure to other and unspecified drugs, medications and biological substances, undetermined intent.





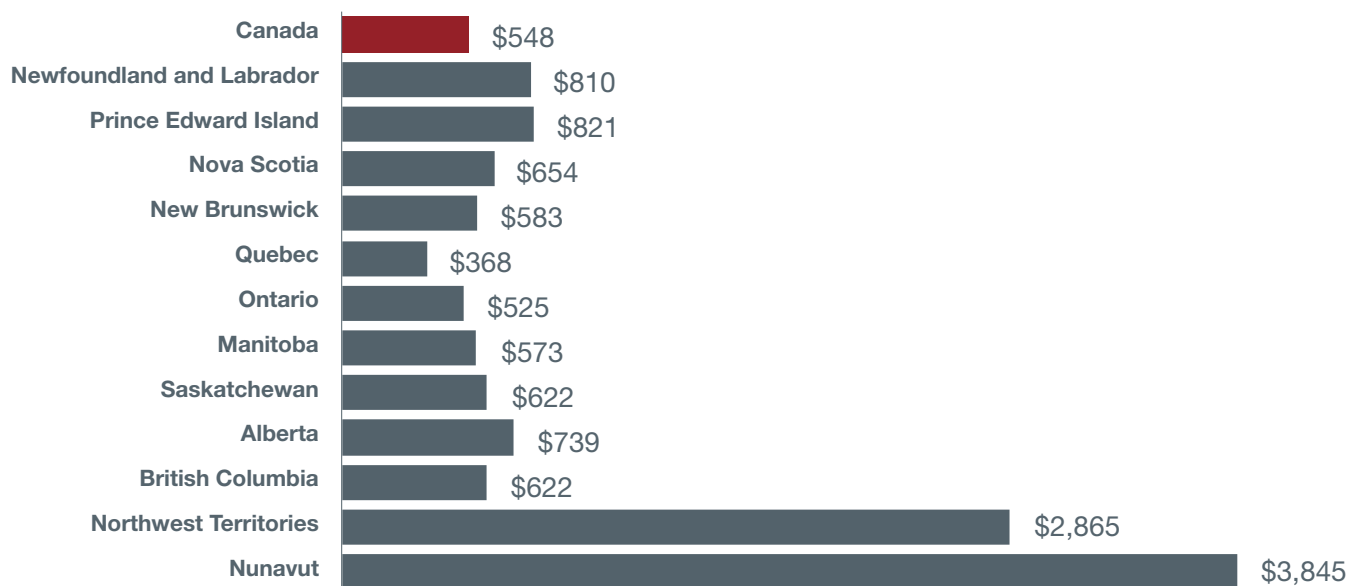
**Figure 8.** Costs (in billions) of lost productivity attributable to substance use in Canada by substance, 2017



**Note:** At the time of this report, the data on premature deaths in Yukon (2017 only) required to calculate costs of potential years of productive life lost were not available from Statistics Canada's Vital Statistics database. A rough calculation based on per-person costs and data in the Northwest Territories suggests that these per-person costs are likely conservative by about 0.5%.

The estimated per-person lost productivity costs attributable to SU for the provinces, territories and Canada are presented in Figure 9. For the whole of Canada, lost productivity attributable to SU costs an average of \$441 per person. Per-person costs were highest in the territories.

**Figure 9.** Per-person lost productivity costs attributable to substance use in Canada by province and territory, 2017



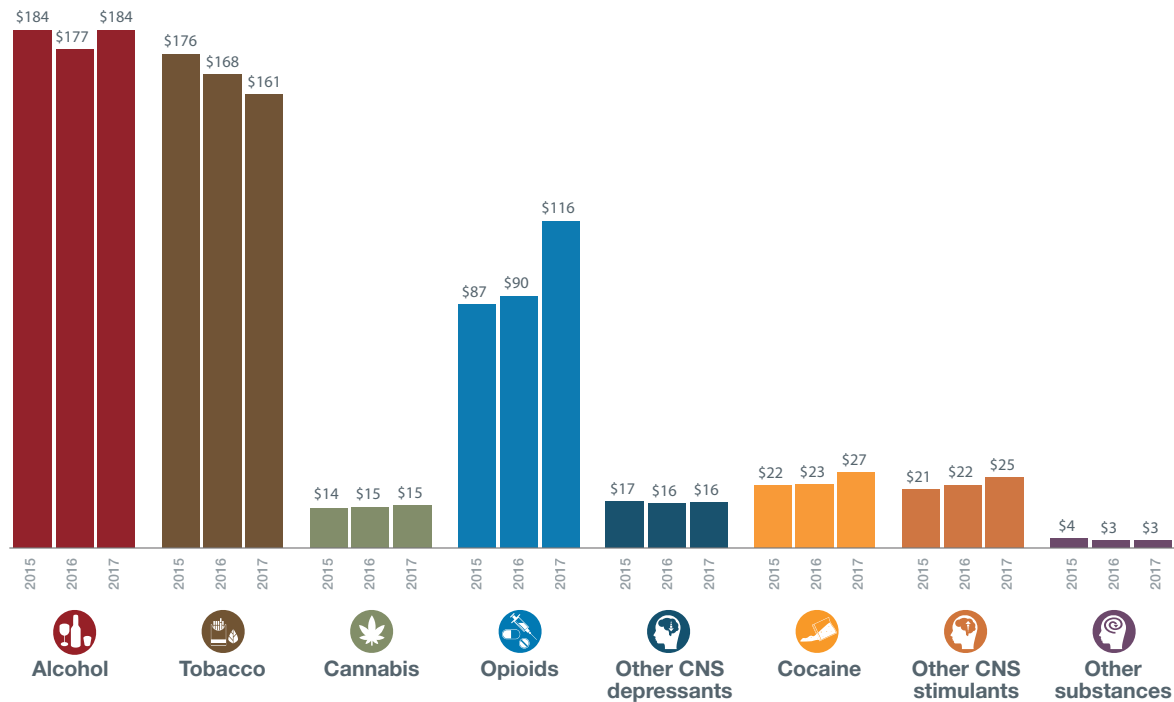
**Note:** At the time of this report, the data on premature deaths in Yukon (2017 only) required to calculate costs of potential years of productive life lost were not available from Statistics Canada's Vital Statistics database. Therefore, meaningful per-person costs for lost productivity could not be calculated for Yukon in 2017.

Overall per-person lost productivity costs increased by 4.5% from \$524 in 2015 to \$548 in 2017. The per-person costs of lost productivity due to alcohol use remained steady from 2015 to 2017 at \$184, while per-person costs related to tobacco use decreased by over 8% (from \$176 in 2015 to \$161 in 2017) (see Figure 10).

