Evidence Summary on the Prevention of Poisoning in Canada

PARACHUTE

AND

INJURY PREVENTION CENTRE,
UNIVERSITY OF ALBERTA

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EXECUTIVE SUMMARY

Poisoning represents a major cause of mortality and morbidity in Canada and around the world. Furthermore, poisonings account for a significant number of hospitalizations and an even greater number of emergency department visits each year in Canada. While it is important to recognize that poisonings can occur in individuals from all walks of life regardless of age, sex or socioeconomic status, certain populations have been identified through research and surveillance as being at an elevated risk for poisoning. These include pediatric, youth and young adults, older adults and Indigenous peoples.

Data indicate that deaths due to unintentional poisonings have shown a marked increase from 2008 to 2018, with a peak observed in 2017 (Figure 3). Comparatively, poisoning deaths due to suicide have shown a modest decrease during the same time period. When poisoning deaths are analyzed by sex (Figure 4), mortality rates among males are consistently higher than females for both unintentional and intentional poisoning deaths during the available time period. Importantly, the mortality rate for unintentional poisonings among males more than tripled from 2008 to 2017, and the bulk of the observed increase in unintentional poisoning deaths are among males as opposed to females. The age groups with the highest observed mortality rate due to unintentional poisonings were individuals ages 30 to 49 (Figure 5). Individuals ages 40 to 64 had the highest mortality rates from suicide poisoning (Figure 5).

Data on rates of hospitalization due to poisonings indicate that unintentional poisoning hospitalizations have shown a steady increase from 2008 to 2018 (Figure 6). Hospitalization rates for intentional self-harm poisonings were consistently higher than unintentional poisonings but did not show a clear trend during the observed time period. When analyzing data between males and females (Figure 7), rates for unintentional poisoning hospitalizations remained quite similar from 2008 to 2014; however, rates among males in the later end of the observed time period increased compared to females.

Available data from emergency departments in two Canadian provinces (Alberta and Ontario) demonstrate a gradual increase in visits due to both unintentional and intentional poisonings, with the rate of unintentional poisonings being more than double that of intentional self-harm poisonings in 2018 (Figure 9).

Based on data from five Canadian poison centres that collectively serve 11 provinces and territories (British Columbia, Yukon, Alberta, Saskatchewan, Northwest Territories, Nova Scotia, Prince Edward Island, Ontario, Manitoba, Nunavut, and Québec), 209,534 cases were opened in 2018 to local poison centres, which averages to 574 cases per day.

Over the past decade, there has been an emergence of several issues that have produced changes in the trends associated with poisoning. The legalization of cannabis, the opioid crisis and the introduction of new products such as laundry detergent pods have resulted in an increase in calls to poison centres, emergency responses and the healthcare system as a whole.

Using an evidence-informed approach in prevention planning ensures that the use of different types of evidence occurs at more than one point in the planning process (MacKay 2005). Knowledge of this process is essential in order to ensure a plan has real impact and uses scarce resources effectively. There are essential components that need to be considered, which include: using the best available research; considering the local health issues and local context; using existing public health resources; and understanding the community and political climate (National Collaborating Centre for Methods and Tools, 2013; Brownson et al., 2009; Saunders et al., 2005; Ciliska et al., 2010).

Over the past decade, there has been increased activity in the field of poison prevention and the theme woven throughout all activity is collaboration. We are collaborating to create and launch a new surveillance system along with supporting working groups, taking collective action on public awareness efforts through Poison Prevention Week, integrating professionals who are focused on prevention and treatment of those affected by poisoning and supporting government action on issues such as the opioid crisis.

A number of challenges remain, including easier access nationally to poison centres (e.g. a national 1-800 number), the integration of existing surveillance systems and those coming online (e.g. the Canadian Surveillance System for Poison Information) and the timely identification, tracking and action on emerging poisoning issues.

Addressing the issue of poison prevention is complex. While data on the number of individuals affected by poisoning are essential, the context in which poisoning occurs needs to be considered as a key component when planning and implementing poison prevention strategies. Establishing community and political support, as well as understanding other community health issues and existing public health resources, all create the necessary pre-conditions to advance injury (poisoning) prevention practice.

This Evidence Summary provides a snapshot of the current poisoning problem in Canada across all age groups to inform current and future prevention initiatives. Recent statistics and analyses are provided to reflect the growing magnitude of the issue, as well as discussion of emerging issues, poisoning prevention best practices and current poisoning prevention initiatives across the country.

Broad recommendations are made from the evidence gathered as well as proposed actions. The recommendations are:

- Advocating for Best Practices
- Access to Canadian-Specific Drug Information
- Understanding Emerging Issues
- Developing National Leadership

While these recommendations may seem divergent, they all require a level of collaboration. The successes that have been achieved since the first Evidence Summary was written are largely the result of collaboration between and among key stakeholders such as the federal government, provincial poison and injury centres and NGOs. This collective action needs to continue so that different perspectives and expertise can be integrated into these efforts moving forward.

Evidence Summary on the Prevention of Poisoning in Canada describes the poisoning issue in Canada and provides recommendations and encourages collaboration across and among jurisdictions so that Canada can achieve further success in poisoning prevention, advance the health of its entire population and build a national culture of safety.

PURPOSE

The purpose of this Evidence Summary on the Prevention of Poisoning in Canada is to describe the current poisoning problem in Canada across all age groups and contexts to inform current and future prevention initiatives. Recent statistics and analyses are provided to reflect the growing magnitude of the issue, as well as discussion of emerging issues, poisoning prevention best practices and current poisoning prevention initiatives across the country.

INTRODUCTION

Poisoning represents a major cause of mortality and morbidity in Canada and around the world. Latest estimates from the World Health Organization indicate that, in 2016, poisonings were the sixth-leading cause of global unintentional injury deaths and resulted in 106,683 deaths (World Health Organization, 2017). Statistics from the U.S. Centers for Disease Control and Prevention indicate that poisonings in that country surpassed road injuries as the leading cause of injury death in 2008 (Warner, 2011), with latest figures indicating unintentional poisonings resulted in 64,795 deaths in the U.S. in 2017 alone (Kochanek et al. 2019), compared to 37,133 deaths as a result of motor vehicle collisions that same year (U.S. Department of Transportation, 2018). A similar situation can be seen in Canada, where unintentional poisonings surpassed transport-related injuries in the annual number of deaths in 2015 and continued to increase to more than twice as many deaths compared to transport-related injuries in 2017 (Figure 1). Recent data from Statistics Canada have shown that, for the first time in over four decades, the life expectancy for Canadians did not increase from 2016 to 2017 (Statistics Canada, 2019a). This was largely attributed to increases in unintentional drug poisonings occurring among young adults that offset any gains in life expectancy due to advances in treatment for cancer and cardiovascular conditions (Statistics Canada, 2019a). Furthermore, poisonings account for a significant number of hospitalizations and an even greater number of emergency department visits each year in Canada.

When all sources of data are combined to show the scope of the issue, poisonings stand out as a much larger public health issue in Canada than is generally recognized. Like other mechanisms of injury, poisonings are predictable and therefore preventable. Since the publication of the first evidence summary on the Prevention of Poisoning of Children in Canada in 2011 (Parachute & Injury Prevention Centre, 2011), positive strides have been made toward preventing poisonings across Canada, including advances in research and public policy as well as, importantly, toward a national surveillance system that includes all poison centre data. Along with these successes came new issues as well, including changes in poisoning patterns, the emerging opioid crisis and the legalization of cannabis, to name a few. Though children are an important high-risk population and were the focus of the original evidence summary, it is important to emphasize that poisonings can impact all Canadians.

In response, nearly a decade since its original publication, this updated evidence summary on the Prevention of Poisoning in Canada describes the current poisoning problem in Canada across all age groups. Recent statistics and analyses are provided to reflect the growing magnitude of the issue, as well as an updated discussion of emerging issues, poisoning prevention best practices and current poisoning prevention initiatives across the country.

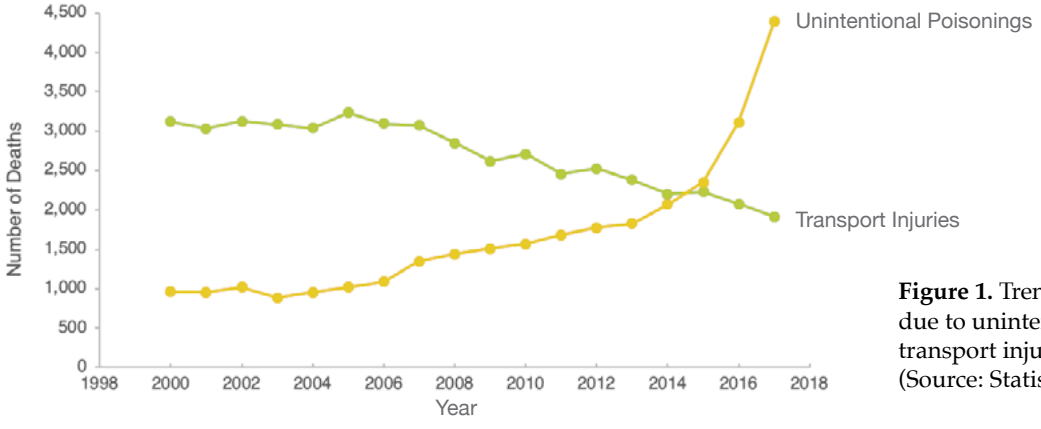


Figure 1. Trends in the number of deaths due to unintentional poisonings and transport injuries, Canada, 2000 to 2017. (Source: Statistics Canada).

DEFINITION OF POISONING

The National Academy of Sciences, Committee on Poison Prevention and Control's operational definition of poisoning subsumes "damaging physiological effects of ingestion, inhalation, or other exposure to a range of pharmaceuticals, illicit drugs, and chemicals, including pesticides, heavy metals, gases/vapors, and common household substances, such as bleach and ammonia" (Institute of Medicine [U.S.] Committee on Poison Prevention and Control, 2004). In short, poisoning events interfere with the balance that the body maintains with the environment. It is important, however, to recognize that poisoning can occur from any substance if the dose and exposure is sufficient.

There is no standard definition of poisoning that is universally accepted and applied in clinical practice, in data collection and in public health policy setting. Within data collection systems, different definitions of eligibility for the purposes of case reporting may apply in various surveillance schemes, making comparisons across systems difficult in some circumstances. For example, there are several types of events that are not universally accepted as poisonings so the inclusion or exclusion of these events can lead to variations in estimating the true magnitude of poisoning. In developing a surveillance system, clarifying the manner in which to handle each of these ambiguous events must be considered. Some of the events that are not universally included as poisoning events include, but are not limited to:

- Envenomation from snakes and spiders
- Insect stings and bites that might not be considered toxic but may be complicated by allergic responses, including fatal anaphylaxis
- Medication responses that may not be dose related
- Unusual toxic responses that may involve susceptible subpopulations
- Adverse therapeutic events such as drug toxicity resulting from drug interactions, increased susceptibility or true allergic sensitivity, or dosing error
- Ethanol poisoning, either acute, chronic or effects of withdrawal
- Seafood-related toxins
- Bacterially derived toxins
- Lay definitions of poisoning such as food poisoning, poison oak or sun poisoning
- Toxin exposure without attributable and defined or discrete clinical effect (exposure to lead).

Factors of intent may also complicate how a poisoning event is categorized. Poisoning events can be classified as being either unintentional, intentional self-harm, intentional assault/homicide or of undetermined intent. Classifications of intent for poisoning events can also change over time as new evidence is collected, especially in cases of suspected suicides and homicides. Importantly, poisonings involving illicit drug use are now overwhelmingly classified as being unintentional as opposed to intentional self-harm because, in most cases, individuals using illicit drugs are not using with the intent to inflict self-harm or commit suicide.

Furthermore, a distinction should be made regarding the term poisoning and overdose as these two terms are often used interchangeably in everyday speech, media and medical literature. Poisoning is the term that more accurately describes the toxic effects of a substance on the body and is used by the World Health Organization International Classification of Diseases coding system. The term overdose refers specifically to the use of a substance beyond a known maximum therapeutic dose. Using the term overdose when referring to illicit drug use implies that individuals know what the correct dose is (though no such dose exists), are willingly exceeding such dose and are hence personally responsible, which can lead to unnecessary stigma among already marginalized populations (Xie et al. 2017). For such reasons, the term poisoning is preferred and will be used in this Evidence Summary.

POISON CENTRES IN CANADA

History

In 1958, Health and Welfare Canada (now Health Canada), established the Poison Control Program within the Product-Related Diseases Division. Product formulation cards (and later microfiche) served as the database for information requests regarding exposures. These cards were distributed to all active treatment hospitals throughout Canada. Manufacturers would voluntarily submit this information to Health and Welfare Canada. Missing information would be solicited by Health and Welfare Canada staff when an exposure occurred to a product about which no information was available. In exchange for these information cards, Centres kept statistics and reported these back to the Program. Annual reports were produced from the data until 1988 when the federal program folded.

Although the database and statistical reports came from the Federal Poison Control Program, funding for the Centres was provincial and varied from province to province. In the '60s and '70s, most Centres were in the emergency departments of active treatment hospitals. The "Poison Telephone" was usually answered by an ER nurse. In the '80s, most of these local centres were replaced by regional or provincial centres with dedicated, trained staff. Physicians with specific training in toxicology were hired to give medical direction and continuing education. As many of the exposures were pediatric, four of the dedicated centres were located within pediatric hospitals. Although initially calls to the Poison Information Centres were from the public, over the years, increasingly, health care providers have come to rely on the toxicological expertise of the staff at Poison Centres to assist with the management of poisoned patients who present to Health Care facilities. Pediatric and adult calls are approximately equal in number.

Canadian Poison Centres

Currently, Canada has five Poison Centres: the British Columbia Drug and Poison Information Centre (DPIC), Alberta's Poison and Drug Information Service (PADIS), Ontario Poison Centre (OPC), Centre antipoison du Québec, and the IWK Regional Poison Centre in Nova Scotia. See Figure 2 for the location of each poison centre and their associated service regions. Each of these Centres are staffed with registered nurses and pharmacists certified by the American Association of Poison Control Centers (AAPCC) as specialists in poison information, or eligible for certification after approximately two years of full-time employment at a poison centre, handling of 2,000 human exposure calls and 1,200 hours. They strive to follow the criteria as set by the AAPCC for medical management of exposures and coding uniformity among five poison centres.

See Appendix A for detailed information on each Poison Centre in Canada.

Canadian Association of Poison Control Centres

In order to provide some cohesiveness and sense of "system" to a fragmented group of poison centres dispersed across the country, a voluntary association, the Canadian Association of Poison Control Centres (CAPCC) was formed at a meeting of Medical Directors in Toronto in 1982. The CAPCC provides a centralized forum for communication, information and idea exchange among Canadian poison centres. While its members are primarily professionals working in poison control centres, other members have included pharmacists, pharmaceutical companies, forensic toxicologists, public health staff and emergency physicians.

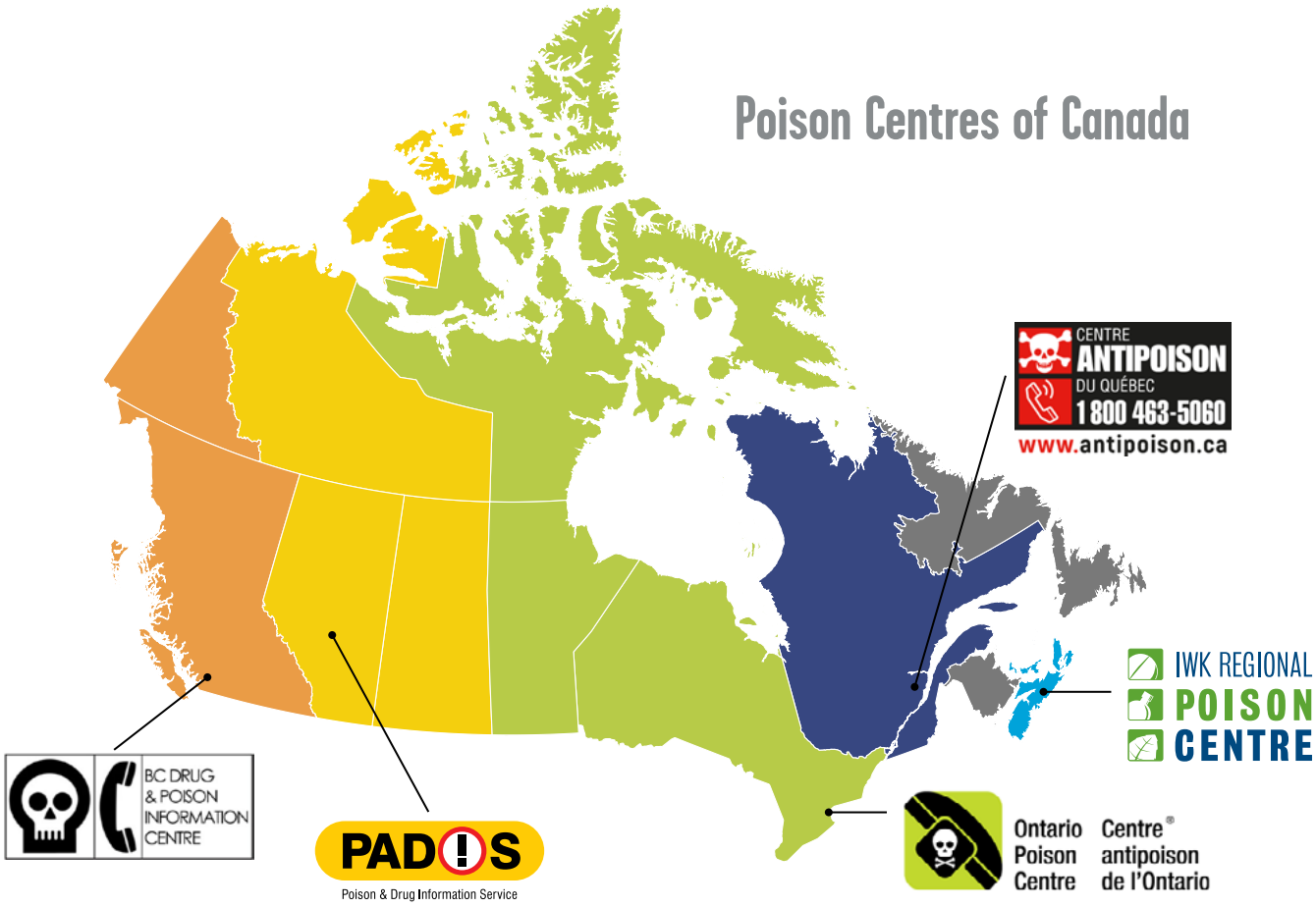


Figure 2. Map of poison centres and the regions they serve in Canada.

Product Formulations Database

The Canadian Poison Control Program was initiated in 1957 as a joint undertaking between the Federal and Provincial departments of health as well as a commitment from the Canadian Paediatric Society (at that time, poison ingestions were mainly a very young children's issue). At the time, patent and proprietary medicine formulas were registered in the then Food and Drugs Directorate and, because of confidentiality of the information, only selected information was given to a physician on direct request or in an emergency. In 1965 there was no regulation that allowed for product information to be given to the poison control centres. To address this problem, Health and Welfare Canada collaborated with industry and manufacturers to establish a voluntary mechanism to collect and distribute product formulations to the poison centres. The federal government product database was maintained and distributed until 1986 when the program as cut. In 1988. this responsibility was handed over the Canadian Paediatric Society. The CPS agreed to use its permanent secretariat address for the receipt of Canadian product formulations from industry and manufactures. The CAPCC decided that the needs of its members would be best served by incorporating the Canadian data into the existing U.S.-based POISINDEX database that was presently being used by all members. POISINDEX is the largest and most complete resource for quickly identifying, managing and treating toxicological exposures. It is used by poison and drug information specialists, emergency department personnel and clinical toxicologists in hospitals, healthcare facilities and

poison control centres all over the U.S. Because of cross-border trade, having access to American data was important. Subsequently, the Canadian federal data files were downloaded into the POISINDEX system. Late in 2005, the Ottawa Regional Poison Centre based at CHEO closed. After this time, only a fairly limited amount of Canadian information is sent to be included in POISINDEX. Canadian poison centres continue to struggle to access domestic product information to support patient treatment. Further, without such information, data collected from poison exposure cases lacks specific product information which can inform poison prevention and harm reduction. By having product information, harmful outbreaks could be detected quicker and valuable comparisons could be made between products: for example, examining effectiveness of different types of child- resistant closures.

POPULATIONS AT RISK

The public health approach seeks to understand the underlying determinants of a health issue in order to develop effective prevention strategies at the population level. An important step in this approach is identifying specific determinants of health and risk factors that predispose individuals to a specific health concern, in our case, poisonings. Factors collectively referred to as the social determinants of health (e.g. income, housing, access to health care, education, social inclusion/exclusion) have gained increased recognition as a major influence on injury risk. While these factors are often considered modifiable and can be addressed by specific interventions, other risk factors are fixed and unchangeable (e.g. age, sex, ethnicity).

For example, when considering opioid-related poisonings, national Canadian data indicate that nearly half of all deaths were among individuals ages 30 to 49 and three-quarters of all deaths were among males (Public Health Agency of Canada [PHAC], 2019), suggesting that males during mid-adulthood are the major population at risk for opioid-related poisonings. With respect to social determinants, research has also shown that drug- and substance-related poisonings are significantly higher in the lowest socioeconomic status communities compared to the highest socioeconomic status communities (Xibiao et al., 2018).

While it is important to recognize that poisonings can occur in individuals from all walks of life regardless of age, sex, or socioeconomic status, certain populations have been identified through research and surveillance as being at an elevated risk for poisoning and are thus discussed briefly in this Evidence Summary.

Pediatric, Youth and Young Adults

Though the pediatric age range is commonly defined as birth to 18 years of age, initial interest in poison prevention arose from the need to prevent unintentional poisonings among young children, especially those ages zero to five years. Data from the U.S. indicate that approximately one million poison exposures occur annually among children under the age of six years (Gummin et al., 2018). Although a significant number of poisonings occur in this population, deaths are extremely rare (Gummin et al., 2018). Several factors have been used to explain why young children are at an increased risk for poisoning, with the two major ones being developmental and environmental factors. A child's skin is thinner compared to an adult's, such that substances can be easily absorbed when exposed on the skin. Children are also physically smaller than adults, such that small doses of substances and medications can pose significant health effects. As infants progress through the typical developmental milestones

during the first years of life, they become more mobile, explore their environments and grab objects as their motor skills improve. Young children often also explore their environments by placing objects into their mouths that can be inadvertently swallowed. Research has further suggested that poisonings among young children may be linked to imitative behaviours as they watch and copy their caregivers taking oral medications (Rodgers, 2012). The home environments in which young infants explore (e.g. kitchen, bathrooms, laundry rooms) commonly have low-lying, unlocked cabinets containing toxic cleaners that can often resemble fruit juices or candy.

Youth and adolescents (typically ages 12 to 18) have also been described as an at-risk group for poisonings. The teenage years are often characterized by periods of impulsivity, rebelliousness and risky behaviour. Indeed, research has suggested that children and adolescents who attempted suicide with poisoning tend to have more impulsive personality traits (Ghanem et al., 2013). Youth and young adults may also be more influenced by social media and peer pressure, as seen most recently with the viral laundry detergent pod challenge. Poisonings related to laundry detergent pods are discussed in greater detail in a separate section of this Evidence Summary.

Older Adults

Poisoning among older adults has become a topic of increased discussion as the percentage of Canadians over the age of 65 is expected to increase from 17.2 per cent of the population in 2018 to as high as 29.5 per cent by 2068 (Statistics Canada, 2019b). Older adults are at risk for poisoning primarily due to polypharmacy (the use of multiple drugs or more drugs than are medically necessary) and adverse drug events. Risk factors unique to older adults can include changes in physiology, pharmacodynamics (what the drug does to the body or the response of the body to the drug), and pharmacokinetics associated with aging (e.g. drug absorption), presence of several comorbid conditions, and cognitive changes that can result in medication-taking errors. Statistics show that more than a quarter (26.5 per cent) of Canadian adults over the age of 65 years were prescribed medications from 10 or more different drug classes and accounted for 58.6 per cent of all adverse drug-related hospitalizations in 2016 (Canadian Institute for Health Information, 2018). The likelihood of severe long-term effects or death are also significantly higher among the elderly population following a drug poisoning event (Wilson et al., 1995).

In addition to unintentional poisonings related to polypharmacy and adverse drug events, growing emphasis has been placed on intentional self-harm poisonings among the elderly. Older adults often experience increased stress in their lives as a result of retirement, changes in their physical/cognitive abilities, chronic illnesses or the loss of a partner or friend. These stressors can compound feelings of loneliness or burdensomeness and potentially lead some older adults to harm themselves (Conejero et al., 2018). Self-harm via poisoning is of particular concern as research has shown that older adults with suicidal ideations often have relatively easy access to large quantities of potent medications (Cobaugh et al., 2015).

Intentional Self-Harm Poisonings

Intentional self-harm (suicide) is a major cause of death in Canada, with recent statistics indicating that suicide is within the top three causes of death among Canadians ages 15 to 44 years old (Statistics Canada, 2019d). Poisoning is the second-leading method of suicide in Canada, accounting for approximately 23 per cent of all deaths by suicide in 2012 (Skinner et al., 2016). With respect to non-fatal self-harm attempts, poisoning is the leading mechanism of self-harm and was responsible for 86 per cent of Canadian hospitalizations due to self-harm in 2012 (Skinner et al., 2016). The most common substances implicated in self-harm poisonings are medications, specifically acetaminophen,

benzodiazepines and antidepressants (Rhodes et al., 2008). The use of prescribed antidepressants for self-harm indicates that individuals with depression and/or other mental health issues are a major population at risk for self-harm poisonings, especially with the fact that the suicide rate among those with clinical depression is higher compared to the general population (Cassano & Fava, 2002).

While poisoning is the leading cause of non-fatal self-harm, deaths by suicide are more likely to involve other more lethal means (e.g. suffocation, firearms). Research has also shown that differences exist between the sexes, with females being more likely than males to choose poisoning as a method of self-harm (Callanan & Davis, 2012). However, when males do choose poisoning as a method of self-harm, they are more likely to die as a result of the poisoning event compared to females (Spiller et al., 2010). Research in British Columbia has demonstrated that female youth and young adults are a particularly high-risk group, with self-harm poisoning hospitalization rate among females ages 15 to 19 years old being the highest across all age groups and both sexes, and more than three times greater than the corresponding rate among males in that age group (191.6 vs. 57.3 per 100,000) (Jiang et al., 2018).

Together, this indicates that certain individuals are more likely to harm themselves via poisoning as compared with others, such as those with mental health conditions including depression and other affective disorders. Suicidality, which can be seen as a clinical condition, is often the common factor that places these individuals at risk of poisoning. This is an important distinction as suicide is a major cause of death in Canada and mental health conditions are amenable to treatment that can prevent suicide attempts and self-harm poisonings.

Indigenous Peoples

Indigenous people in Canada are at an increased risk of mortality and morbidity compared to non-Indigenous Canadians, with the growing recognition that much of this is a direct consequence of the devastating impacts of colonization and subsequent ongoing intergenerational trauma (Truth and Reconciliation Commission of Canada [TRCC], 2015). Of particular concern is the growing number of deaths among Indigenous peoples in Canada due to illicit drug and substance-related poisonings (e.g. opioid poisonings). Though the opioid crisis has affected individuals from all walks of life, research suggests that Indigenous people are a disproportionately impacted group. Data from British Columbia demonstrates that although Indigenous people comprise only 3.4 per cent of the province's population, they accounted for 10 per cent of all illicit drug- and substance-related poisoning deaths and were three times more likely to die from such poisoning events compared to non-Indigenous individuals (First Nations Health Authority, 2017). Young Indigenous people who use drugs and substances are a particularly high-risk group as research has shown they are 13 times more likely to die than non-indigenous Canadians of the same age, with the leading cause of death being drug- and substance-related poisoning (Jongloed et al., 2017).

The factors that increase mortality, morbidity and predispose individuals to drug and substance use and poisonings among Indigenous people in Canada are complex and deeply rooted in the historical, intergenerational and ongoing trauma associated with colonization, the residential school and child welfare systems, poverty, racism and inadequate access to health and social services (TRCC, 2015; First Nations Health Authority, 2017; Goodman et al., 2017). Though a full discussion of these complex issues is beyond the scope of this Evidence Summary, a few key factors that have been proposed to influence substance-related harms among Indigenous people are discussed below. A more general discussion on opioids, illicit drugs and substance-related poisonings is also discussed in a separate section of this Evidence Summary.

- *Intergenerational trauma is associated with an increased risk for substance use among Indigenous people in Canada.* Oppressive colonial policies and practices, including the residential school system, have had

a substantial intergenerational impact as survivors pass on feelings of shame and self-hatred to their descendants, which can lead to increased rates of suicide, depression, anxiety and substance use (Syme et al., 2010). Drug and substance use have been reported among Indigenous populations as a coping mechanism for trauma, stress and grief (Anderson & Collins, 2014). As a result of the trauma experienced by survivors of the residential school system and the intergenerational trauma felt by their children, many Indigenous people may have a certain level of distrust towards the healthcare system, which can lead many to not seek appropriate care (Monture, 2007).

- *Reduced access and barriers to health services.* Indigenous people using illicit drugs and substances have reported reduced access to medical therapy for their addiction and substance-use disorders, including suboxone and methadone maintenance therapy (BC Centre for Excellence in HIV/AIDS, 2009). Furthermore, Indigenous people may experience increased prejudice in healthcare settings when their pain symptoms are dismissed or being denied commonly prescribed pain-relieving medications, which can lead many to seek illicit drugs and substances as a source of pain control (Western Aboriginal Harm Reduction Society, n.d.).

THE IMPACT OF POISONINGS IN CANADA

Methodology

Statistics and figures presented in this Evidence Summary are based on analyses performed by the Public Health Agency of Canada of mortality data from Statistics Canada's Canadian Vital Statistics death database (2008 to 2018), hospitalization data from the Canadian Institute for Health Information's Discharge Abstract Database (2008 to 2018 fiscal years; data from Quebec not included), and emergency department visit data from Alberta and Ontario from the Canadian Institute for Health Information's National Ambulatory Care Reporting System (2010 to 2018 fiscal years). Data were also available from the electronic Canadian Hospitals Injury Reporting and Prevention Program (eCHIRPP) database (2012 to 2019), which amalgamates emergency room data from 11 pediatric and nine general hospitals in Canada. For full details of data extraction codes and methodology used to define poisonings in this Evidence Summary, please refer to Appendix B. Data are presented as rates per 100,000 population and, when applicable, standardized based on the 2011 Canadian population.

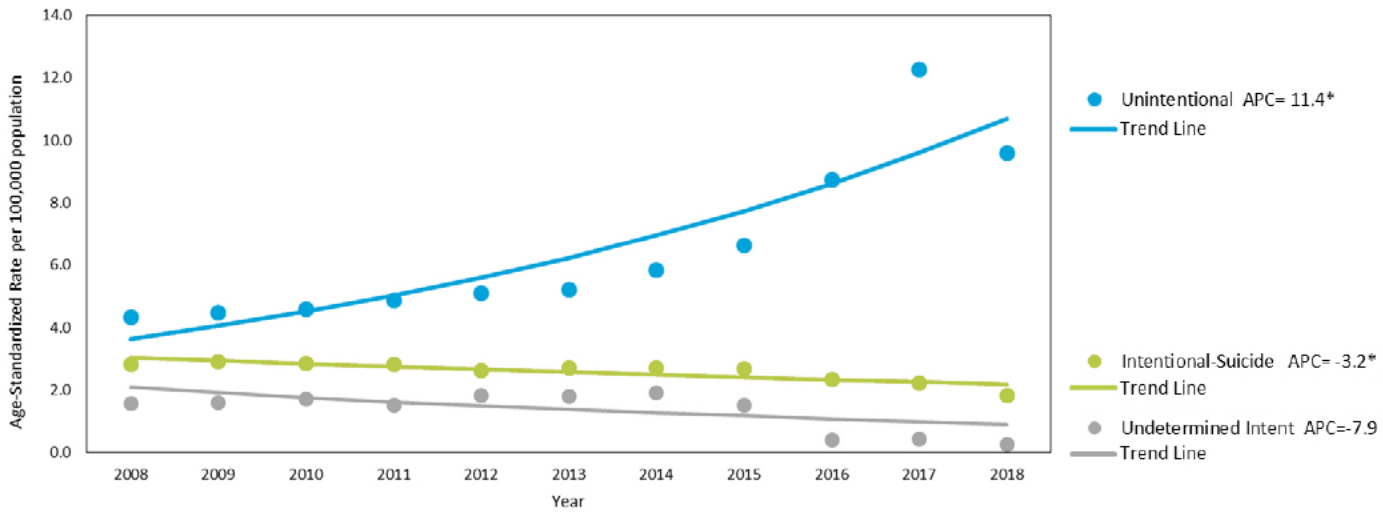
Age-standardized rates are used throughout this report to describe rates across time. To allow for a comparison across the years, age-standardized rates were calculated using the direct method. This method controls for potential sources of bias resulting from variations in the age distribution of populations across time.

The change in trending of the age-standardized rates over time is expressed in annual per cent change (APC) between time periods. The sum of the average percentage change will give the overall change. The trending was done with the Joinpoint Regression Program. To ensure the data in this report are illustrated in an effective and useful manner, data fields with small numbers are not included in graphs. In these cases, a note is included below the graph. Data trends on mortality, hospitalizations and emergency department visits of undetermined nature can be found in Appendix D.

Deaths due to Poisonings

Data indicate that deaths due to unintentional poisonings have shown a marked increase from 2008 to 2018, with a peak observed in 2017 (Figure 3). Comparatively, poisoning deaths due to suicide have shown a modest decrease during the same time period. When poisoning deaths are analyzed by sex (Figure 4), mortality rates among males are consistently higher than females for both unintentional and intentional poisoning deaths during the available time period. Importantly, the mortality rate for unintentional poisonings among males more than tripled from 2008 to 2017, indicating that the bulk of the observed increase in unintentional poisoning deaths are among males as opposed to females. The age groups with the highest observed mortality rate due to unintentional poisonings were individuals ages 30 to 49 (Figure 5). Individuals ages 40 to 64 had the highest mortality rates from suicide poisoning (Figure 5).