The largest increase was related to opioid use. The per-person cost of opioid use increased by more than 34% over the course of the project from \$87 per person in 2015 to \$116 per person in 2017 (see Figure 10). This increase is largely due to the growing number of poisoning deaths related to opioids (see Figure 11).

Per-person lost productivity costs were higher for cocaine and other CNS stimulants. The per-person costs for cocaine use increased by 20.1% from \$22 in 2015 to \$27 in 2017, while the per-person costs for other CNS stimulants increased by 21.6% from \$21 in 2015 to \$25 in 2017.

**Figure 10.** Per-person lost productivity costs attributable to substance use in Canada by substance, 2015–2017



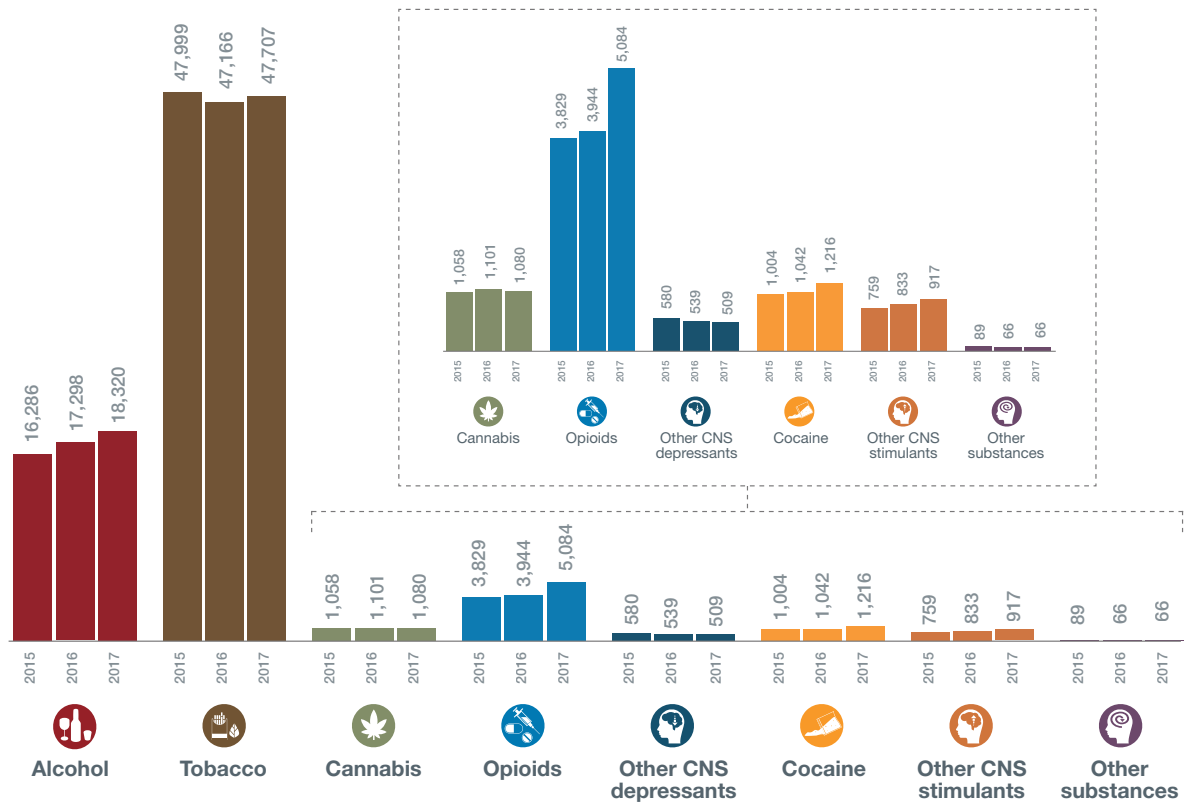
**Note:** At the time of this report, the data on premature deaths in Yukon (2017 only) required to calculate costs of potential years of productive life lost were not available from Statistics Canada’s Vital Statistics database. These per-person costs are likely conservative by about 0.5%.



Underlying these costs are the estimated numbers of deaths and the potential years of productive life lost, as shown in figures 11 and 12, respectively. Tobacco use was the leading cause of the 75,900 SU-attributable deaths with 47,707 deaths in 2017, followed by alcohol use with 18,320 deaths and opioid use with 5,084 deaths. One measure of the economic toll of SU-attributable deaths is the total number of potential years of productive life lost, which are calculated up to 65 years of age.

Alcohol was the leading contributor to the 338,555 SU-attributable potential years of productive life lost with 113,713 in 2017. Due to the young age of many opioid-attributable deaths (mean=45.5), use of this substance accounted for as many as 99,836 potential years of productive life lost.

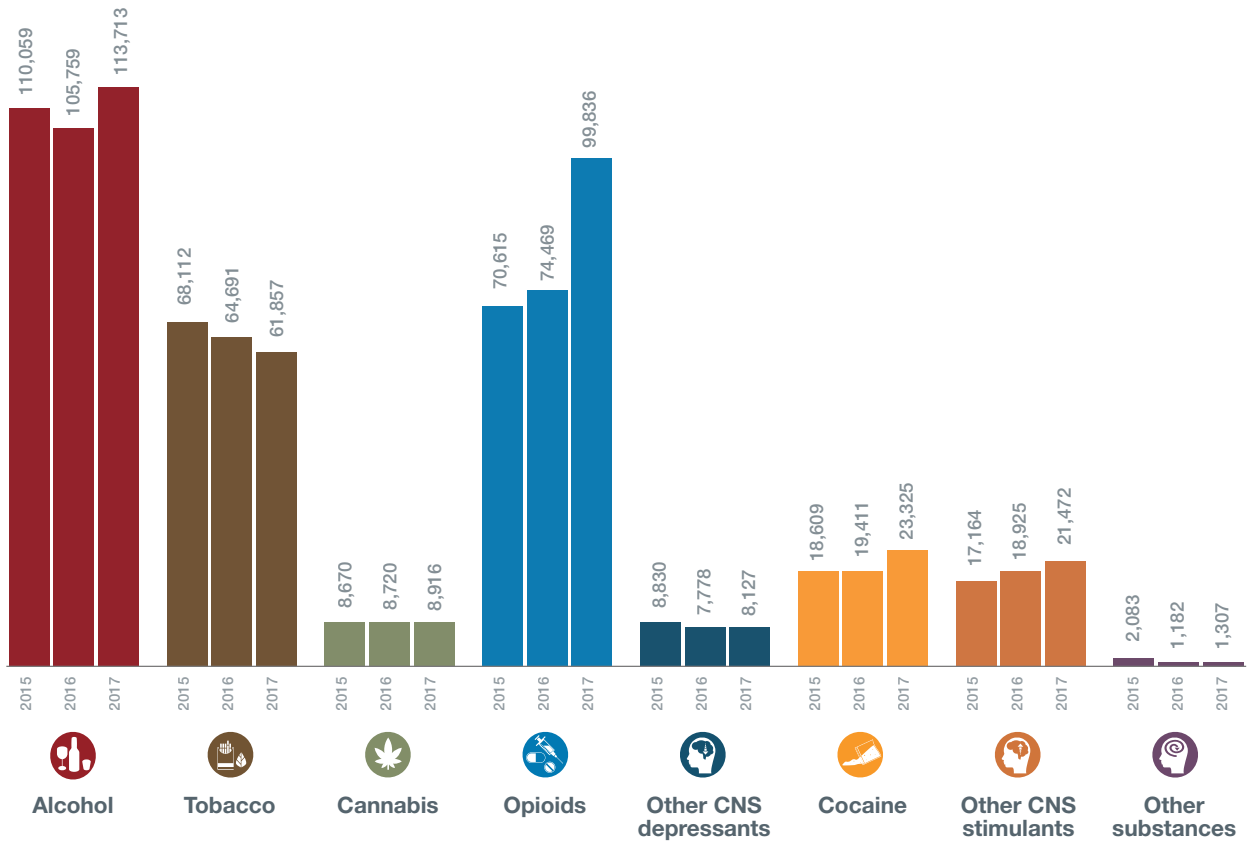
**Figure 11.** Number of deaths attributable to substance use by substance, 2015–2017



**Note:** At the time of this report, data on premature deaths in Yukon (2017 only) were not available from Statistics Canada’s Vital Statistics database.



**Figure 12.** Number of potential years of productive life lost due to substance use-attributable premature deaths by substance, 2015–2017



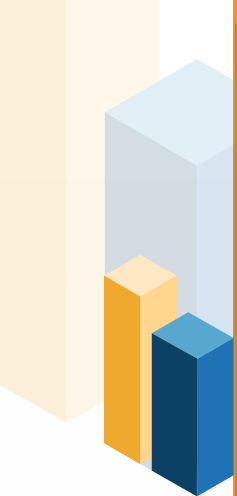
**Note:** At the time of this report, data on premature deaths in Yukon (2017 only) were not available from Statistics Canada’s Vital Statistics database.

### Limitations


To meet its data confidentiality requirements, Statistics Canada used a disclosure method called the Laplace mechanism when it provided the mortality data to the research team. This mechanism adds a random amount of noise to each count, which can result in negative estimations when counts are very low. While the negative values were left in the poisoning weights, after the weights were applied to the death counts, all negative counts were truncated to zero. Although this is a widely accepted solution to address negative values after application of the Laplace mechanism (Holohon, Braghin, Antonatos, & Aonghusa, 2018), it does result in a small positive bias for the final estimates. This bias likely had a greater effect on estimates for less-populous regions (e.g., the territories) that have low counts of premature deaths.

In addition to this limitation, when calculating potential years of productive life lost we had to use the average ages of death calculated for the 2007–2014 report as Statistics Canada could not release this information due to privacy rules.





# Criminal Justice Costs







## Criminal Justice Costs

Criminal justice costs include costs associated with policing, courts and correctional services. Included in our calculations are expenditures for crimes that are both 100% and partially attributable to SU. The 100% attributable offences include impaired driving and drug-related offences that are in violation of the *Controlled Drugs and Substances Act*. These offences include the possession, trafficking and production of controlled substances. In addition to fully attributable crimes, we also included crimes that are partially attributable to SU. These include violent offences such as homicide or assault, and non-violent offences such as theft or arson.

Attributable fractions for crimes related to SU were estimated based on a comprehensive self-report intake survey. This survey was given to more than 29,000 offenders as they entered federal prisons about the role SU played in their offences. These attributable fractions are included in the 2007–2014 report. They were applied to counts of partially-attributable, Criminal Code incidents (for policing costs), charges (for court costs) and admissions to correctional facilities (for correctional costs). The result was added to the number of fully attributable incidents, charges or admissions, and then divided by the total to assess the proportion of SU-attributable counts. The resulting proportions were then applied to the total costs associated with policing, court and correctional services by year and by province and territory.

The data sources we used to develop our estimates are listed in Table 8. Details on the methods used to produce the criminal justice cost estimates are available in the technical report.

**Table 8.** Data sources used to estimate criminal justice costs attributable to substance use

Costs/Harm	Data Sources
Crime-related attributable fractions	Correctional Service of Canada: Computerized Assessment of Substance Abuse (CASA) (Kunic and Grant, 2006); Women's CASA (Correctional Service of Canada, 2017)
Policing (crime incidents)	Uniform Crime Reporting Survey 2009–2017 (Statistics Canada, 2019l)
Courts (charges)	Integrated Criminal Court Survey 2008/09–2016/17 (Statistics Canada, 2019h)
Correctional services (admissions to sentenced custody)	Adult Correctional Services 2008/09–2017/18 (Statistics Canada, 2019b; Statistics Canada, 2019c) Youth Custody and Community Service Survey 2008/09–2017/18 (Statistics Canada, 2019o)
Criminal justice costs	Office of the Parliamentary Bureau Officer: Expenditure Analysis of Criminal Justice in Canada, 2013 (Story & Yalkin, 2013); Canadian Centre for Justice Statistics: Policing Expenditures Data 2014/15–2016/2017 (Mazowita & Greenland, 2016; Alam & Greenland, 2017; Connor, 2018). Tobacco Enforcement: Treasury Board of Canada Secretariat: Tobacco Control Strategy 2006/07–2014/15 (Treasury Board of Canada Secretariat, 2015); Health Canada: Federal Tobacco Control Strategy 2015/2016–2017/18 (Health Canada, 2016, 2017a, 2017b).