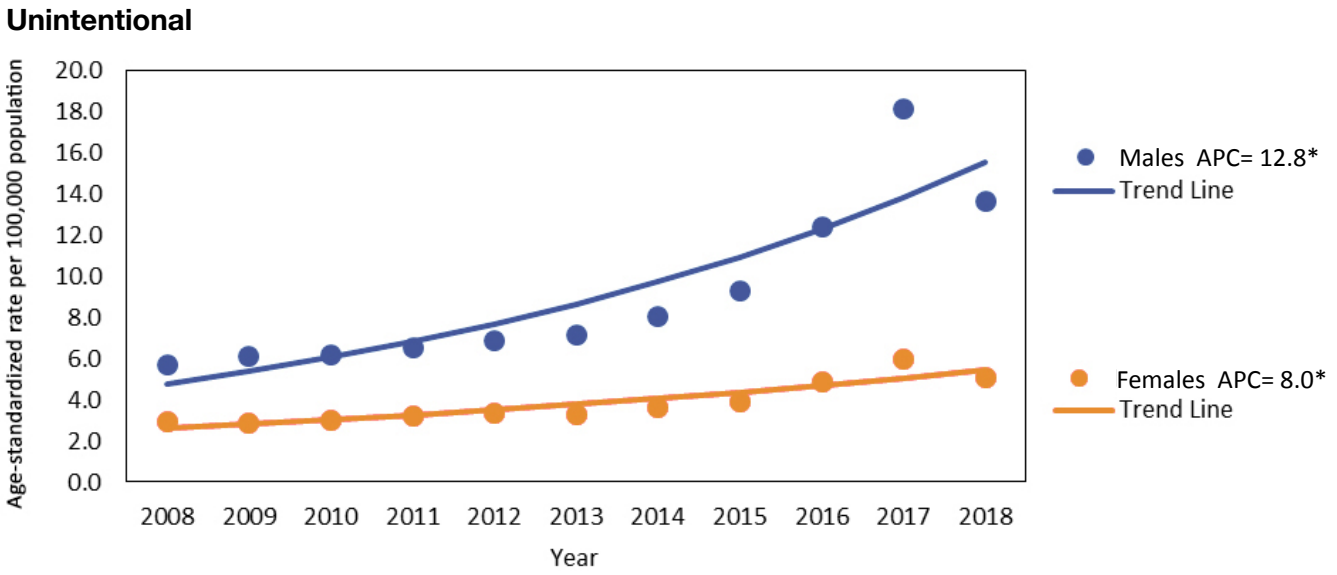
Figure 3. Mortality due to poisonings in Canada by intent, 2008 to 2018.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

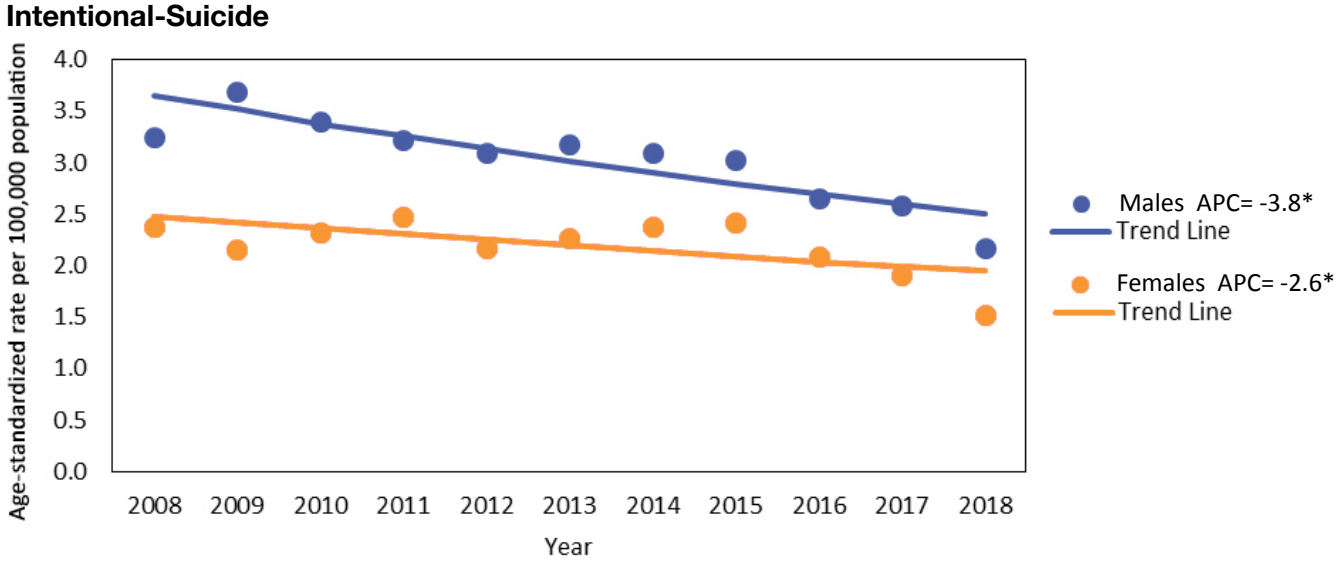
Over the 11-year period from 2008 to 2018, the death rate due to unintentional poisoning had a statistically significant average increase of 11.4 per cent each year. Intentional-suicide and undetermined intention of poisoning both experienced a decrease in death rate. Intentional-suicide poisoning death rate had a statistically significant decrease average of 3.2 per cent each year. Undetermined intent poisoning death rate had an average 7.9 per cent decrease each year. Due to the small numbers, poisoning with intent to harm another person were not included.

Figure 4. Mortality due to poisonings in Canada by intent and sex, 2008 to 2018. Age-standardized rates rates per 100,000 population.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

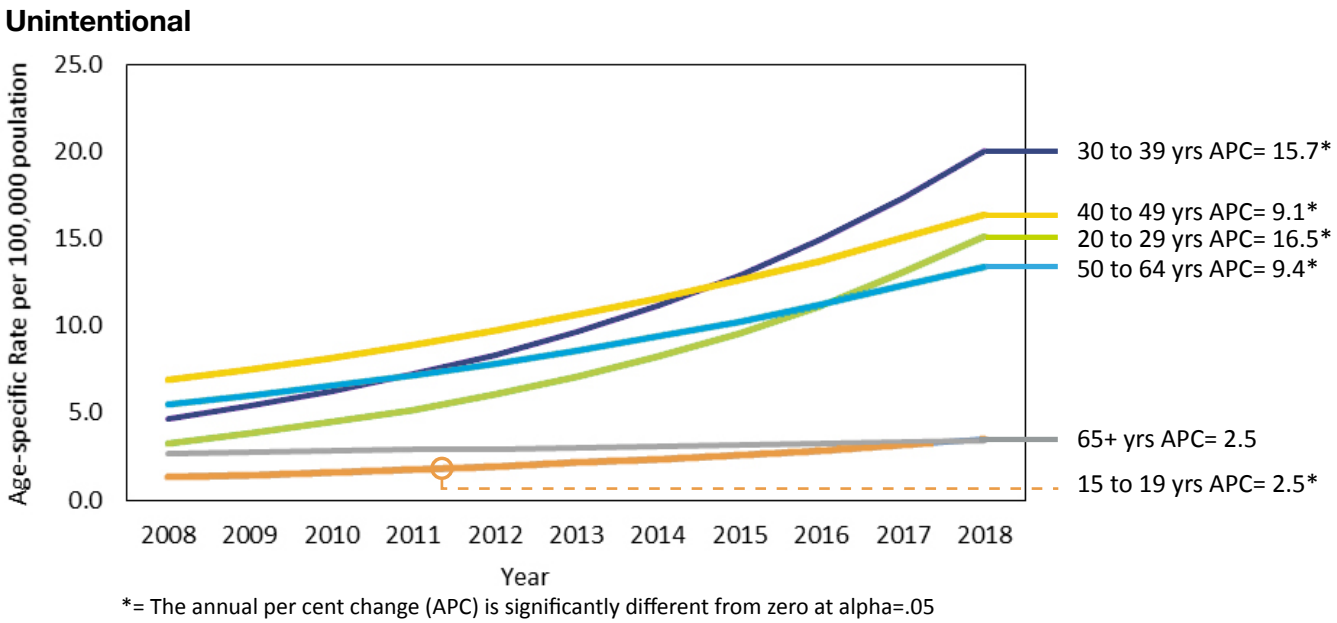
Over the 11 year period from 2008 to 2018 both males and females had a statistically significant increase in the unintentional poisoning death rate. Males had an average increase in the unintentional poisoning death rate of 12.8 per cent each year and females had an average increase in unintentional poisoning death rate of 8.0 per cent each year.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

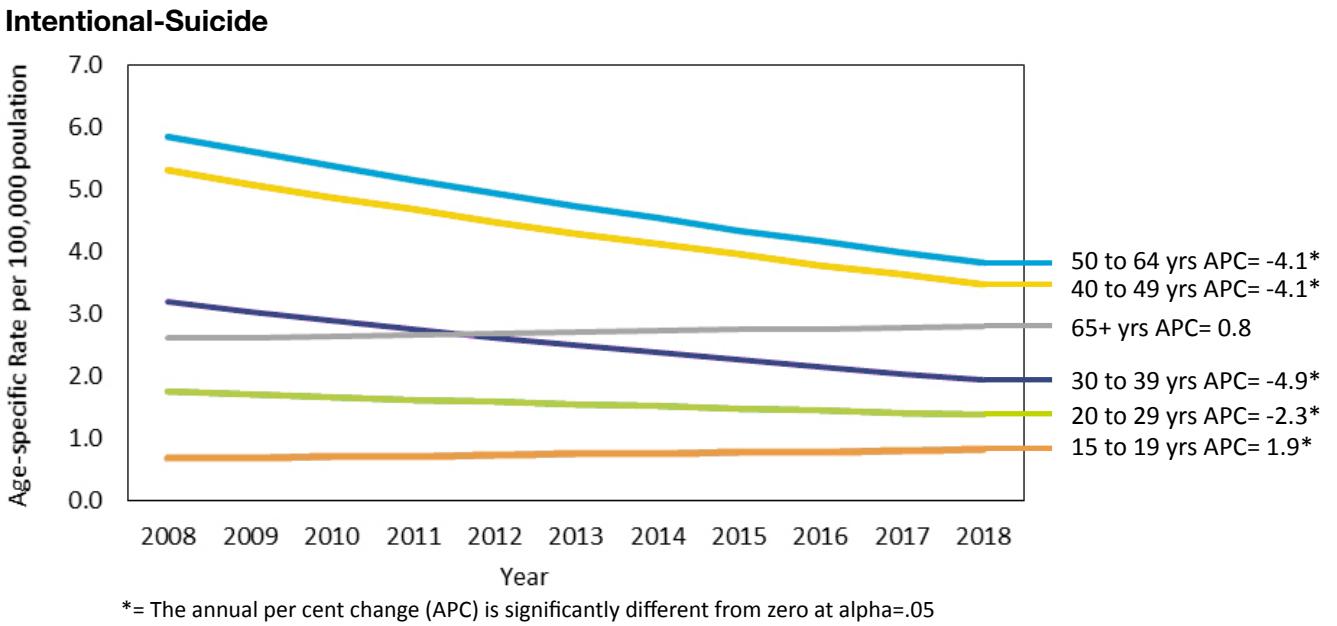
Over the 11 year period from 2008 to 2018 both males and females had a statistically significant decrease in the death rate due to intentional-suicide poisonings. Males had an average decrease in intentional-suicide poisoning death rate of 3.8 per cent each year and females had an average decrease in intentional-suicide death rate of 2.6 per cent each year.

Figure 5. Mortality due to poisonings in Canada by intent and age group (years), 2008 to 2018.
Age-specific rates per 100,000 population.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the 11-year period from 2008 to 2018, all age groups 15 years of age and older had a statistically significant increase in unintentional poisoning death rate with the exception of those 65 years of age and older. Those 65 years of age and older had an increase but it was not statistically significant. Canadians 20 to 29 years of age had the largest annual percent increase of unintentional poisoning death rate with an average 16.5 per cent each year. This was followed by Canadians 30 to 39 years of age with an average increase of unintentional poisoning death rate of 15.7 per cent each year. Due to small numbers, unintentional poisoning deaths of Canadians under the age of 15 are not presented.



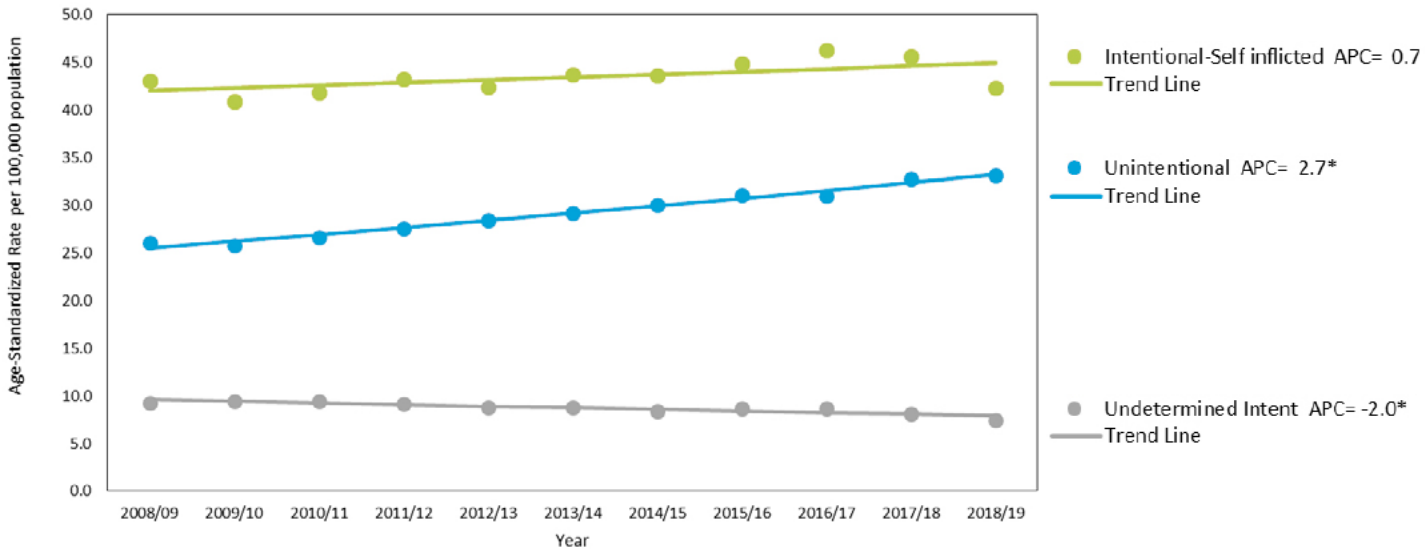
*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the 11-year period from 2008 to 2018, all age groups except for Canadians 15 to 19 years of age and those 65 years of age and older had a significant annual decrease in the intentional-suicide death rate. Canadians 30 to 39 years of age had the largest average decrease of intentional-suicide death rate of 4.9 per cent each year. This was followed by Canadians 40 to 49 years of age and those 50 to 64 years of age, each with a 4.1 per cent average annual decrease in the intentional-suicide death rate. Due to small numbers, intentional-suicide poisoning deaths of Canadians under the age of 15 are not presented.

Hospitalizations due to Poisonings

Data on rates of hospitalization due to poisonings indicate that unintentional poisoning hospitalizations have shown a steady increase from 2008 to 2018 (Figure 6). Hospitalization rates for intentional self-harm poisonings were consistently higher than unintentional poisonings but did not show a clear trend during the observed time period. When analyzing data between males and females (Figure 7), rates for unintentional poisoning hospitalizations remained quite similar from 2008 to 2014; however, rates among males in the later end of the observed time period increased compared to females. With respect to intentional self-harm poisoning hospitalizations, rates among males appear to have decreased during the study period, whereas hospitalization rates among females have fluctuated, with the 2018 hospitalization rate approximately twice that of the corresponding rate among males. Rates for unintentional poisoning hospitalizations were highest among individuals 65 years of age or older (Figure 8). Hospitalization rates for intentional self-harm poisoning were highest among individuals ages 15 to 19, with the rate nearly doubling between 2009 and 2017 (Figure 8).

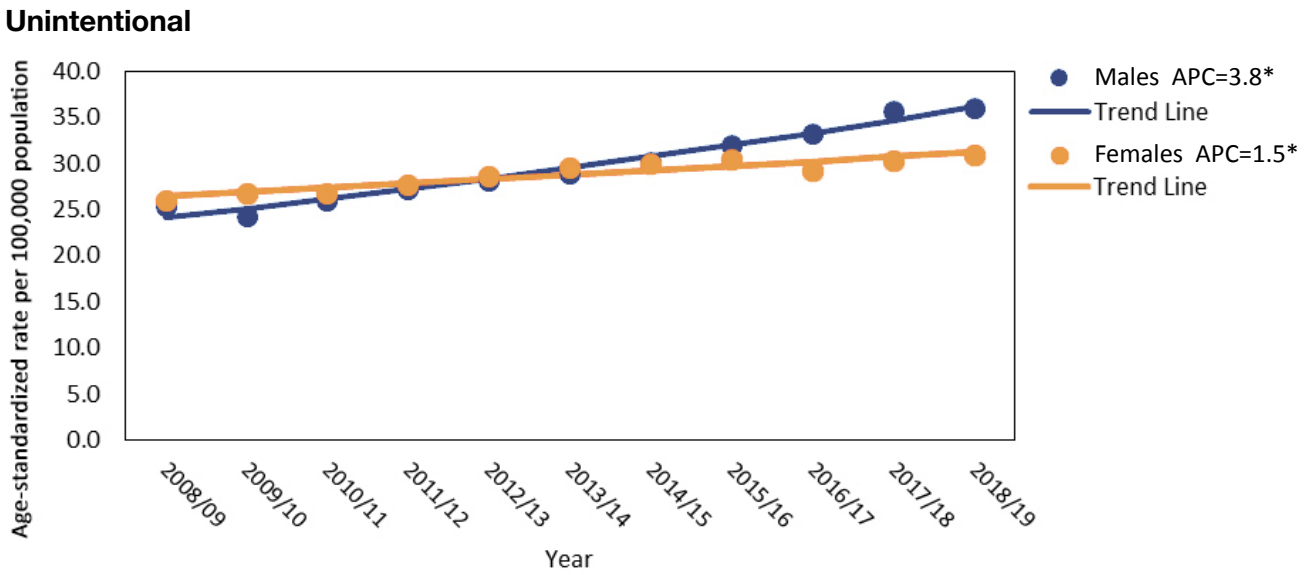
Figure 6. Hospitalizations due to poisonings in Canada, excluding Quebec, by intent, fiscal years 2008 to 2018.
Age- standardized rates per 100,000 population



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

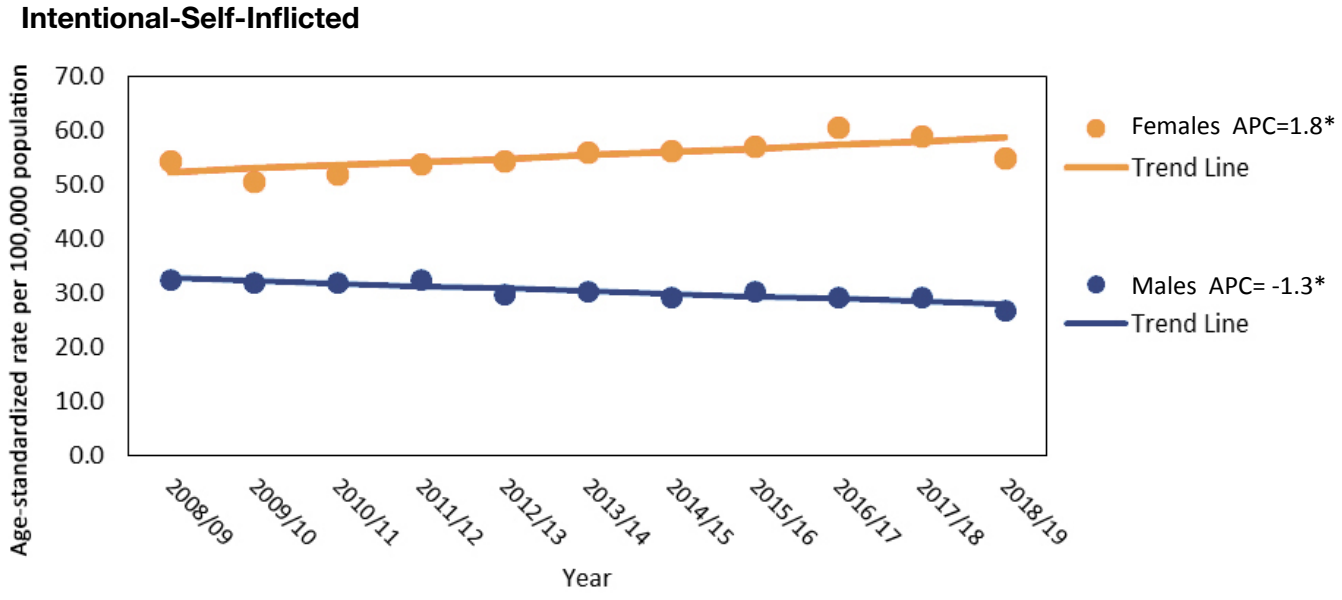
Over the 11-year period from 2008/09 to 2018/19, hospitalization rate due to unintentional poisoning had a statistically significant average increase of 2.7 per cent each year. The hospitalization rate for self-inflicted poisonings increased on average 0.7 per cent each year. The hospitalization rate for poisoning with undetermined intention had a statistically significant decreased on average of 2.0 per cent each year. Due to the small numbers, poisoning with intent to harm another person were not included.

Figure 7. Hospitalizations due to poisonings in Canada, excluding Quebec, by intent and sex, fiscal years 2008 to 2018. Age-standardized hospitalization rates per 100,000 population.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

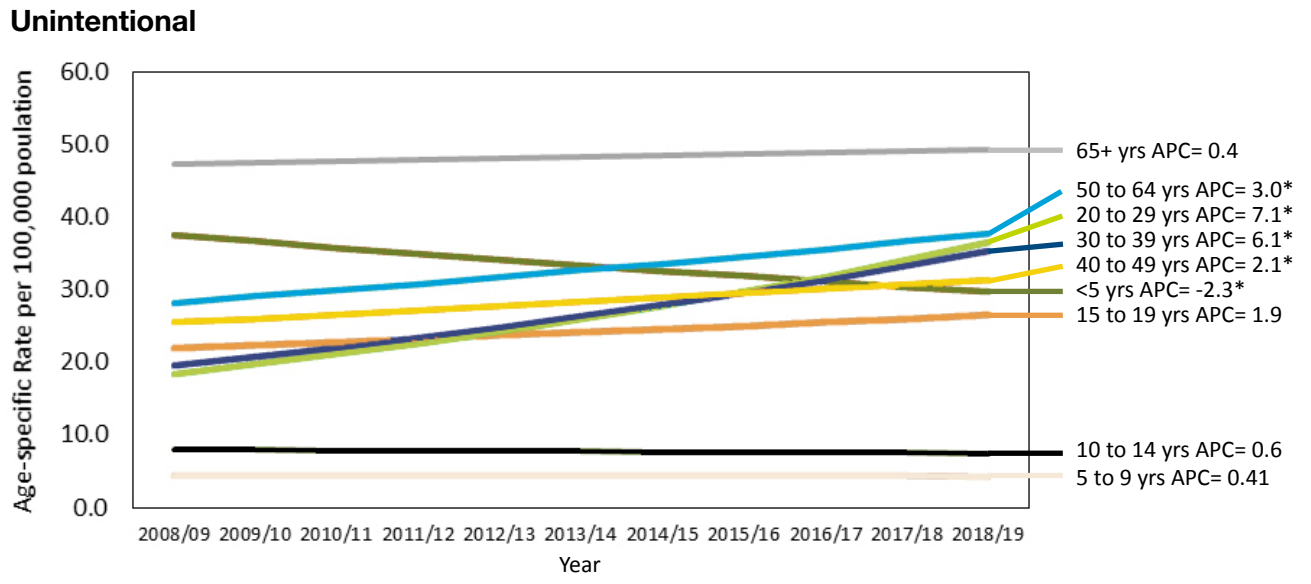
Over the 11-year period from 2008/09 to 2018/19, both males and females had a statistically significant increase in the unintentional poisoning hospitalization rate. Males had an average increase of hospitalization rate for unintentional poisoning hospitalizations of 3.8 per cent each year and females had an average increase of 1.5 per cent each year.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

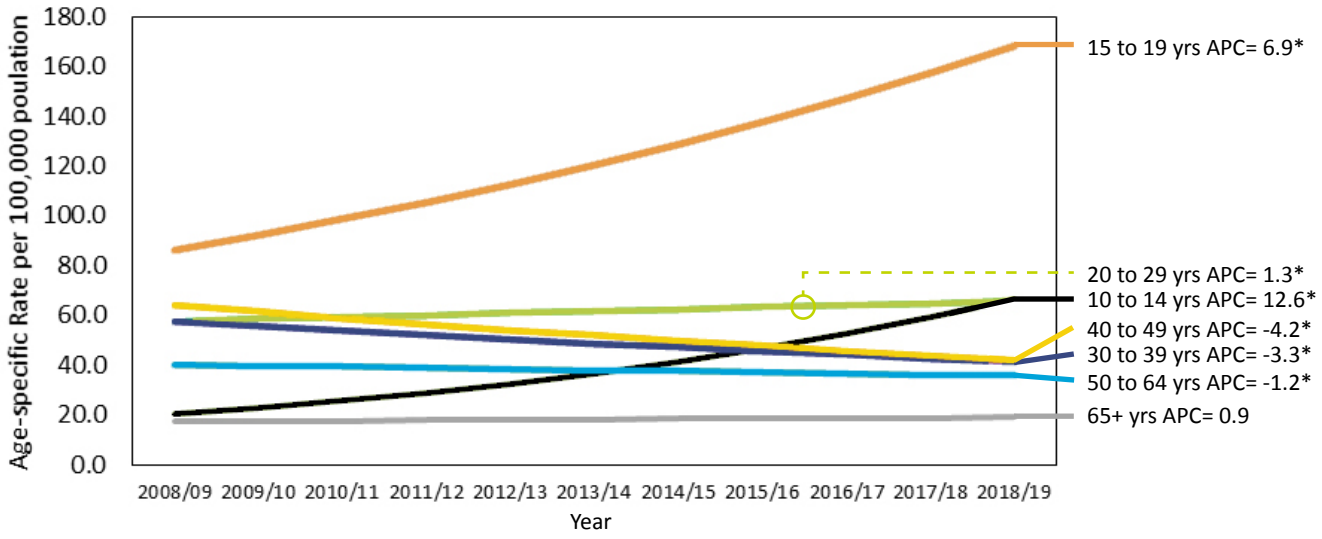
Over the 11-year period from 2008/09 to 2018/19, males had a statistically significant average decrease in the intentional-self-inflicted hospitalization rate of 1.3 per cent each year and females had a statistically significant average increase in the hospital admission rate of 1.8 per cent each year.

Figure 8. Hospitalizations due to poisonings in Canada, excluding Quebec, by intent and age group (years), fiscal years 2008 to 2018. Age-specific hospitalization rates per 100,000 population.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the 11-year period from 2008/09 to 2018/19, the age group that had the largest annual per cent change in hospitalization rate due to unintentional poisoning was Canadians 20 to 29 years of age with a statistically significant average increase of 7.1 per cent each year. This was followed by those 30 to 39 years of age with a statistically significant average increase of 6.1 per cent. Due to small numbers, unintentional poisoning deaths of Canadians under the age of five are not presented.



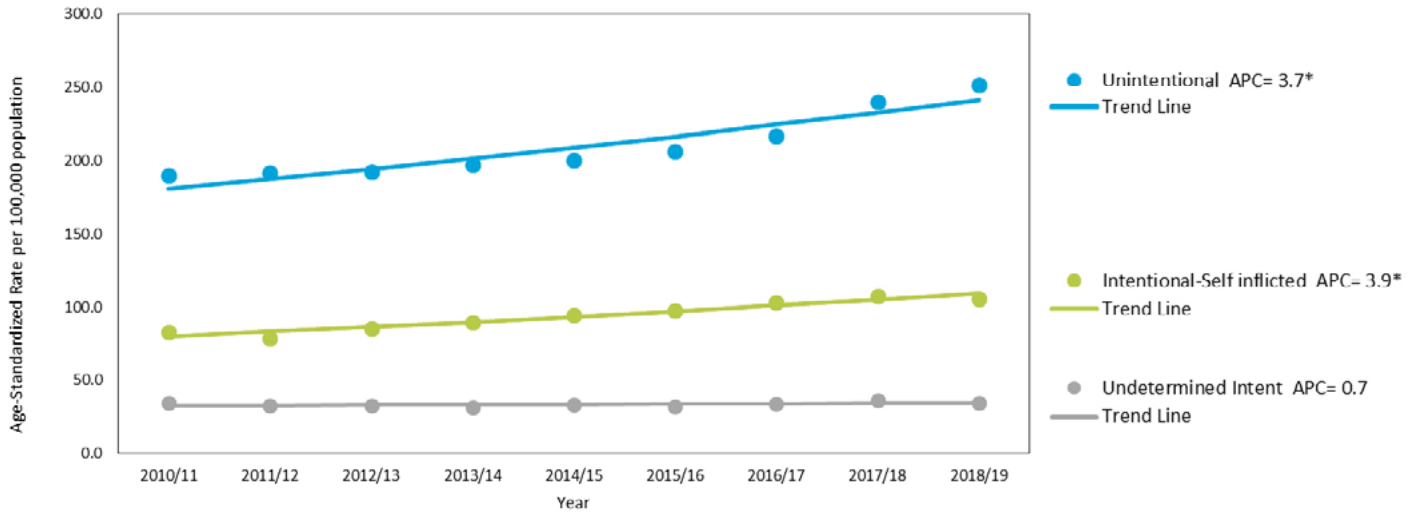
*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the 11-year period from 2008/09 to 2018/19 Canadians, 10 to 14 years of age had the largest percent increase in intentional self-inflicted poisoning hospitalization with a statistically significant average increase of 12.6 per cent each year. This was followed by those 15 to 19 years of age with a statistically significant average increase of 6.9 per cent each year. Canadians 40 to 49 years of age had a statistically significant average decrease in the hospitalization rate due to intentional-self-inflicted poisoning with 4.2 per cent each year. Due to small numbers, intentional self-inflicted poisoning hospitalizations of Canadians under the age of 10 is not presented.

Emergency Department Visits due to Poisonings

Available data from emergency departments in two Canadian provinces (Alberta and Ontario) demonstrate a gradual increase in visits due to both unintentional and intentional poisonings, with the rate of unintentional poisonings being more than double that of intentional self-harm poisonings in 2018 (Figure 9). Males comprised a greater proportion of emergency department visits due to unintentional poisonings, whereas rates of intentional-self harm poisoning were higher among females (Figure 10). Young children younger than five years old had the highest rate of emergency department visits for unintentional poisonings during the observed study period (Figure 11). Emergency department visits for unintentional poisonings among those ages 20 to 29 also saw a marked increase during the study period. Similar to poisoning hospitalizations, rates of intentional self-harm poisoning emergency department visits were highest among those ages 15 to 19 and showed an increasing trend during the study period (Figure 11).

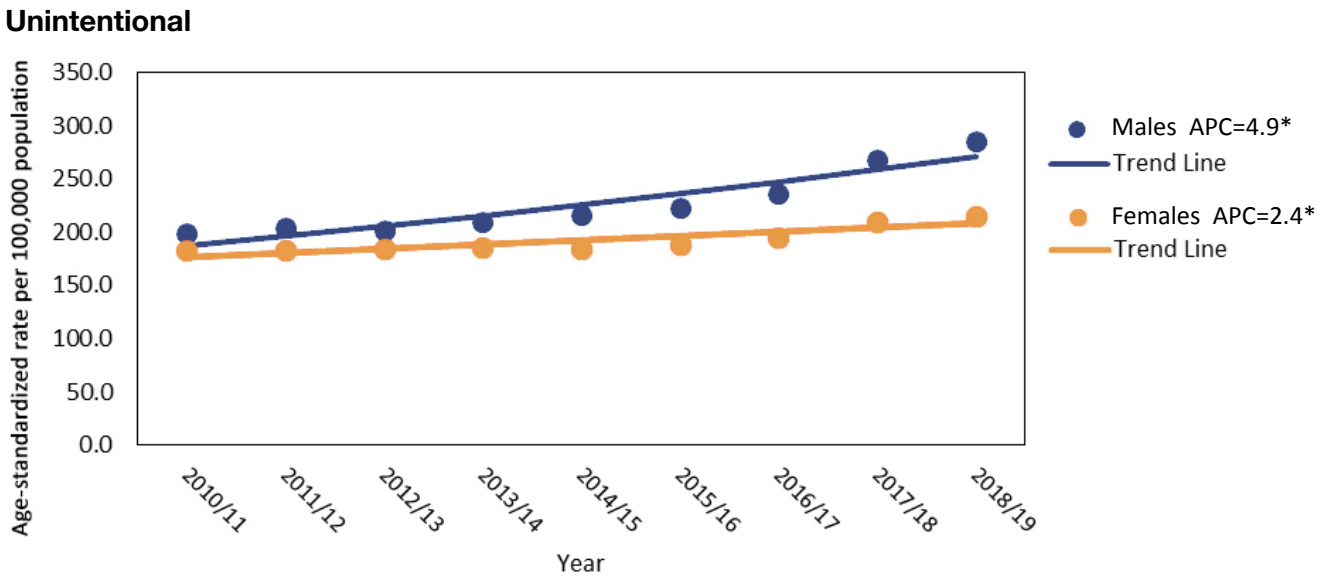
Figure 9. Emergency department visits due to poisonings in Alberta and Ontario by intent, fiscal years 2010 to 2018. Age-standardized rates per 100,000 population.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

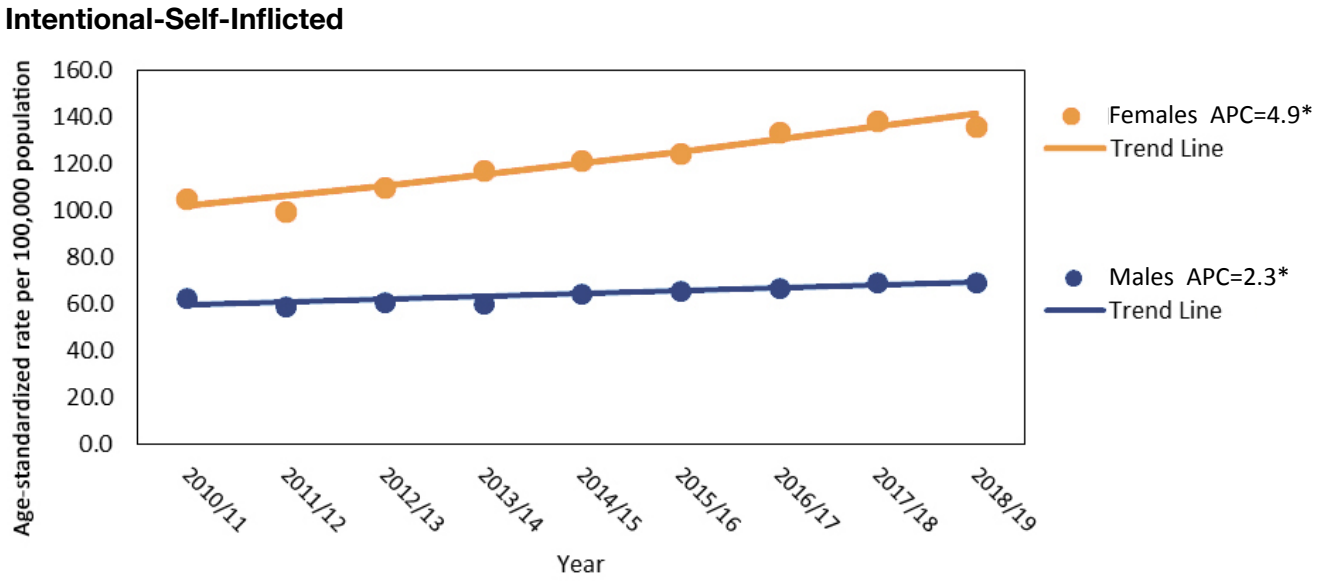
Over the nine-year period from 2010/11 to 2018/19, the emergency department visit rate of residents of Alberta and Ontario due to unintentional poisoning had a statistically significant average increase of 3.7 per cent each year. The visit rate for intentional-self-inflicted poisonings also had a statistically significant average increase of 3.9 per cent each year. The emergency department visit rate for poisoning with undetermined intention had a slight increase of 0.7 per cent each year. Due to the small numbers, poisoning with intent to harm another person were not included.