### Methodological Differences from CSUCH 2007–2014

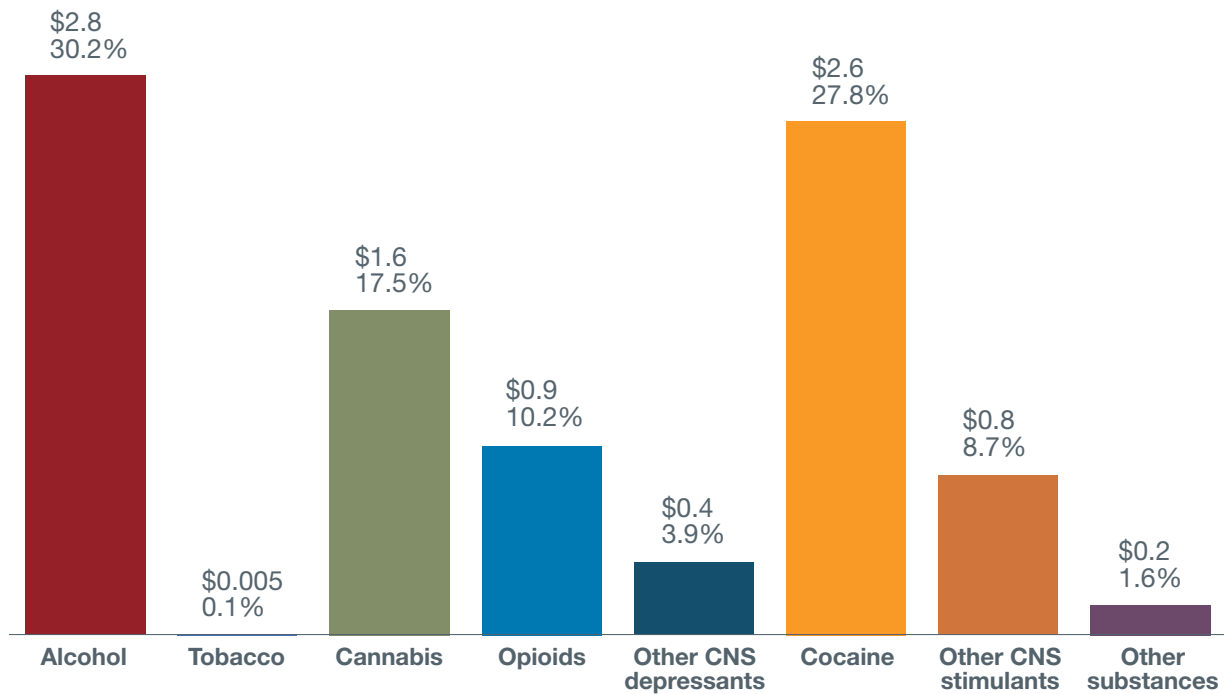
We used the same methods to calculate costs related to policing, courts and correctional services for 2015–2017 as we did to calculate the 2007–2014 estimates. The previous source for criminal justice costs (Story & Yalkin, 2013) only provided estimates to 2012, so we replicated the methodology used in this report in retrieving the 2015–2017 data from all reported sources.

### Results

In 2017, over \$9.2 billion was spent on SU-attributable criminal justice costs. Costs incurred from policing crimes related to SU were the highest, followed by the costs of correctional services and court costs.

Alcohol use accounted for more than 30.2% of total costs (see Figure 13). After alcohol use, cocaine use accounted for the second-highest costs to the criminal justice system at over \$2.5 billion. Despite prevalence rates of less than 2% in the Canadian general population, cocaine use was associated with 24.0% of all costs related to violent offences and 37.4% of all costs related to non-violent offences. Policing, court and correctional services costs associated with violent and non-violence offences accounted for 92.0% of the criminal justice costs associated with cocaine use. The remaining 8.0% of costs were associated with violations of the *Controlled Drugs and Substances Act*. In contrast, 44.4% of criminal justice costs related to cannabis use were associated with violations of the act.

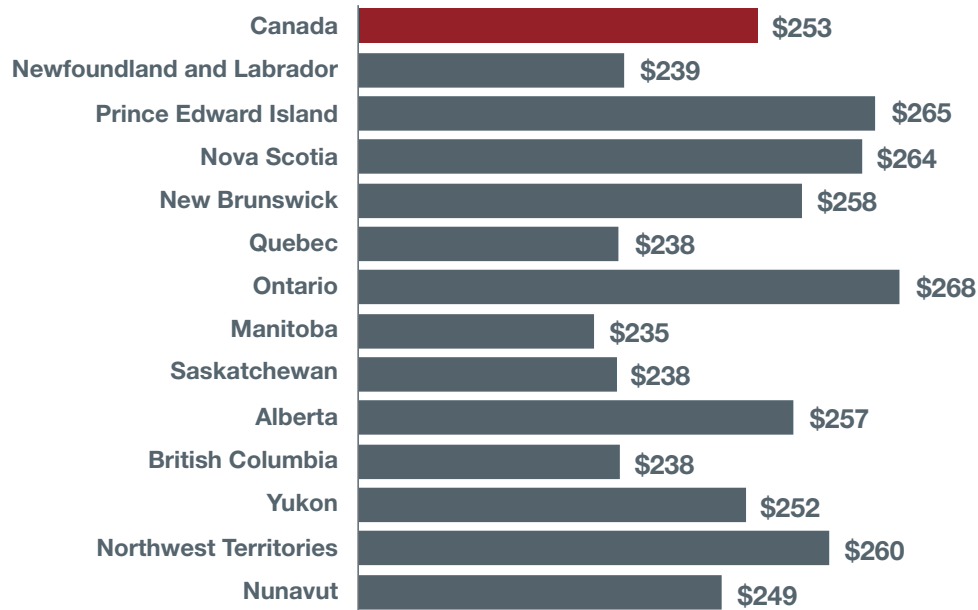
**Figure 13.** Criminal justice costs (in billions) attributable to substance use in Canada by substance, 2017



The per-person criminal justice costs of SU in 2017 were \$253 (see Figure 14). These costs were highest in Ontario and lowest in Manitoba.

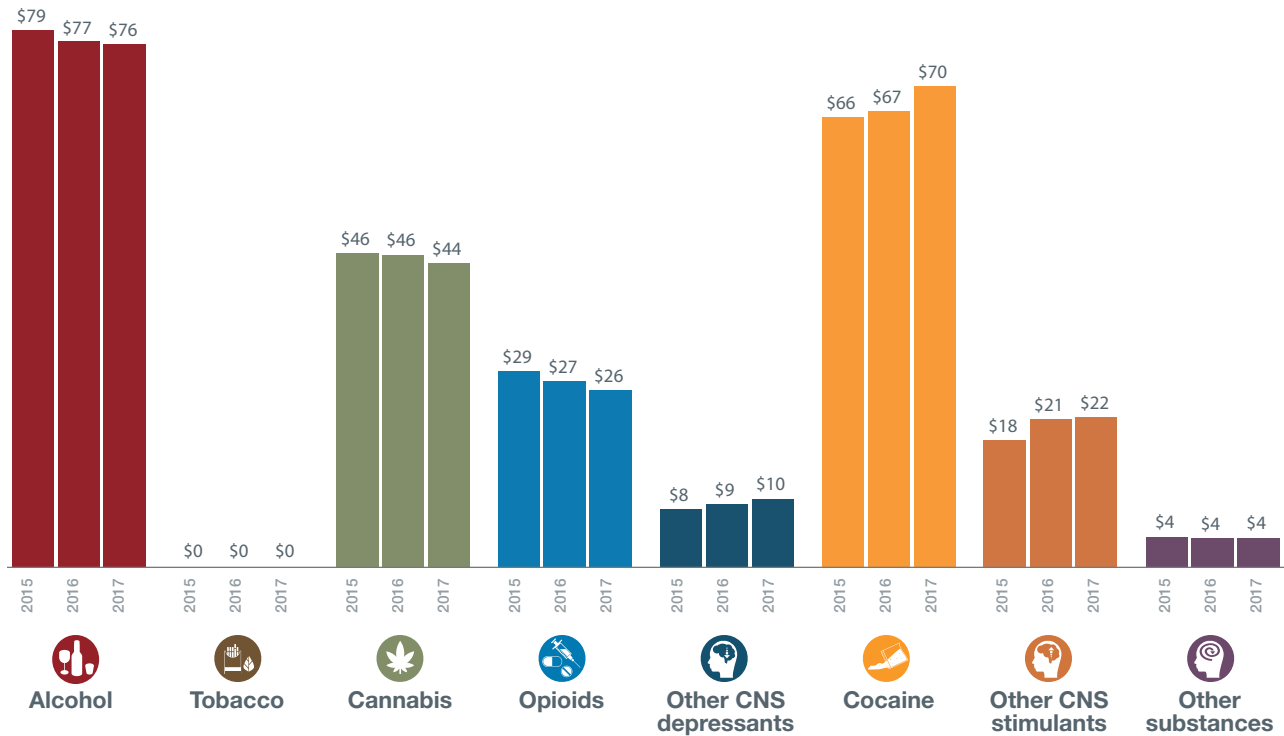


**Figure 14.** Per-person criminal justice costs attributable to substance use in Canada by province and territory, 2017



Although overall per-person criminal justice costs remained relatively stable between 2015 and 2017 with just over a 1% increase, there were differences by substance. Per-person criminal justice costs associated with alcohol use decreased 2.7% from \$79 in 2015 to \$76 in 2017 (see Figure 15). Per-person criminal justice costs related to cannabis use decreased 3.4% from \$46 in 2015 to \$44 in 2017 (see Figure 15). During that same time, per-person criminal justice costs associated with cocaine use increased by 6.8% and criminal justice costs related to the use of other CNS stimulants increased by almost 19%.

**Figure 15.** Per-person criminal justice costs attributable to substance use in Canada by substance, 2015–2017



### Limitations

Despite having relatively comprehensive data, in some cases we had to manipulate it to sort it in a way that permitted us to calculate estimates. For example, we needed to reorganize correctional admissions data by offence category (i.e., impaired driving violations, violations of the *Controlled Drugs and Substances Act*, violent and non-violent crimes). To do so, we allocated correctional admissions to the relevant offence categories according to the same distribution as that observed for court charges.

In addition to distributing correctional admissions data, we also needed to impute some missing data. While we retrieved costing data directly from criminal justice expenditure data sources (e.g., federal and provincial public accounts), the detailed, itemized breakdown of expenditures required to calculate these estimates was only available for certain provinces and territories. Therefore, we needed to make some imputations to distribute costs across the provinces and territories for which there were no data.

Criminal justice costs associated with tobacco use include costs for federal control and enforcement only. These costs should therefore be considered underestimates as we were unable to obtain provincial or territorial estimates for these costs or for other federal policing, courts and correctional services costs related to tobacco use (e.g., incidents related to tobacco smuggling).



# Other Direct Costs



38.00

37.00

85.4m

68.3m

51.2m

34.2m

17.1m

1.45

1.05

0.89

0.63

0.43

0.23

0.03

-0.17

-0.37

-0.57

-0.77

100

91

82





## Other Direct Costs

Other direct costs include estimates for expenditures related to SU across several categories. They include costs for research and prevention, which are considered policy costs (Single et al., 2003), and costs associated with fire and damage to motor vehicles. Other direct costs also include workplace costs not already covered in our review of lost productivity costs: costs related to employee assistance programs and drug testing programs, and administrative costs associated with workers' compensation.

Our methods to estimate SU-attributable costs varied significantly across the different categories. Some expenditures, such as costs associated with workplace drug testing and federal spending dedicated to SU research and prevention, are considered 100% attributable to SU. For other categories, such as property damage from fires or damage to motor vehicles damage attributable to the use of a particular substance, we used the attributable fraction approach to estimate the proportion of costs attributable to SU. Methods used for each category are described in detail in the technical report. The data sources used to develop the cost estimates are listed in Table 9.

**Table 9.** Data sources used to estimate other direct costs attributable to substance use

Costs/Harm	Data Sources
Research and prevention	Health Canada; Canadian Institute for Health Research; Heart and Stroke Foundation; Canadian Cancer Society; Canadian Partnership Against Cancer; Canadian Council for Tobacco Control; Traffic Injury Research Foundation; Treasury Board of Canada Secretariat: Tobacco Control Strategy 2006/07–2017/18
Fire damage	Provincial/territorial fire marshal and fire commissioners reports 2015–2017; personal communications with provincial/territorial fire marshals and fire commissioners
Damage to motor vehicles	National Collision Database (Transport Canada, 2017) (counts); General Insurance Statistical Agency (2017) (costs)
Workplace drug-testing programs	Recent Alcohol and Drug Workplace Policies in Canada: Considerations for the Nuclear Industry (Barbara Butler & Associates Inc., 2012) (counts and costs)
Employee-assistance programs	Labour Force Survey 2007–2014 (Statistics Canada, 2017s); The Prevalence and Characteristics of Employee Assistance, Health Promotion and Drug Testing Programs in Ontario (Macdonald & Wells, 1995) (counts); personal communications with Morneau Shepell (costs)
Workers' compensation administrative costs	Provincial/territorial workers' compensation boards annual reports 2007–2017