Figure 10. Emergency department visits due to poisonings in Alberta and Ontario by intent and sex, fiscal years 2010 to 2018. Age-standardized rates per 100,000 population.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

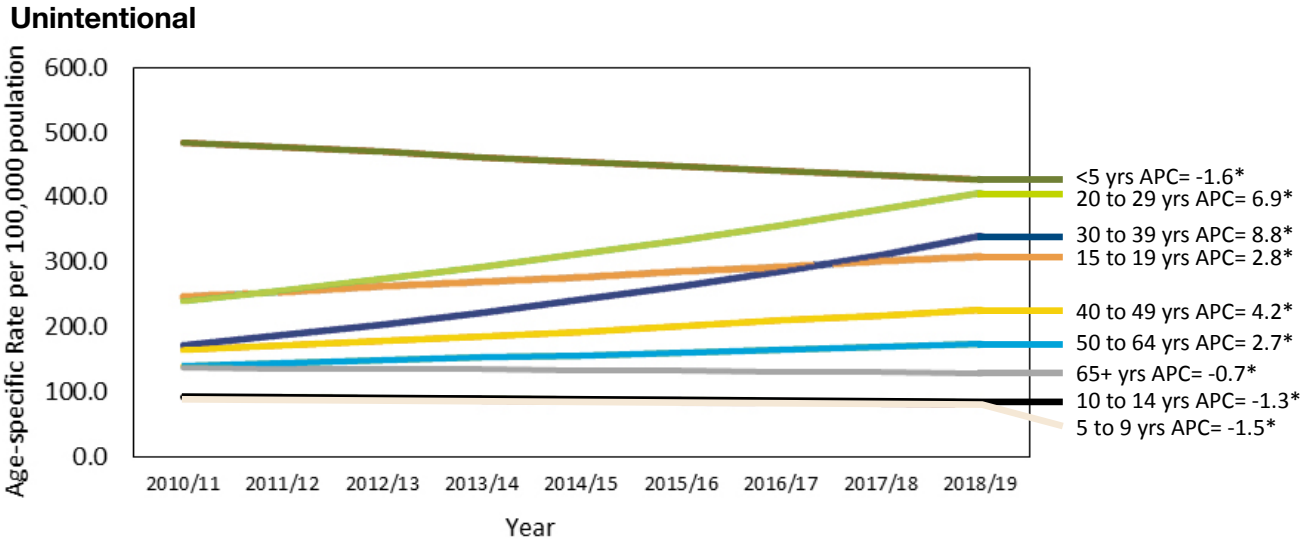
Over the nine-year period from 2010/11 to 2018/19, both males and female residents of Alberta and Ontario had a statistically significant increase in the unintentional poisoning emergency department visit rate. Males had a statistically significant average increase in emergency department visit rate of 4.9 per cent each year and females had a statistically significant average increase in emergency department visit rate of 2.4 per cent each year.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

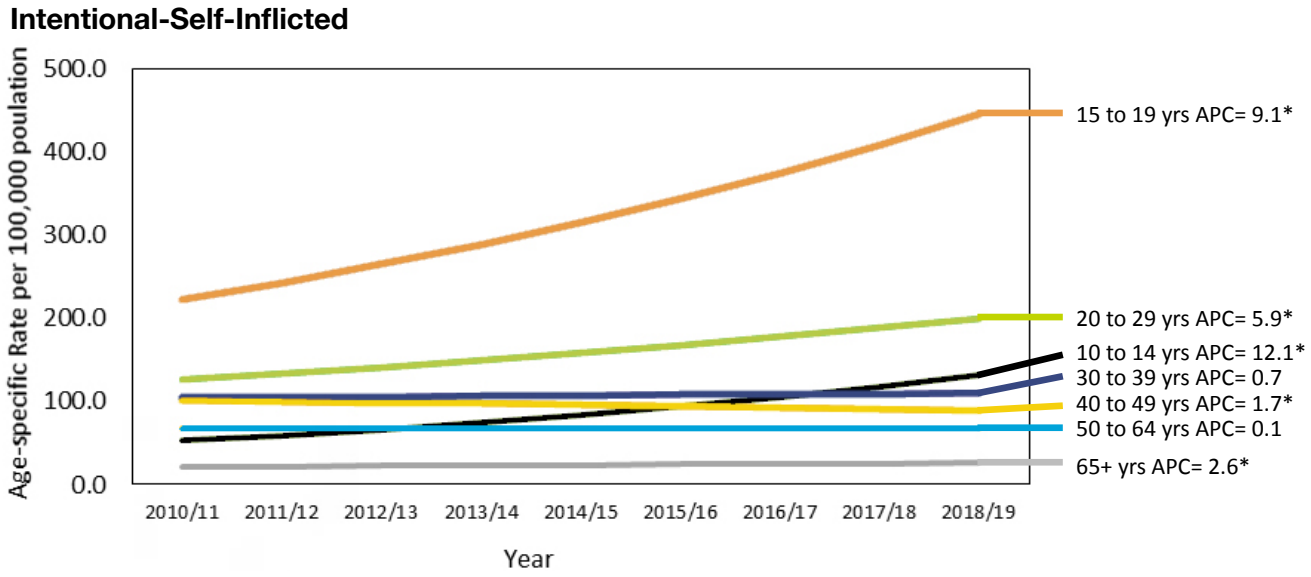
Over the nine-year period from 2010/11 to 2018/19, both males and female residents of Alberta and Ontario had a statistically significant increase in the intentional self-inflicted poisoning emergency department visit rate. Males had a statistically significant average increase in emergency department visit rate of 2.3 per cent each year and females had a statistically significant average increase in emergency department visit rate of 4.9 per cent each year.

Figure 11. Emergency department visits due to poisonings in Alberta and Ontario by intent and age group (years), fiscal years 2010 to 2018. Age-specific rate per 100,000 population.



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the nine-year period from 2010/11 to 2018/19, the age group in Alberta and Ontario that had the largest annual per cent change in emergency department visit rate due to unintentional poisoning was those 30 to 39 years of age with a statistically significant average increase of 8.8 per cent each year. This was followed by those 20 to 29 years of age with a statistically significant average increase of 6.9 per cent each year.



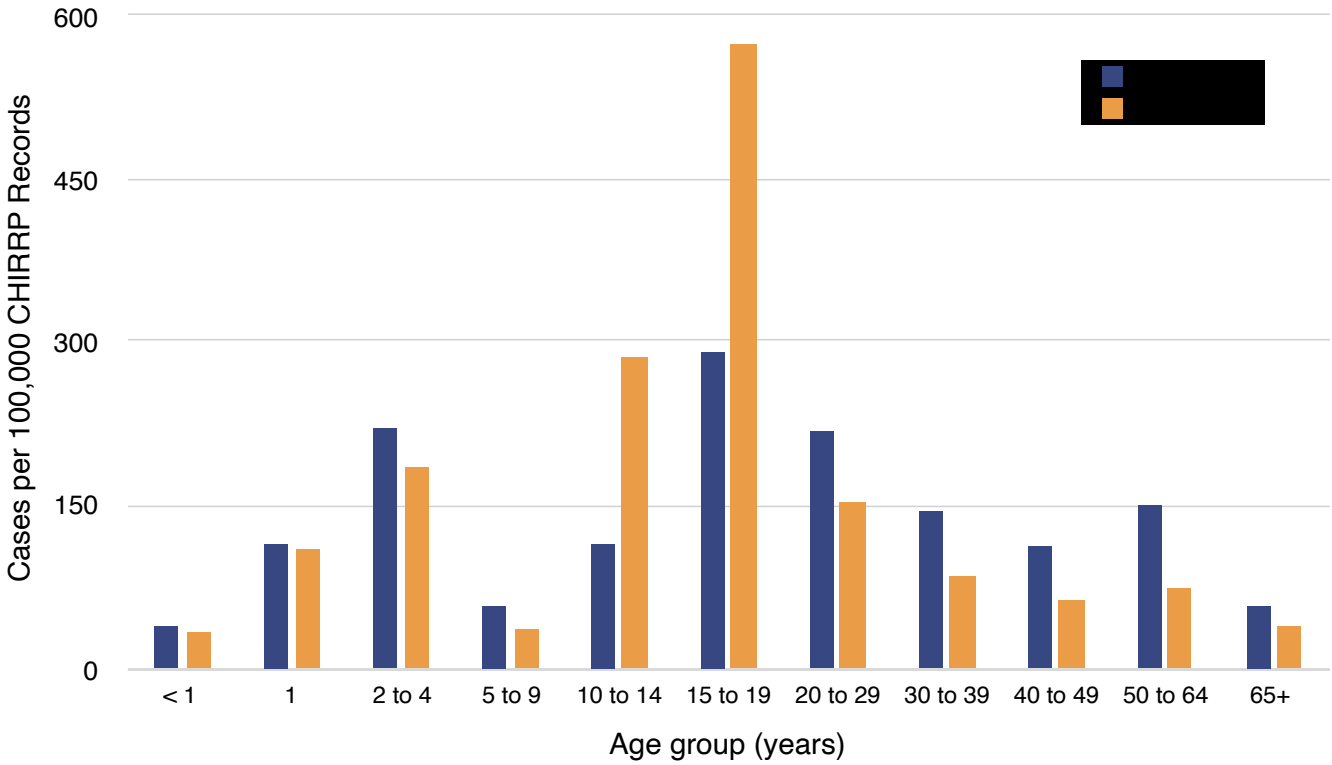
*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the nine-year period from 2010/11 to 2018/19, the age group of those in Alberta and Ontario that had the largest annual per cent change in emergency department visit rate due to intentional-self-inflicted poisoning was youth 10 to 14 years of age with a statistically significant average increase of 12.1 per cent each year. This was followed by those 15 to 19 years of age with a statistically significant average increase of 9.1 per cent each year. Due to small numbers, unintentional poisoning deaths of Canadians under the age of 10 are not presented.

Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP)

The Canadian Hospitals Injury Reporting and Prevention Program is a sentinel injury and poisoning surveillance system that collects and analyzes data on injuries to people who are seen at the emergency rooms of 11 pediatric hospitals and nine general hospitals in Canada

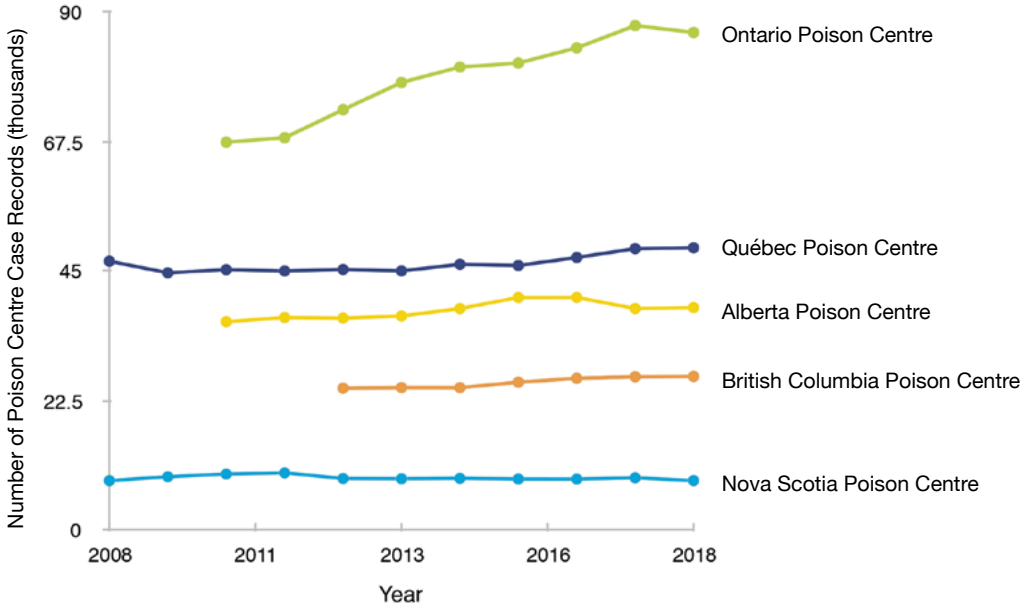
Figure 12. Visits due to poisoning (all intents) by age group and sex, 2012 to 2019.
Data from the Canadian Hospitals Injury Reporting and Prevention Program.



From 2012 to 2019, 38,694 emergency department visits occurred as a result of poisonings. Unintentional poisonings accounted for 61 per cent of these visits, while intentional self-harm poisonings represented 26 per cent of visits. With respect to age, individuals ages 15 to 19 years old had the highest number of poisoning-related emergency department visits across both sexes, with the number of visits among females being nearly double that of males for this age group (Figure 15). With respect to the location of the poisoning event, approximately 40 per cent of poisonings occurred in the individual's own home. The leading substances implicated in emergency department visits due to unintentional poisonings were alcohol (25 per cent), street drugs (7.1 per cent), and acetaminophen (6.4 per cent). The leading substances for emergency department visits due to intentional self-harm poisonings were psychoactive medications (17 per cent), acetaminophen (12 per cent), and alcohol (5.3 per cent).

Case Records for Canadian Poison Centres

Figure 13. Yearly number of case records tracked by five Canadian poison centres.
Note: range of years in which data was available differed between the included poison centres.



Based on data from five Canadian poison centres that collectively serve 11 provinces and territories (British Columbia, Yukon, Alberta, Saskatchewan, Northwest Territories, Nova Scotia, Prince Edward Island, Ontario, Manitoba, Nunavut, and Québec), 209,534 cases were recorded in 2018 by local poison centres, which averages to 574 poison centre cases recorded per day.

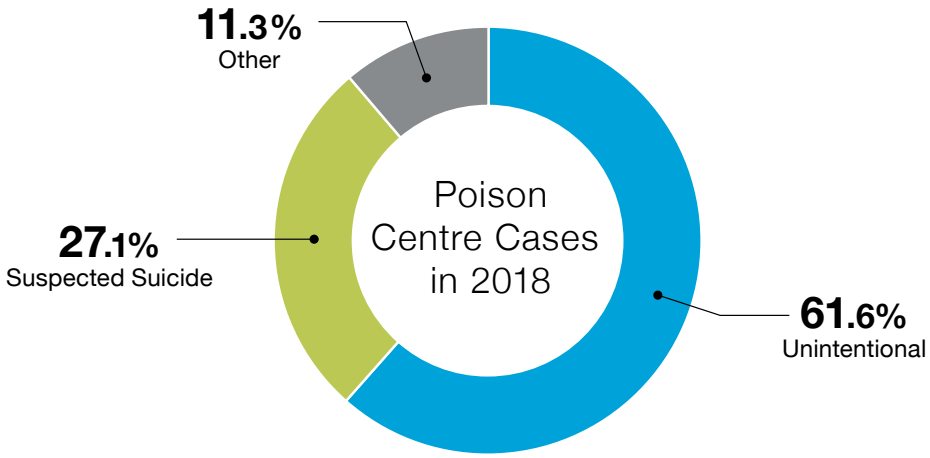
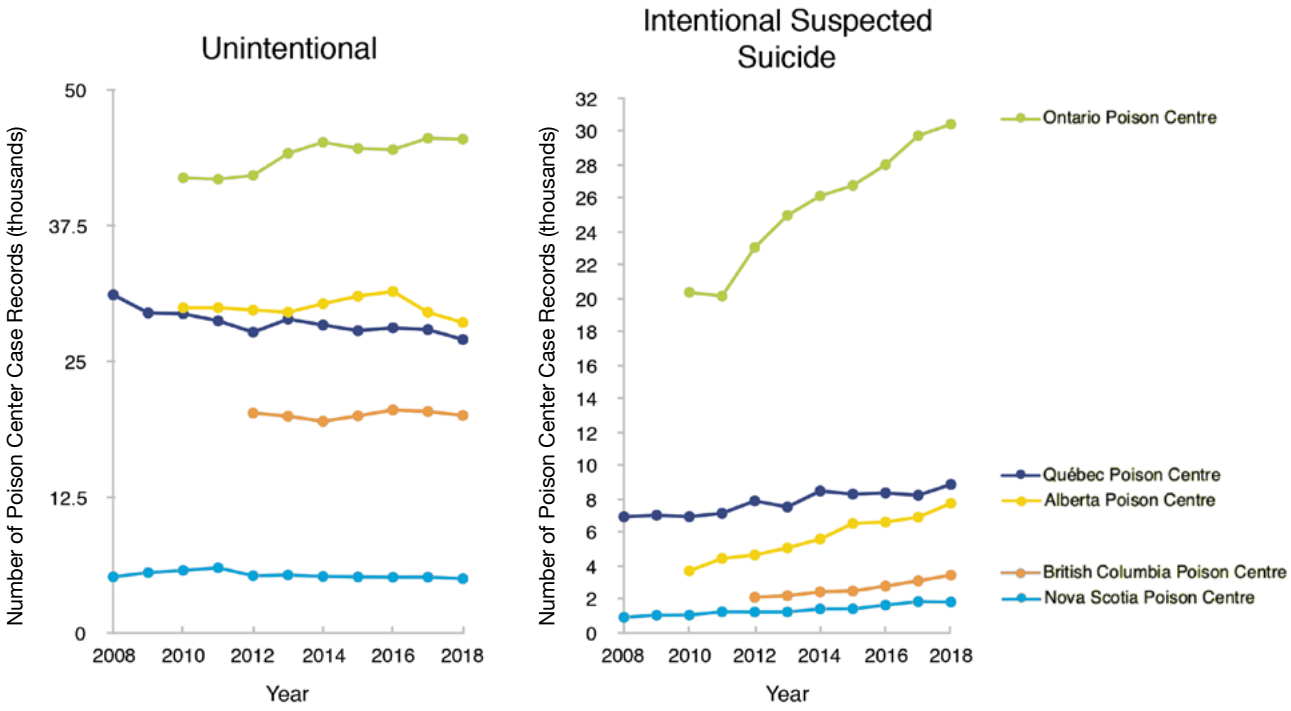


Figure 14. Proportion (percentage) of poison centre cases by intent in 2018. Data from the British Columbia, Alberta, Ontario, and Nova Scotia poison centres. Note: Québec poison centre data not included due to differences in coding of intent.