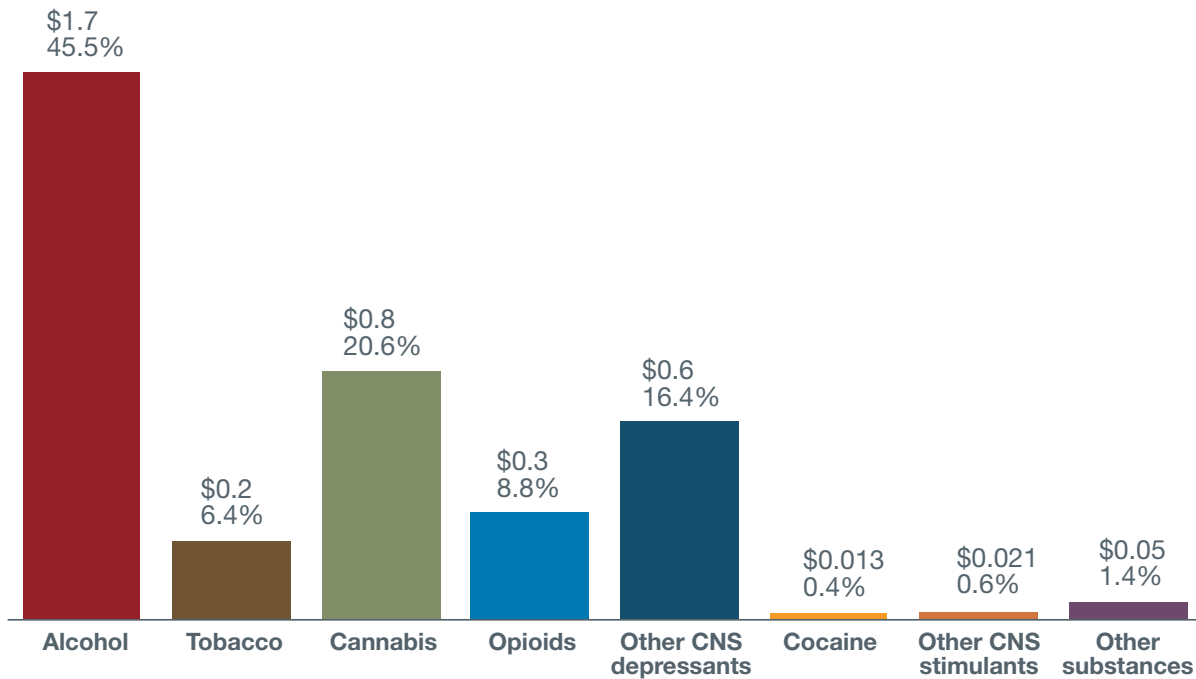
### Methodological Differences from CSUCH 2007–2014

We used largely the same methods for this report as we did for the 2007–2014 estimates. We used linear regression to substitute estimates in cases where more recent data could not be found.

### Results

In 2017, over \$3.6 billion was spent on other direct costs attributable to SU. Close to half of these costs (45.5%) were attributable to alcohol use (see Figure 16). Cannabis use accounted for the second-highest proportion of other direct costs at over 20%.

**Figure 16.** Other direct costs (in billions) attributable to substance use in Canada by substance, 2017

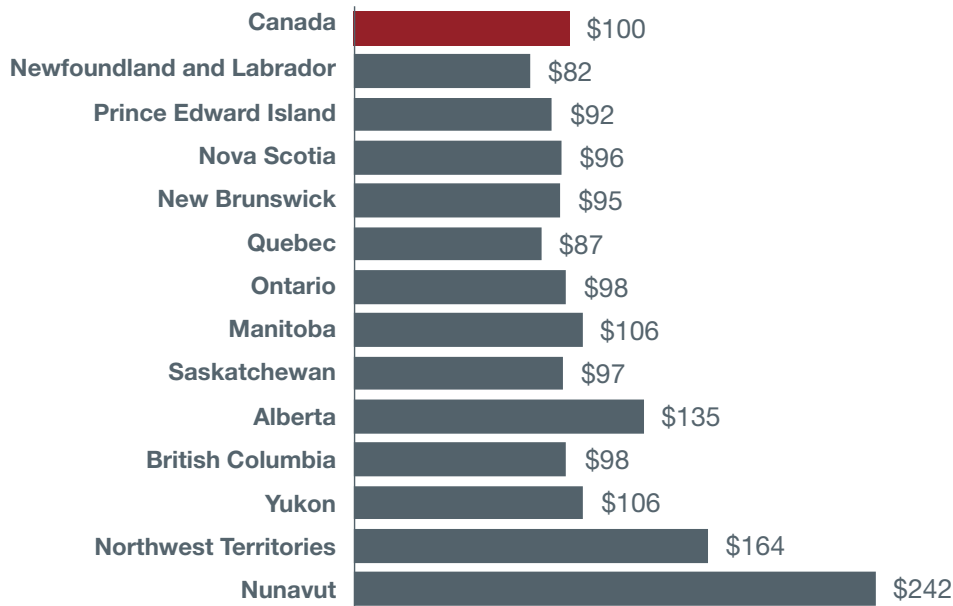


The largest proportion of other direct costs was associated with damage to motor vehicles, which accounted for two-thirds (over \$2.4 billion) of the costs. This was followed by fire damage to property, which amounted to \$745 million in costs.

The rates of estimated other direct costs attributable to SU per person are shown in Figure 17. In 2017, for Canada as a whole, about \$100 per person was spent on other direct costs attributable to SU. The range in costs was fairly broad across the country with a low of \$82 spent per person in Newfoundland and Labrador and a high of \$242 spent per person in Nunavut.