With respect to intent, the large majority of poison centre case records in 2018 were classified as being unintentional poisoning episodes. Importantly, more than a quarter of these poison centre cases in 2018 were classified as being a suspected suicide.

Figure 15. Number of poison centre case records classified as being unintentional (left) and suspected suicide (right) by provincial poison centres, 2012 to 2018. Note: Data from the Québec Poison Centre is coded differently than the other Centres; as such, only cases coded as strictly unintentional (involontaire) and intentional (volontaire; which includes self-harm/ suicide/assault/ homicide cases) are presented.



When poison centre case records data were analyzed by year and intent, results demonstrated that, while cases records for unintentional poisonings remained relatively constant between 2012 and 2018, a steady increase in the number of cases related to suspected suicide attempts was seen across all five poison centres, with the most marked increases seen in the Ontario and Alberta poison control centres.

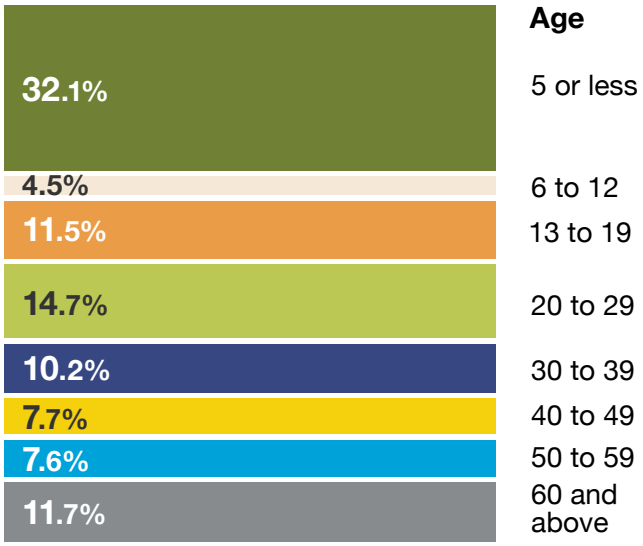


Figure 16. Proportion (percentage) of poison centre cases by age group (years) in 2018. Data from British Columbia, Ontario, Québec, and Nova Scotia poison centres. Note: Alberta poison centre data not included due to differences in age-group reporting.

The largest proportion of poison centre case recorded made in 2018 were concerning children ages five years or less (Figure 16). When considering the location in which cases originated, data from four poison centres indicated 85 per cent of poison centre cases in 2018 originated from a call placed from the caller's own residence while four per cent were from a healthcare facility (Québec Poison Centre data unavailable).

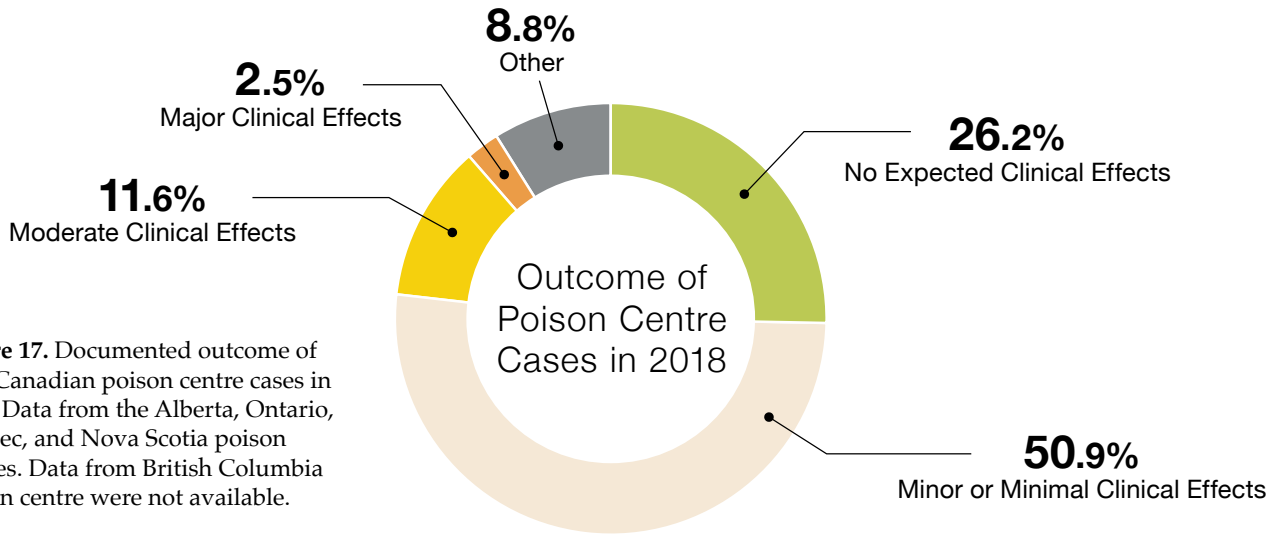


Figure 17. Documented outcome of four Canadian poison centre cases in 2018. Data from the Alberta, Ontario, Québec, and Nova Scotia poison centres. Data from British Columbia poison centre were not available.

When considering the outcome of poison centre cases in 2018, a majority of the cases had either no expected or minimal clinical effects (Figure 17), e.g. self-limited gastrointestinal symptoms (aka "mild GI upset"), skin irritation, first-degree dermal burn, transient cough. A minority of cases had any major clinical effect. Of note, out of the 182,290 poison centre cases in 2018 (excluding British Columbia data), 390 deaths (0.2%) were recorded as an outcome of the exposure.

Data on the specific substances associated with poison centre cases were available for the British Columbia, Nova Scotia and Québec poison centres (Appendix C). Analgesics and household cleaners were the leading pharmaceutical and non-pharmaceutical causes for cases at all three of the included poison centres.

Limitations of Poisoning Data

Several limitations of the poisoning data in this Evidence Summary should be mentioned and kept in mind when interpreting the data presented. Firstly, the statistics for mortality due to poisonings are based on the underlying cause of death. This is an important point as poisonings can often play a pivotal role in deaths but may not be coded as the underlying cause of death. For example, a death due to a motor vehicle collision under the influence of drugs or alcohol would most likely be coded as a traffic-related cause of death with poisoning being a supplementary factor. Thus, the statistics presented in this Evidence Summary can be seen as only conservative estimates as to the true burden of poisonings in Canada. Secondly, the data in this Evidence Summary do not capture the growing burden of substance-related, addictions, and mental-health conditions that often involve substances such as opioids and other illicit drugs. Data on deaths, hospitalizations, and emergency department visits due to mental health, addictions and substance-use-related conditions are beyond the scope of this Evidence Summary and are captured using different ICD-10 codes than the ones used presently. As such, while the data in this Evidence Summary present the overall impact of poisonings in Canada, it does not allow for interpretation of trends or patterns in substance-use, illicit drug use, or addictions and mental health issues. Data on emergency department visits (CHIRPP) due to poisoning in Canada reflect only that of the participating hospitals and not all emergency departments in the country and thus may not be completely

representative or generalizable to all centres across Canada. Lastly, hospitalization data were unavailable from the province of Québec.

Limitations of data from Canadian poison centres include the fact that majority of cases are self-reported by individuals, with the possibility of errors on the part of the caller and the limitation that exposures to the substance are not always confirmed. The data presented may also not be entirely reflective of the entire country as a majority of calls received by a particular poison centre is from the province it is situated in. Several jurisdictions in Canada do not have a local poison centre of their own and instead rely on services of nearby poison centres in another province.

Economic Burden of Unintentional Poisonings in Canada

In addition to the human toll, poisonings also place a major economic burden to the Canadian healthcare system and society as a whole. Health economic analyses often distinguish between direct and indirect costs to society due to specific illness or injury. Direct costs include the goods and services used in the diagnosis and care of afflicted individuals. These can include, but are not limited to, costs associated with hospitalization, emergency room visits, outpatient care programs, long-term care facility costs, and healthcare administrative costs. In contrast, indirect costs reflect decreased productivity due to morbidity, disability and premature death based on estimates of average lifespans, average earnings and workforce participation rates.

In The Cost of Injury in Canada Report published in 2015 by Parachute, unintentional poisonings were the third-leading cause of overall injury costs, accounting for $1.26 billion in 2010, equivalent to $1.46 billion in 2020 (Parachute, 2015). Table 1 presents direct, indirect and total cost estimates due to unintentional poisonings by province in 2010. An important limitation of this analysis was that only costs associated with unintentional poisonings were included; hence, these figures can be seen as conservative estimates as they do not consider the economic burden associated with intentional poisonings. Lastly, these estimates also do not take into account the intangible costs of human suffering and pain experienced by patients and their loved ones due to poisoning that are difficult, if not impossible, to quantify.

Province	Direct Costs ($ millions)	Indirect Costs ($ millions)	Total Costs ($ millions)
Alberta	66	59	125
British Columbia	63	180	243
Manitoba	14	49	63
New Brunswick	10	18	27
Newfoundland and Labrador	5	4	9
Nova Scotia	9	25	34
Ontario	134	359	494
Prince Edward Island	0.001	0.002	0.003
Quebec	65	108	172
Saskatchewan	21	41	62
CANADA TOTAL	**396**	**868**	**1264**

Table 1. Economic cost of unintentional poisonings in Canada by province, 2010.

Source: The Cost of Injury in Canada, Parachute 2015.

EMERGING POISONING ISSUES

Over the past decade, several issues and changing trends in poisoning have emerged. The legalization of cannabis, the opioid crisis and the introduction of new products such as laundry detergent pods have resulted in an increase in calls to poison centres, emergency responses and the healthcare system as a whole.

Cannabis

Cannabis is an overarching term used to refer to the various preparations of the *Cannabis sativa* plant, including marijuana (dried and crushed leaves or flower buds), hashish (flower bud resin), and cannabis extracts (oils or wax) (Grant and Bélanger, 2017). Common colloquial terms used to refer to cannabis products include "weed" and "pot". Cannabis products can be ingested in the form of edibles (e.g. cookies and candies) or inhaled as smoke or vapour. The use of cannabis in Canada has become increasingly prevalent following its legalization in October 2018 with recent figures from a 2019 survey indicating an estimated 18 per cent of Canadians having used cannabis in the past three months, equivalent to approximately 5.3 million people, increasing from only 14 per cent of the population in the year prior to legalization (Statistics Canada, 2019c). Importantly, a major component of this increase was due to an estimated 646,000 new first-time users of cannabis during the first quarter of 2019 following legalization (Statistics Canada, 2019c). Males rather than females (22 per cent vs. 13 per cent of respective populations) and individuals ages 15 to 24 years rather than those 25 years and older (30 per cent vs. 16 per cent of respective populations) were more likely to consume cannabis, which remained unchanged post-legalization (Statistics Canada, 2019c).

Bill C-45: the Cannabis Act sets the legislative framework for the regulation and control of production, distribution, sale and possession of cannabis in Canada (Cannabis Act, 2018). Importantly, the Act restricts youth under the age of 18 years from access to cannabis, prohibits promotions designed to encourage use of cannabis among youth, establishes strict product safety and quality requirements and regulates the access to quality-controlled cannabis.

Though now legalized, it is important to recognize that cannabis is not a completely benign substance; there are several risks and harms associated with its use. In particular, children are a population of concern with respect to acute cannabis poisoning, especially when considering the fact that cannabis edibles often resemble non-cannabis-containing foods (e.g. cookies and candies). Signs and symptoms of acute cannabis poisoning vary by age. In children, acute cannabis poisoning can present as ataxia (loss of control of body movements), excessive or purposeless motor activity of the extremities, lethargy, sleepiness, vomiting, as well as dilated or constricted pupils (Wang 2019). These clinical signs and symptoms are often non-specific to any one condition, which can potentially delay diagnosis and treatment especially in non-verbal children who cannot report what they have ingested. In adults and adolescents, acute cannabis poisoning can present in a number of ways, including an elevation in heart rate, blood pressure, and respiratory rate, ataxia, slurred speech, and reddening of the eyes among other signs and symptoms (Wang, 2019). Edible cannabis products raise considerable concern as their psychoactive effects and signs of possible intoxication can be delayed by several hours following ingestion when compared to inhalation, which may provoke some individuals to ingest larger amounts initially under the impression that there are no harms, only to feel the cumulative toxic effects hours later.

Research in the U.S. has shown that reported cases of cannabis poisoning among children increased significantly following legalization

in certain states (Wang et al., 2013; Wang et al., 2014; Wang et al., 2016). This may be explained by the increased availability and potential for unintentional exposures to children following legalization; it may also be the case that, prior to legalization, parents and caregivers may not have readily reported exposures for fear of the associated stigma and possible legal repercussions. In Canada, cannabis was associated with nearly 40 per cent of substance-related hospitalizations among youth ages 10 to 24 in 2017 to 2018 (pre-legalization), topping alcohol as the most commonly documented substance in this age group (Canadian Institute for Health Information [CIHI], 2019). The opposite was true for those aged 25 and older, in which alcohol was associated with 58 per cent and cannabis associated with only 11 per cent of substance-related hospitalizations, respectively (CIHI, 2019). Data from the Québec provincial poison centre indicate that calls related to cannabis have more than tripled following legalization (Centre antipoison du Québec, 2019).

In response to the growing concern about unintentional cannabis exposures among children, additional regulations were passed under the Cannabis Act in October 2019 that require cannabis products be 1) limited to a maximum of 10 mg of total tetrahydrocannabinol, the main psychoactive compound in cannabis 2) placed in child-resistant packaging and 3) wrapped in plain packaging with the appropriate warning and health labels. These new regulations, among other additional measures, seek to address concerns regarding the safety of Canadian children and the general public. As the legalization and introduction of several regulations on cannabis have been in place only recently, future surveillance and research is required to determine whether further efforts are needed to prevent acute cannabis poisonings among Canadians.

Opioids and Illicit Drugs

Poisonings as a result of illicit drug use are a growing issue across North America. Specifically, substances classified as opioids (e.g. heroin, fentanyl) have become a major cause of mortality and morbidity across Canada to the point of a national crisis. Poisoning from opioids classically presents as a triad of signs and symptoms including pinpoint pupils, respiratory depression and decreased level of consciousness. In 2018, 4,614 deaths were a result of opioids, equating to approximately 13 lives lost per day (PHAC 2019). Hospitalizations due to opioid poisoning have also increased by 27 per cent from 2013 to 2017, with an estimated 17 hospitalizations per day in Canada due to opioid poisonings (Canadian Institute for Health Information, 2018). Western Canada has been one of the most impacted regions, with British Columbia having declared a public health emergency in 2016 due to the rapidly increasing number of illicit drug toxicity deaths (BC Government News, 2016). Individuals using illicit substances can be at increased risk for poisoning events despite using their usual amount of substances as there is growing concern regarding contamination with fentanyl and other ultrapotent opioids that can lead to respiratory arrest and death. Recent statistics from B.C. indicate that, of the 1,542 deaths due to illicit drug use in 2018 (rate of 30.9 per 100,000 persons), fentanyl was detected in 87 per cent of these cases (BC Coroners Service, 2019).

Importantly, the increase in mortality and morbidity seen with the opioid crisis is largely due to unintentional poisonings as opposed to intentional self-harm or suicides by poisoning. Research conducted in Alberta demonstrated that, from 2000 to 2016, there was no proportionate rise in the number of opioid-related suicide cases in the province in comparison to the significant rise in unintentional opioid-related deaths (Chang et al., 2018). A similar study conducted in the U.S. found that, while the absolute rate of opioid-

related suicides increased from 2000 to 2017, the proportion of opioid-related deaths that were classified as suicides decreased from nine per cent to four per cent (Olfson et al., 2019). Together, these findings suggest that deaths from unintentional opioid poisonings and those from suicide using opioids are likely distinct populations with the former experiencing the disproportionate rise amidst the opioid crisis. This may further indicate that addressing these two issues would likewise require two differing public health approaches as opposed to an overarching response. However, it is important to recognize that the exact categorization of intent between unintentional and suicide may be difficult to distinguish among individuals using opioids and other illicit substances as the exact motivations are often unclear in those with a substance use disorders and/or mental health issues. Coroners and medical examiners are often unable to determine the intent of an opioid-related death with absolute certainty, having to rely on autopsy data and circumstantial evidence from the scene and any witnesses. Indeed, research has shown that poisonings of undetermined intent constitute as much as 80 per cent of all undetermined intent deaths in Canada (Skinner et al., 2016), suggesting that many of these deaths may be misclassified suicide cases.