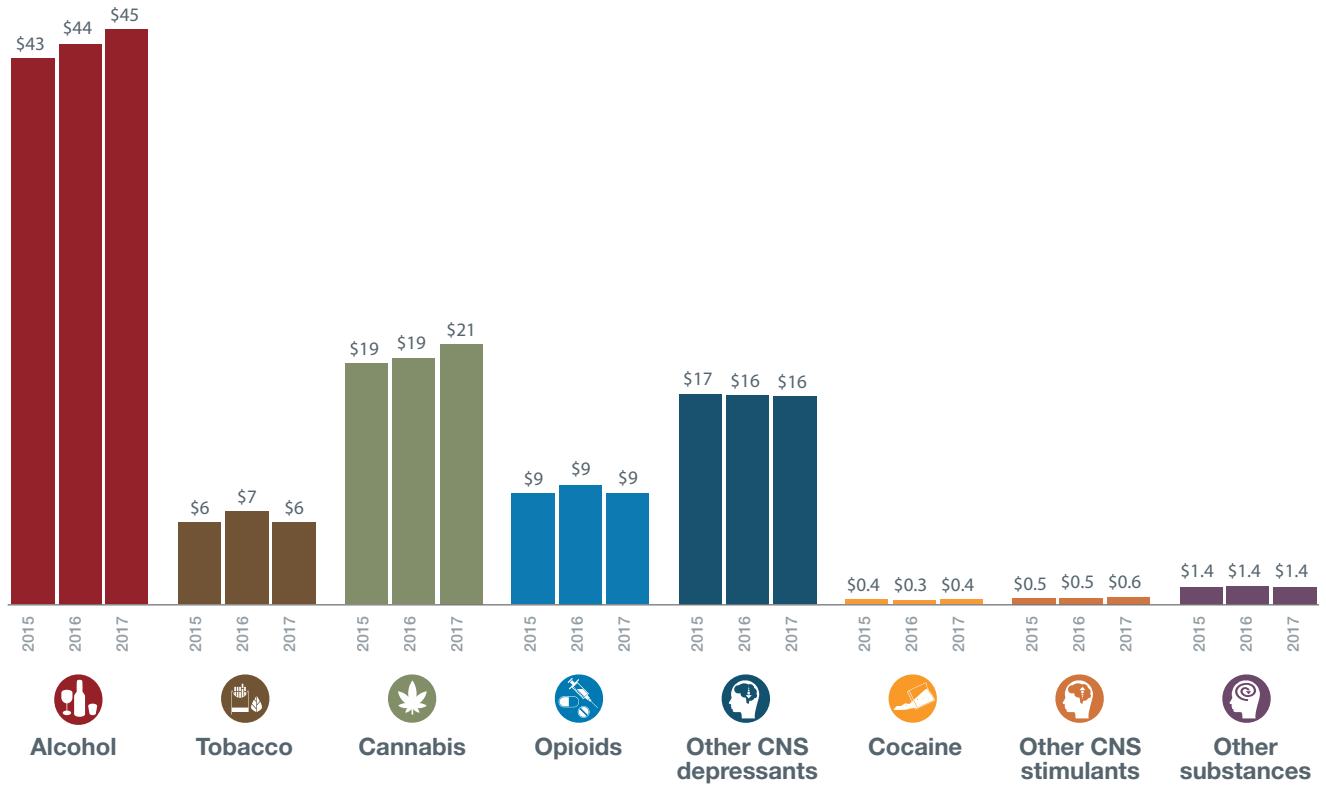


**Figure 17.** Other direct costs per person attributable to substance use in Canada by province and territory, 2017



The other direct costs per person associated with SU increased 4.1% from 2015 to 2017 (see Figure 18). Other direct costs per person associated with alcohol use increased 5.4% from \$43 in 2015 to \$45 in 2017. Other direct costs per person related to cannabis use increased 8.3%, from \$19 in 2015 to \$21 in 2017. The largest per-person cost increase was for other CNS stimulants at 21.7%, although other direct costs associated with this substance category represented less than 1% of the total costs. These yearly cost trends largely mirror those of damage to motor vehicles, which is consistent with the major contribution of this cost category to the total amount of other direct costs.

**Figure 18.** Other direct costs per person attributable to substance use in Canada by substance, 2015–2017



### Limitations

The datasets that were used to estimate other direct costs attributable to SU varied significantly. The unique limitations associated with each dataset are described in the technical report. In general, the SU-attributable other direct costs were largely accounted for by expenditures on damage to motor vehicles (66.0%) and fire damage (20.4%) and so were largely influenced by the limitations associated with these datasets.





# Discussion





## Discussion

In 2017, SU cost Canadians almost \$46 billion. Costs associated with the use of substances legally available at the time (alcohol and tobacco) accounted for the majority of these costs. This fact does not diminish the terrible human toll of the opioid crisis gripping our country. Over 5,000 people died from opioid use in 2017, and across Canada significant efforts have been made to address this public health crisis.

In addition to the impacts of opioid use, our estimates also clearly describe the impact of the reemergence of methamphetamine and cocaine. However, our findings indicate that when it comes to public health and the Canadian economy, alcohol and tobacco use cannot be ignored. These two legal substances together accounted for almost two-thirds of the total cost of SU and led to over 66,000 preventable deaths in 2017.

### *Alcohol and Tobacco*

Tobacco was by far the deadliest substance, leading to 47,707 deaths in 2017. It was followed by alcohol (18,320 deaths) and all other drugs combined (8,872 deaths). Although more deaths can be attributed to tobacco use, alcohol use led the way in total costs because it can be attributed to injuries and deaths of people at a younger age and was therefore responsible for more lost years of productive life. Alcohol use is also a contributing factor in almost 20 percent of all violent crime.

A rise in alcohol-related costs and a decrease in tobacco-related costs is hardly surprising. While we have been reaping the benefits of strong public-health policies designed to curb tobacco use, this has not been the case for alcohol. It is well established that increased availability of alcohol is associated with higher consumption. Yet some provincial and territorial governments have substantially loosened restrictions on the sale and availability of alcohol. Furthermore, our national advertising codes have not been updated in a quarter of a century. Of particular concern is that these codes do not apply to modern digital media, which many young people use to communicate. These factors may be contributing to the increasing alcohol-related costs and harms. With the arrival of COVID-19, there are signs that alcohol consumption is increasing due to a lack of regular schedule, stress and boredom (NANOS Research, 2020), which suggests there will likely be more alcohol-attributable harms in future estimates.

### *Opioids*

As expected, after alcohol and tobacco, opioid use accounted for the third-highest costs at \$5.9 billion or 12.9% of the total costs. Per-person costs also increased by 20.9% from \$135 in 2015 to \$163 in 2017. This increase was largely due to the rapid increases in lost productivity costs attributable to opioid use, which are largely driven by opioid-related deaths.

Estimates of opioid-related deaths presented in this report differ from those released by the Government of Canada. In March 2020, the Special Advisory Committee on the Epidemic of Opioid Overdoses (2020) released public health surveillance data with updated numbers of apparent opioid-related deaths. Estimates presented here are higher. For example the Government of Canada reported 3,025 deaths in 2016 and 4,144 in 2017. In contrast, we estimated 3,944 deaths in 2016 and 5,084 in 2017.



Our estimates are different for several reasons:

- The counts provided by the Government of Canada only include poisoning (toxicity) deaths. Our estimates include poisoning as well as other partially attributable conditions, such as opioid-attributable infectious diseases and motor vehicle collisions.
- The Government of Canada public health surveillance estimates include all deaths caused by a poisoning (intoxication/toxicity) resulting from SU, where one or more of the substances was an opioid. We attributed only a portion of polysubstance poisoning deaths involving opioids to opioids.
- The data sources for the two updates were different. We acquired national vital statistics data from Statistics Canada, while the Government of Canada acquired its public health surveillance data from provincial and territorial offices of chief coroners or chief medical examiners.