The reasons and causes of the rising deaths due to illicit drugs and opioids are complex and multifactorial with research currently underway to delineate possible etiologies and risk factors. One such factor is the growing rate of contamination found in illicit drugs with fentanyl and other ultrapotent opioids (BC Coroners Service, 2019), placing individuals using these substances at increased risk for poisoning events and possibly death. Misuse of prescribed opioid medications has also been linked to subsequent illicit drug use, with research suggesting as many as 80 per cent of heroin users previously misused prescription opioids (Muhuri et al. 2013). A recent Canadian national qualitative study interviewing medical examiners, coroners and toxicologists about their experiences during the opioid crisis identified several key characteristics about individuals that died due to illicit drug poisonings (PHAC, 2019):

- Individuals came from all sociodemographic and socioeconomic groups
- A history of mental health issues, substance use disorder or trauma was common
- Poisoning deaths were often triggered by drug use after a long period of not being exposed regularly to drugs (e.g. while incarcerated or in a treatment centre) when the body had developed reduced tolerance to the substance
- Individuals were often using substances alone with a lack of social supports, suggesting a strong component of social isolation
- The use of many substances together (polysubstance use) as well as contamination with fentanyl and other ultrapotent opioids were common

Together, these findings suggest that rather than discrete and identifiable factors that influence risk, broader social, environmental and contextual factors may play a much larger role in influencing any specific individual's risk for poisoning due to illicit substances. As such, public health and prevention efforts aimed toward reducing the number of opioid and illicit drug poisonings should address individual, social and system-wide factors.

E-Cigarettes and Vaping Fluid Poisoning

Electronic cigarettes (e-cigarettes) refer to a wide range of small, battery-operated devices that convert an "e-liquid" that typically contains nicotine and may also contain varying compositions of flavourings, propylene glycol, vegetable glycerin and other ingredients. The liquid is heated to create an aerosol that the user inhales. This practice is commonly referred to as "vaping".

E-cigarettes mimic the smoking experience, but no actual combustion, burning or smoke production occurs. A similar process of inhaling very hot vapours from heating cannabis oils, concentrates, or extracts is referred to as "dabbing".

E-cigarettes have shown a steady increase in popularity in Canada since their introduction in 2006, with 15.4 per cent of Canadians reporting ever having used an e-cigarette in 2017 (Reid et al., 2019). In particular, youth and young adults have become a significant user group with surveys in the U.S. indicating that e-cigarettes are the most commonly used smoking-related product among American middle and high school students, with an estimated 30 million users in 2015 (Singh et al., 2016). Similarly, in Canada, an estimated 22.8 per cent of Canadians ages 15 to 19 and 29.3 per cent of those ages 20 to 24 years have tried an e-cigarette (Reid et al., 2019). This rapid growth may in part be due to developers/vendors advertising their products as a cheaper, healthier and safer alternative to traditional cigarettes (Palazzolo, 2013). Indeed, emerging evidence suggests that, while e-cigarettes appear to pose fewer health risks compared to traditional cigarettes (National Academies of Sciences, Engineering, and Medicine [NASEM], 2018), they are not without harms. While e-cigarettes contain fewer combustion-associated toxicants compared to traditional cigarettes, their use is not completely benign as has been demonstrated with the recent outbreak of e-cigarette- and vaping-associated lung injury in the U.S. and Canada (discussed in greater detail below). The long-term inhalational effects and second-hand vapour exposure are not fully known (NASEM, 2018), with recent literature suggesting significant respiratory health effects comparable to traditional tobacco cigarettes (Gotts et al., 2019). As such, it is strongly recommended that youth, individuals who are pregnant and those who are currently not smoking should not take up e-cigarette use or vaping.

With the rising popularity of e-cigarettes coupled with the inconclusive research as to their risks and health effects, it comes as no surprise that there is growing concern among clinicians and public health professionals. A particular worry is the risk of poisoning when a child is exposed to the nicotine-containing liquid used in e-cigarettes. Recent statistics from the US National Poison Reporting System indicate that the monthly calls related to e-cigarette exposures among children younger than six years old have increased nearly 1,500 per cent from 2012 to 2015, with one fatality during this time period (Kamboj et al. 2016). The same study also found that children younger than two years old accounted for more than 40 per cent of all e-cigarette exposures and that those exposed to e-cigarettes were 5.2 times more likely to be hospitalized compared to an exposure to traditional cigarettes (Kamboj et al. 2016). In Canada, data from the British Columbia Drug and Poison Information Centre indicate that exposures related to e-cigarettes have increased significantly from 2012 to 2017, with children younger than five years of age accounting for 43.5 per cent of total documented exposures; over half these cases were as a result of unintentional ingestion of e-cigarette liquid (Choi et al. 2019). Nicotine can have toxic effects in children ranging from vomiting, seizures, changes in mental status and, in the most severe cases, can lead to cardiovascular/respiratory failure and death if not treated promptly (Normandin & Benotti, 2015). Children are particularly at risk for poisoning as physiologically their bodies are

still developing. The exact lethal dose of nicotine in children is unknown but estimates have suggested that as little as one to 10 mg/kg can result in death (Durmowicz, 2014). Furthermore, unintentional ingestions of e-cigarette liquids may also be due to the fact that the liquids used for e-cigarettes had often come in flavours such as cherry, chocolate and cotton candy that are attractive for young children.

In response to the growing prevalence of e-cigarette use and public safety concerns, the Canadian Government legalized the use of e-cigarettes with and without nicotine with the passing of Bill S-5: *an Act to amend the Tobacco Act and the Non-smokers' Health Act and to make consequential amendments to other Acts* in May 2018 (Bill S-5, 2018). This Act created the legal framework in which to regulate the manufacturing, sale, labelling and promotion of e-cigarette products in Canada by creating the *Tobacco and Vaping Products Act* (TVPA). Upon royal assent of the Act, vaping products that contain nicotine and are not marketed for a therapeutic use are considered consumer products and subject to the Canada Consumer Product Safety Act (CCPSA) (Canada Gazette, 2019). Importantly, the TVPA and other associated regulatory authorities have taken several measures in hopes of preventing unintentional poisonings, including, but not limited to:

- Banning the sale of e-cigarettes and associated products to persons under the age of 18
- Banning the promotion of e-cigarette products using specific flavour descriptors or illustrations that would be appealing to children and youth
- Banning the inclusion of certain flavour types including confectionery and dessert
- Requiring all e-cigarette products to have clear labelling of ingredients, health warnings, and nicotine concentration
- Setting the legislative framework for further proposed regulations requiring child-resistant packaging and labelling as consistent with the Canada Consumer Product Safety Act

As the implementation of the TVPA and subsequent regulations are still in the early stages, it remains unclear as to what the exact effects of this legislation will have on preventing e-cigarette-related poisonings among Canadians. However, with the fact that e-cigarette use is on the rise, policy makers are at a crucial point in time where strategic and well-informed decisions can have a major impact on preventing poisonings related to e-cigarettes among Canadian children. For further information on the status of e-cigarettes and vaping products in Canada, please refer to the Government of Canada info page, available at: www.canada.ca/vaping

E-CIGARETTE/ VAPING-ASSOCIATED LUNG INJURY/ ILLNESS IN THE U.S. AND CANADA

The emergence in 2019 of e-cigarette/ vaping-associated lung illness/injury (EVALI / VALI) in the U.S. and Canada (US CDC, 2020; Health Canada, 2019), also known as severe pulmonary illness associated with vaping, has raised additional concerns about the short- and longer-term effects of vaping.

In the U.S., the number of persons admitted to hospital and the number of deaths related to EVALI continue to decline from the outbreak peak, which occurred in September 2019. As of February 4, 2020, almost 2,800 patients have been hospitalized and more than 60 people have died from EVALI across the U.S. The median age of patients was 24 years (13 to 85 years) while the median age of deceased patients was 51 years (15 to 75 years). Most patients reported using e-cigarette products containing tetrahydrocannabinol (THC), with 33 per cent reporting exclusive use of THC products and 57 per cent of patients reported using nicotine

products, with 14 per cent reporting exclusive use of nicotine products. Vitamin E acetate, which is added to some THC-containing products, is strongly linked to the EVALI outbreak in the US. THC containing e-cigarette, or vaping products, particularly from informal sources such as friends, family, or in-person or online dealers, are linked to most EVALI cases and played a major role in the outbreak. However, according to the Centers for Disease Control and Prevention in the U.S., there is still not enough evidence to rule out the contribution of other chemicals, including chemicals in either THC or non-THC products, in some of the reported EVALI cases (Health Canada, 2019). Cases of EVALI-like illness have been reported in five other countries.

In Canada, there have been proportionally fewer cases of VALI than expected based on the extent of the U.S. EVALI outbreak. As of February 11, 2020, 18 cases of VALI have been reported to the Public Health Agency of Canada by the provincial and territorial health authorities, with no deaths (Health Canada, 2019). Fourteen people have required admission to a hospital. Four cases are youth 15 to 19 years; five are between 20 and 34 years; four are between 35 and 49 years; and five are 50 years and older. Ten cases are male and eight are female. Ten cases reported vaping nicotine only; four cases reported vaping THC only; one case reported vaping flavoured liquid only; and three cases reported vaping a variety of substances, including THC and nicotine. Eight cases reported buying their vaping products in Canada; two reported buying online (US CDC, 2016).

While the cause of EVALI/VALI is still under investigation in both the U.S. and Canada, Canadians concerned about the health risks related to vaping should consider refraining from using vaping products. Vaping products may contain dozens of chemicals. Most vaping substances available for sale are flavoured and contain nicotine. Vaping may predispose youth to addiction to nicotine and possibly other drugs (Health Canada, 2020). Heath Canada advises that young people, persons who are pregnant, and those who do not currently vape should not vape (Health Canada, 2020).

Laundry Detergent Pods

Laundry detergent pods consist of concentrated liquid detergent available in small, single-use packets surrounded by a thin, water-soluble membrane (Beuhler et al., 2013). Introduced to the North American market in 2012, these single-use pods were marketed as convenient alternatives to more traditional bulk liquid and powder laundry detergents. Laundry pods are commonly manufactured with a transparent water-soluble membrane, allowing the colourful detergents to be visible, and often in large containers containing large numbers of the single-use pods. As such, laundry pods pose a significant concern as an important emerging poisoning hazard. Exposure to the liquid laundry detergent pods has been documented to be associated with vomiting, respiratory depression with central nervous system effects, aspiration pneumonia and even death when ingested (Banner et al., 2020). Ocular injuries have also been reported whereby the liquid detergent can squirt into an individual's eyes when the soluble membrane is broken (Haring et al., 2017).

Young children are the primary population at risk for unintentional poisoning as these colourful, transparent laundry pods often resemble candies or toys. Data from the U.S. indicate that, from 2012 to 2017, U.S. poison control centres received 72,947 calls related to laundry detergent pods, with more than 91 per cent of these exposures occurring in children younger than six years old (Gaw et al. 2019). The same study demonstrated that, while laundry detergent pod exposures in this age group increased more than 110 per cent from 2012 to 2015, there was a relative decrease of 18 per cent observed through 2017. The authors argue this may be attributable to several public awareness campaigns and the introduction of a voluntary product safety standard, ASTM F3159-15, in

2015 (Gaw et al., 2019). Indeed, in the year following the initial market release of laundry detergent pods, some manufacturers-initiated changes toward opaque pods, clearer health and warning labels and child-resistant container latches (Procter & Gamble, 2013). This was followed by proposed legislation in the United States requiring the Consumer Product Safety Commission (CPSC) to establish mandatory safety standards for liquid detergent packets (Bill H.R.1139 – Detergent Poisoning and Child Safety Act of 2015), as well as several public health awareness campaigns from pediatric, child safety and injury prevention organizations.

While unintentional poisonings due to laundry detergent pods appear to be curtailing among young children since 2015 (American Association of Poison Control Centers [AAPCC], 2019), a separate phenomenon of *intentional* laundry detergent pod ingestions emerged as a recent trend among teens. The viral trend was commonly described as being a "challenge" in which youth upload videos of themselves intentionally ingesting the laundry detergent packets to various video-sharing and social media platforms to challenge others to do the same. Data from the U.S. indicate that intentional ingestions of laundry detergent pods are on the rise, with 39 and 53 reported cases in 2016 and 2017 (AAPCC 2018a), respectively, and 86 cases within the first three weeks of 2018 (AAPCC 2018b). This rise in intentional poisonings resulted in several statements issued by manufacturers, government bodies and health organizations emphasizing the harm and dangers associated with ingesting laundry detergent pods, and sites such as YouTube and Facebook forcibly removing any videos or posts encouraging the challenge.

In addition to the identified poisoning risk of laundry detergent pods to young children and adolescents, there have been reports of laundry detergent pod poisonings among older adults with cognitive impairment (Janeway, 2017). Older adults with cognitive impairment (e.g. dementia, Alzheimer's disease) can mistake the colourful pods for food or medicines and end up unintentionally ingesting them, resulting in potentially dire consequences. As such, extra precautions should be taken when storing laundry detergent pods (as well as any other potentially poisonous substances) to reduce the potential for unintentional poisonings among older adults with cognitive impairments.

POISONING PREVENTION BEST PRACTICES

Evidence-informed public health is "the process of distilling and disseminating the best available evidence from research, context and experience, and using that evidence to inform and improve public health practice and policy" (National Collaborating Centre for Methods and Tools, 2013). It is the process and practice of making decisions and creating change to promote health and wellbeing. This is different from classically defined evidence-based practice that, in principle, suggests practice decisions are made from clinical research studies. Over the past few decades, it has been recognized that there is much to be gained from the evidence of prevention in "real world" practice, including evidence from practitioners, stakeholder, knowledge users and other resources. In the current healthcare environment of scarce resources and competing issues, it is important that existing efforts and resources are focused on programs that are effective and evidence-based.

Using an evidence-informed approach in prevention planning ensures that the use of different types of evidence occurs at more than one point in the planning process (MacKay 2005). Knowledge of this process is essential in order to ensure a plan has real impact and uses

scarce resources effectively. There are essential components that need to be considered, which include:

- using the best available research
- considering the local health issues and local context
- using existing public health resources
- understanding the community and political climate

(National Collaborating Centre for Methods and Tools, 2013; Brownson et al., 2009; Saunders et al., 2005; Ciliska et al., 2010).

A model that emerged in post-Second-World-War industrial safety programs was organized around the Three Es of Safety: Education, Enforcement and Engineering.

The Three Es of Injury Prevention

Education - The public, given information or skill training, will retain what has been taught and use it to reduce the risk of injury.

Enforcement - Includes the creation and enforcement of laws, regulations and policies aimed at reducing injuries. These strategies are generally effective when enforced; however, they are often a contentious public issue as opponents often characterize them as limiting personal freedoms.

Engineering - Engineering strategies involve developing or modifying products and environments to make them safer. Generally, engineering efforts are very effective.

The major contribution of the 3 Es model of injury prevention has been the shift in focus from injuries being seen as the sole responsibility of the person injured to the recognition that others (e.g., employers, supervisors, equipment manufacturers, policy makers, designers of the built environment, whole community) have a collective responsibility to prevent injuries. Multi-faceted initiatives that use more than one strategy have the greatest chance for success (MacKay et al., 2011).

This is the framework that underpins the approach of the injury prevention field of practice.

Poison Centres

Toll-free phone-in poison centres are effective in helping determine whether a child is at risk from a potential poisoning and what actions a health professional, parent or caregiver should take. Poison centres are staffed by trained specialists who can provide information on whether treatment is required, provide guidance and education, and collect data as part of surveillance programs. Research has further shown that establishing poison control centres can result in considerable cost savings by diverting appropriate cases from emergency rooms if the public is well informed about them (Miller & Lestina, 1997; Bunn et al., 2008; Vassilev & Marcus, 2007; Blizzard et al., 2008). A report from the Nova Scotia Poison Centre states that 86 per cent of cases would have gone to emergency rooms were it not for the information provided by the phone-in centre (IWK Health Centre, 2010). Indeed, for every dollar spent on a poison control centre, an estimated more than seven dollars are saved by avoiding unnecessary healthcare visits (Blizzard et al. 2008). It is recommended that the phone number for the local poison information centre should be kept nearby the phone in every household that has a landline as well as stored in the contacts list of cellphones for ease of access. A 2019 Ipsos online survey of Canadian parents found that only 40 per cent of parents know their local poison contact information (Ipsos, 2020).

The role of poison centres in monitoring trends is important. Their links to other organizations, for example Health Canada's Consumer Product

Safety Directorate, provincial, territorial and local public health agencies and injury prevention centres, are important as they are on the front lines tracking, reporting and monitoring poisoning in Canada. Based on monitoring trends and the data from their cases, poison centres can inform and disseminate key messages as well as alert regulatory agencies and the public to emerging issues.