Given that the number of deaths related to opioid use remains high in 2019 (Special Advisory Committee on the Epidemic of Opioid Overdoses, 2020), we expect we will continue to see an increase in costs and harms related to opioid use in future updates of this report.

## *Cocaine and Other CNS Stimulants*

A key emerging finding from the analyses presented is the rapid rise in harms related to the use of cocaine and other CNS stimulants. In 2017, costs attributable to cocaine use were \$3.7 billion or 8.1% of the total costs. Costs attributable to the use of CNS stimulants (excluding cocaine) were \$2.0 billion or 4.3% of the total costs.

Per-person costs associated with use of cocaine and CNS stimulants increased dramatically. In fact, between 2015 and 2017, per-person costs associated with the use of CNS stimulants (excluding cocaine), increased 22.1% from \$44 to \$54 per person — the steepest increase of all the substances examined. These cost increases are thought to be largely attributable to methamphetamine use and harms (Canadian Centre on Substance Use and Addiction, 2018; Canadian Community Epidemiology Network on Drug Use, 2019). These harms are potentially exacerbated by the intentional or unintentional use of stimulants with other harmful substances, such as fentanyl and its analogues, benzodiazepines or synthetic cannabinoids that are present in the illegal, unregulated and toxic drug supply (Canadian Community Epidemiology Network on Drug Use, 2019; Payer, Young, Mill, Maloney-Hall et al, 2020).





# Strengths and Limitations





## Strengths and Limitations

Making comprehensive estimates of costs associated with health care, lost productivity, criminal justice and other direct costs for eight categories of substances, 13 provinces and territories and multiple years continues to be a substantial undertaking. Throughout this work, we used best practice methodologies and drew upon the most up-to-date relevant survey and administrative data sources available to us.

Notable strengths of the project include:

- Use of the latest World Health Organization methodologies to assess burden of disease (Degenhardt et al., 2016) and estimates for the contributions of SU to disease and injury as, for example, summarized in the new International Model of Alcohol Harms and Policies (Sherk et al., 2017, Sherk et al., 2020);
- Comprehensive modelled estimates of SU prevalence by age, sex, province and territory, year and type of substance. These estimates incorporate data from about 150,000 Canadians who have completed various national, provincial and territorial surveys, as well as multiple national datasets on retail sales, and hospitalization data specific to SU;
- Application of recommended modern methods for estimating impacts on lost productivity resulting from both long-term disability and premature death (Schroeder, 2012; see also Sorge et al, 2019); and
- Use of a comprehensive survey administered to offenders when they are admitted to federal penitentiaries that specifically asks about the role psychoactive substances played in their crimes.

Although we intended to use exactly the same methods for this report as we did for our 2007–2014 estimates, we were able to improve our methodologies since our previous report (Canadian Substance Use Costs and Harms Scientific Working Group, 2018). We felt strongly that it was important to incorporate these refinements to improve the accuracy of our estimates. Most notably, these included updated methods to estimate the prevalence of SU and poisoning deaths attributable to SU.

While our methods have many strengths, there are also limitations and areas of uncertainty that should be recognized when interpreting the estimates and placing them in context. Most of these limitations have already been described in the relevant sections of the report. However, the following limitations apply more broadly.

### Reliance on Self-Reported Data

We relied extensively on self-reported data throughout the project. It is well known that self-reported levels of SU, particularly for illegal substances, are underestimated to some degree (Zhao, Stockwell, & MacDonald, 2009). As a result, we have likely underestimated the prevalence of SU and associated costs. Fortunately, the majority (about 70%) of healthcare conditions related to illegal SU can be estimated directly from diagnostic data and do not need to be imputed from self-reported survey data using the attributable fraction methodology, so this area of uncertainty is relatively small.

### **Use of Hospitalizations to Estimate Other Costs**

Like Rehm and colleagues (2006), we relied heavily on estimates of the contribution of SU to hospitalizations given the strong and reliable data available from the Canadian Institute for Health Information. The proportional contributions by substance and year to hospitalizations were directly applied to other cost areas, including prescription drugs, specialized treatment, physician time and long-term disability. We cannot be certain, of course, of the extent to which these proportional contributions by different types of substance apply to these diverse areas of healthcare. We also inherited limitations in each of the major databases we drew upon for our analyses.

### **Missing Costs**

The list of cost categories included is not exhaustive, and the project would benefit from additional cost categories, such as the costs of emergency medical services and harm reduction services. In all cases, we erred toward including costs that could be quantified with available data and research. We will examine additional cost categories to determine whether to include them in future studies. While we believe we have already captured the majority of costs related to SU, we recognize that the addition of new cost categories could further improve our understanding of the costs of SU in Canada.

Despite these limitations and assumptions, we used the most up-to-date, reliable and comprehensive data and methods available in developing our estimates. In the future there will no doubt be better data and more research available that will allow us to improve our estimates (as we were able to improve on Rehm et al., 2006). Until such data and research become available, we feel confident that we have developed the best estimates possible.







# Conclusions



## Conclusions

These estimates give us a picture of the costs and harms associated with SU in Canada. They are a baseline against which to monitor the impacts of current and future policies designed to limit harms from SU in Canada.

For example, it is likely that the crime-related costs associated with cannabis will decrease when we update our data to include 2019, the first full year that non-medical cannabis was legalized. Will healthcare and other costs increase? Will the costs of alcohol use continue to rise as some provinces move to privatize its sale and distribution? Will tobacco and nicotine-related harms and costs increase or decrease as people who smoke switch to vapour devices for delivering nicotine? What will be the short- and long-term impact of the COVID-19 pandemic on SU and related harms in Canada? We plan to answer these and other questions by updating our estimates regularly to support evidence-based decision making and efforts to reduce the costs and harms from SU in Canada.

We are in a critical period for Canadian policy making about SU. Researchers and lawmakers are assessing the impacts of legal, non-medical cannabis. The nation is still in the midst of an opioid epidemic, many regions are experiencing increases in harms related to the use of methamphetamines, and in the early months of 2020, the world was hit by a pandemic that significantly changed our social landscape. It is unclear what the full impact of these major social changes will be on SU in Canada.

Throughout this crucial time, Canadian policy makers must prioritize policies to reduce harms from the legal substances that we take for granted yet have disproportionately large negative impacts on public health. We need to take a long, hard look at the varying impacts of different types of psychoactive substances on health, crime and productivity, and design regulatory systems that create appropriate access to substances while limiting harms. *Canadian Substance Use Costs and Harms* provides evidence upon which to base substance use policies and against which to measure their success.



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