Changing and Influencing Legislation and Policy

Public health policy, in the form of legislation and regulations, has long been seen as an effective tool in improving the health of populations. Indeed, several landmark public health achievements of the 20th century that have significantly improved life expectancy have each based their effects on changes at the policy level (US Centers for Disease Control and Prevention,1999). As such, legislation at the local, provincial and national level can often have major impacts on reducing poisonings. Legislation can control the types of foods, drugs and chemicals allowed for sale in Canada as well as their safe and sanitary manufacturing and packaging to protect consumers and the public. Importantly, policy changes should be informed by the best available evidence, including both quantitative (e.g. epidemiogical data and trends, mathematical modelling) and qualitative (e.g. narrative interviews, focus group statements) evidence. The following Canadian federal Acts and their associated regulations each have sections that relate to the protection of people from poisoning:

- *The Food and Drugs Act* and Associated Regulations
  - Available at: http://www.hc-sc.gc.ca/fn-an/legislation/acts-lois/act-loi_reg-eng.php
- *The Canada Consumer Product Safety Act* and Associated Regulations
  - Available at: http://laws-lois.justice.gc.ca/eng/acts/C-1.68/index.html
- *The Pest Control Products Act*
  - Available at: http://laws-lois.justice.gc.ca/eng/acts/P-9.01/
- *The Cannabis Act* and Associated Regulations
  - Available at: https://laws-lois.justice.gc.ca/eng/acts/c-24.5/
- *The Tobacco and Vaping Products Act*
  - Available at: https://laws-lois.justice.gc.ca/eng/acts/T-11.5/

Safer Medication and Substance Packaging

Child-resistant packaging has been shown to significantly reduce death and injury (Rodgers, 2002). Child-resistant packaging is required by law for certain medications (Chien et al., 2003). The standards required for child-resistant packages state that packages be difficult for children younger than five years of age to open and obtain a toxic amount within a reasonable time (Health Canada, 2007). It is considered impossible to manufacture a package or a closure that would prevent every single child from getting into the contents under all possible circumstances. Most child test protocols require that at least 80 per cent of children being tested be prevented from opening the container during a 10-minute test. This requirement means that some children are likely to be able to open a container, if given enough time to do so and, therefore, even medications with child-resistant caps must be kept locked up (Health Canada, 2007). Requiring products to have child-resistant packaging is also cost-effective, with recent estimates from the Government of Canada regarding requirements for cannabis products suggesting that the benefits associated with mandatory child-resistant packaging would exceed their costs if one emergency department visit due to poisoning was prevented every 7 to 29 days, or one death prevented every 24 to 92 years (Government of Canada, 2019).

From a design perspective, avoiding colourful and enticing packaging designs may also serve to make containers more child resistant. This

is particularly important when considering how common cleaners and detergents are often brightly coloured and can resemble candies or juice. Furthermore, the emerging trend of e-cigarettes has led to an increasing market for different flavours of liquid nicotine, many of which have both names and packaging designs that can be enticing for young children. As such, requiring potentially harmful substances be placed in plain, opaque packaging represents a simple method to deter children and prevent unintentional poisonings. Research has shown that opaque packaging and the colour black are helpful for young children to recognize potentially harmful products (Schwebel et al., 2014). Similarly, plain packaging may also prevent poisonings among the elderly, especially in those with cognitive decline from mistaking poisonous products from candies and other edibles.

Unit dosing (e.g. blister packages) has also been used as a technique for preventing poisonings. Requirements for unit dosing of certain medications has yielded promising results of reducing unintentional exposures among children, with data from the U.S. confirming decreases in iron poisoning rates in young children following legislation requiring the medication be unit-dose packaged (Tenenbein 2005). Furthermore, unit-dose packaging may also prevent teen and adult suicide attempts using medications as it is thought that suicidal thoughts or crises are often short and influenced by impulsiveness, which suggests that limiting a person's access to large amounts of medications by unit dosing may deter and prevent suicide attempts (Daigle, 2005; Sarchiapone et al., 2011). Unit-dosing in the form of organized blister packages is also commonly used for the elderly to decrease any mistakes when medications are self-administered.

Placing limits on the total quantity of potentially harmful medications that can be purchased in a single package has also been proposed as a straightforward method of preventing unintentional poisonings in all ages. While this intervention seems promising in theory, available evidence indicates mixed success. Research has shown that when the package size for acetaminophen was restricted in the United Kingdom, the average total dose ingested by patients presenting to hospital for acetaminophen poisoning decreased. However, there was no observed change in the number of patients who had ingested larger amounts in excess of 50 pills (Bateman, 2009). In Canada, acetaminophen became more readily available after restrictions that limited the sale of acetaminophen doses greater than 325mg and packages containing more than 24 pills to only pharmacies were lifted in 1999. Though availability increased, there was no associated increase in the rate of reported hospitalizations related to acetaminophen poisoning (Prior et al. 2004). Together, this suggests that preventing poisonings may not be as simple as decreasing availability and package size but rather may require a layered approach of several engineering and design changes that together may protect individuals from poisoning.

Safe Storage

Storage of poisonous substances in a location inaccessible to children is essential as, while containers can be child resistant, they are not child *proof*. A proportion of young children may be able to open containers in short periods of time and more could do so if given longer periods of time. Safe storage of poisonous substances requires proper behaviour of adults in all homes where children live or visit. Research has shown that most unintentional poisonings among young children occur with substances stored in locations that do not require the child to climb (Ozanne-Smith, 2001). A recent national poll of American older adults inquiring about practices when caring for their grandchildren revealed that more than 80 per cent of those polled kept their medications in the same location when their grandkids visited, with only five per cent reporting they place their

medications in a locked cabinet or cupboard (Malani et al., 2019). When taking medications with them to visit their grandchildren, 72 per cent reported keeping their medications in a bag or purse and seven per cent leaving them on an open counter (Malani et al., 2019). Parents have also been shown to demonstrate improper storage practices, with a survey suggesting while 90 per cent of those polled agree it is important to store medications out of a child's sight, only approximately 30 per cent of those polled actually reported doing this (SafeKids, 2017). In addition to preventing poisonings among young children, safe storage of potentially harmful substances can also prevent poisonings among older adults with cognitive impairments such as dementia and Alzheimer's disease.

Furthermore, it is important to keep medications and other harmful substances in their original containers, especially if these containers have a child-resistant packaging design. A study from British Columbia has shown that a significant portion of poison centre cases were related to substances transferred to food or beverage containers (Lepik et al., 2003). Removing medications from their original containers is often done for convenience, with polls indicating as many as 29 per cent of grandparents choose to use other containers and, among these individuals, 83 per cent report that the new containers are pill boxes or other easily opened containers that are not child-resistant (Malani et al., 2019).

In short, the key message to all parents and caregivers regarding safe storage of medications, cleaners and any other potentially harmful substances is to keep them in their original, child-resistant packaging (if applicable) and to store them in high, locked-away spaces. The message to manufacturers is to consider the safety packaging of their products.

Carbon Monoxide Detectors

Carbon monoxide (CO) is a toxic, colourless and odourless gas that is a byproduct of combustion. Common sources of CO in the home include gasoline- and electric-powered generators, malfunctioning cooking appliances, furnaces and boilers, and vehicle exhaust. CO poisoning can result in flu-like symptoms at low levels including malaise, headaches, muscle weakness, while at higher levels can result in chest pain, dizziness, vision changes, convulsions and death (Health Canada, 2019). Given the fact that the gas is not detectable to human senses, individuals can often become sick without realizing they are being exposed to CO. Recent data indicate that there are more than 300 CO-related deaths and more than 200 CO-related hospitalizations per year in Canada (Cohen et al., 2017). However, CO poisonings, like other causes of poisoning, are preventable.

The presence of CO can be detected through the use of CO detectors, which detect potentially harmful levels of CO and alert individuals to evacuate the premise. CO detectors are readily available at most hardware stores and are often simple to install. CO detectors have shown to be effective in detecting potentially life-threatening levels of CO (Wheeler-Martin et al., 2015) and preventing deaths due to CO poisonings (Yoon et al, 1998). Poisoning can also be prevented through regular maintenance and inspection of home appliances and ensuring adequate ventilation when using fuel-burning appliances. However, it appears that public knowledge of the risks posed by CO poisoning remains low, with a national survey indicating that 40 per cent of Canadians do not have a CO alarm and 44 per cent of respondents reporting that they do not regularly check their heating systems (Hawkins-Gignac, 2015).

Legislation requiring mandatory CO alarms are effective in preventing and providing early warning of a potential harmful level of CO. Several provinces and one territory have passed legislation making it mandatory to have CO alarms in residential building: they include Alberta, Saskatchewan, Manitoba, Ontario, Quebec and the Yukon. Others do not have mandatory requirement through legislation but rather have requirements through their provincial building codes. However, the same requirements are not necessarily in place for institutional buildings, e.g. schools, leaving a gap in the efforts to prevent CO poisoning.

Carbon Monoxide Detector and Smoke Detector Canadian Legislation Chart

Province/ Territory	Mandatory CO Detector	Mandatory Smoke Alarm	Comments[1]
British Columbia British Columbia Fire Code Article 2.1.3.3	Yes*	Yes	No provincial CO detector law. The City of Vancouver made CO detectors mandatory in the city in May 2017. Smoke alarms must be installed in each dwelling unit.
Alberta Alberta Fire Code	Yes	Yes	All new residential construction containing fuel burning appliances or an attached storage garage require CO detectors to be installed. All dwelling units are required to have a smoke alarm.
Saskatchewan Building Standards Advisory	Yes*	Yes*	CO detectors are required in all buildings where regular sleeping accommodation is provided and the building contains a fuel-fired appliance, a solid-fuel fired appliance, or an attached garage. All homes are required to have smoke alarms.
Manitoba Manitoba Building Code Manitoba Fire Code Regulation	Yes	Yes	CO detectors are mandatory in new homes and other buildings built after 2011, and in structures that require regular fire safety inspections, including: motels, hotels, hospitals, personal care homes, restaurants with living quarters, schools and daycares. A smoke alarm must be installed in each sleeping room and on each floor.
Ontario Ontario Fire Code Fire Protection and Prevention Act	Yes	Yes	CO detectors are required in all buildings that contain a residential occupancy with a fuel-burning appliance, a fireplace or a storage garage. CO detectors must be located adjacent to all sleeping areas of the home and in service rooms, and adjacent sleeping areas in multi-residential units. Smoke alarms are required in all dwelling units, guest suites, sleeping rooms not within a dwelling unit, and other occupancies required under Building Code.

Province/ Territory	Mandatory CO Detector	Mandatory Smoke Alarm	Comments[1]
Quebec Building Act, r.3 Safety Code	Yes	Yes	A CO detector must be installed in every dwelling unit, residential occupancy for the elderly or residential board and care occupancy that contains a heating appliance or direct access to an indoor parking garage. Smoke alarms must be installed in every dwelling unit, on each storey, in each corridor and shared rest or activity area in residential occupancy for elderly that is not equipped with fire alarm and detection system, in each sleeping room, corridor and share rest or activity area of single-family type residential occupancy for the elderly, in sleeping rooms and corridors of a residential board and care occupancy if bedrooms are not equipped with smoke detectors, and in each sleeping room that is not part of a dwelling unit (except in care or detention occupancies, which must be equipped with a fire alarm system).
New Brunswick Fire Prevention Act	Yes*	Yes*	No provincial CO detector law. Smoke Alarms and Smoke Detectors Regulation of the Fire Prevention Act was repealed in 2014.
Nova Scotia Fire Safety Act	Yes*	Yes	No provincial CO detector law. Smoke alarms are required in each sleeping area.
Prince Edward Island Fire Prevention Act	No	Yes	No provincial CO detector law. Smoke alarms are required in all bedrooms, outside each sleeping area, and on each level.
Newfoundland and Labrador Fire Protection Services Act Fire Protection Services Regulations	Yes*	Yes	No provincial CO detector law. Smoke alarms are required in new and existing dwelling units and in each sleeping room not within a dwelling unit, privately owned and occupied seasonal cottages and homes, in all existing one and two family units, owner occupied or rented, unless governed by municipal by-law, and other areas as determined by fire commissioner.
Yukon Oil-Fired Appliance Safety Statutory Amendment Act	Yes	Yes	All Yukon residences with a fuel-burning device or an attached garage are required to have CO detectors. All Yukon homes are required to have smoke alarms on every level of the home and outside all sleeping areas.
Northwest Territories	No	Yes*	No provincial CO detector law. National Building Code of Canada is adopted, requiring smoke alarms in all new dwelling units, sleeping rooms, and on every floor.

Province/ Territory	Mandatory CO Detector	Mandatory Smoke Alarm	Comments[1]
Nunavut	No	Yes*	No provincial CO detector law. National Building Code of Canada is adopted, requiring smoke alarms in all new dwelling units, sleeping rooms, and on every floor.

Endnotes

[1] For information purposes only. Please consult local authorities for further interpretation and current status.

* Adopted National Model Construction Codes — National Fire Code and/or National Building Code.

Interventions for Poisonings due to Illicit Drug Use

Preventing poisonings due to illicit drug use is a complex issue requiring a multifaceted approach that addresses the biological, socio-economic and system-level factors involved. One such strategy that has been adopted in Canada and several other countries around the world (e.g. Germany, Switzerland, Australia) is the *Four Pillars Approach* to drug and substance use. A full discussion of the four pillars approach is beyond the scope of this Evidence Summary; however, a brief overview of each of the components is as follows (Adapted from Health Canada, 2019):

- Harm Reduction: measures that reduce the negative effects and stigma associated with drug and substance use on individuals and their communities, while recognizing that completely abstaining from substance use may not be possible.
- Prevention: includes measures such as resources and educational campaigns to inform Canadians about the risks associated with drug and substance use.
- Treatment: support individuals in receiving treatment and rehabilitation services for substance use disorders and any other associated mental health disorders.
- Enforcement: measures to address illegal production, trafficking and diversion of drugs and substances.

A particular harm reduction intervention that has gained increasing attention is the implementation of supervised injection facilities (SIFs). SIFs provide individuals using substances with a safe and hygienic environment to inject their illicit drugs without fear of legal intervention, access to sterile syringes, needles and safe disposal methods, and medical attention from trained staff if needed. The first SIF in North America, INSITE, was opened in Vancouver, British Columbia, Canada in 2003. Since opening, research conducted out of Vancouver has shown promising results, with reported decreases in needle sharing, usage of substances in public and improper disposal of used syringes, as well as increases in the number of referrals to social services and addictions medicine (Kerr et al., 2005; Wood et al., 2006; Stoltz et al., 2007; Health Canada, 2008). Mathematical modelling of data from INSITE further suggests that the SIF saves approximately one life a year as a result of intervening in illicit drug poisoning events and that there was a positive cost-benefit ratio of as much as $4 saved for every $1 spent on operating the facility (Health Canada, 2008). Since the opening of INSITE, other SIFs have developed around the world with studies showing positive effects. A systematic review of 75 studies on SIFs concluded that they are an effective intervention for marginalized populations using drugs and substances, promote safer injection practices, enhance access to social services and primary care and reduce overdose frequency without increasing overall drug use, drug trafficking or

crime in the surrounding communities (Potier et al., 2014).

Recently, opioid poisonings in Canada have been addressed by the introduction of naloxone distribution programs. Naloxone (brand name: Narcan) is a medication that can rapidly reverse the effects of opioid poisoning and has recently been made available to laypersons in the form of take-home naloxone kits that can be used by bystanders in the event of an opioid poisoning. Currently, every Canadian province and territory has an existing take-home naloxone program in place that provides the public with naloxone kits for free. Analyses of the available literature on the topic overwhelmingly support the fact that take-home naloxone programs are associated with fewer deaths among those using opioids (Chimbar & Moleta, 2018). Research has also shown that, even under conservative estimations, distributing take-home-naloxone kits is a cost-effective strategy in preventing opioid poisonings and deaths (Coffin & Sullivan, 2013; Langham et al., 2018).

Raising Awareness and Educating

The focus of outreach education and communication in poison prevention messaging often has multiple goals. Messaging that aims to impact the "pre-exposure" state include raising awareness of poison prevention strategies, educating the public on developmental risk factors and providing evidence regarding toxicity of potential toxins. Messaging that addresses the "exposure" state include raising awareness of safe first-aid practices, promoting familiarity of the toll-free phone number of the poison centre and reinforcement of how the poison centre can provide assistance. Education is often also aimed at healthcare professionals regarding best practice in the care of the poisoned patient. "Post-exposure" messaging may relate to advocacy around improved product regulation as well as awareness-raising in the general public regarding new and emerging toxic threats. In the past, various strategies have been employed by key stakeholders to disseminate these messages, which have been met with variable success.

Education campaigns have primarily been focused on preventing unintentional poisonings among children in the home. These home-safety education initiatives often include poison-prevention information, cupboard locks and poison control centre number stickers provided for free or at low cost. They can be an effective method of increasing safe storage of medicines and cleaning products. A 2008 systematic review and meta-analysis evaluated the effect of home safety education and the provision of safety equipment on poison prevention practices and poisoning rates (Kendrick et al., 2008). Studies included were either randomized-control trials, non-randomized control trials (quasi-randomized), and controlled before and after studies. The key findings from this systematic review and meta-analysis suggests that home safety education initiatives can improve poison prevention practices and are as follows:

- Families receiving home safety education (treatment group) were 57 per cent more likely to store medicines safely than control group families [odds ratio (OR) 1.57, 95 per cent confidence interval (CI) 1.22-2.02]
- Families receiving home safety education (treatment group) were 63 per cent more likely to store cleaning products safely than control group families (OR 1.63, 95 per cent CI 1.22-2.17)
- The effect of the home safety education appeared to be greater among studies providing families with cabinet locks (OR 1.90, 95 per cent CI 1.25-2.89) than those providing education only (OR 1.12, 95 per cent CI 0.89-1.41); however, this was not statistically significant.
- Home safety education provided in clinical settings appeared to have a smaller effect (OR 1.29, 95 per cent CI 1.09-1.53) than those delivered in the community (OR 2.31, 1.00-5.32); however, this was not statistically significant.
- Although poison prevention practices improved, there was no statistically significant effect of home safety education on poisoning rates.

Recommendations of best practices from *Preventing Serious Injuries in Children and Youth in Atlantic Canada: A Guide for Decision Makers* (Child Safety Link 2019) include:

- Create a national phone number for poison information to increase access of safety information.
- Invest in or financially support the creation/development of campaigns and programs.
- Create programs to teach caregivers behaviours to prevent unintentional poisonings in the home. Pair these programs with distribution of home safety equipment, such as locked boxes for poisons.
- Communicate safety information to increase public awareness of the importance of safe packaging and storage of medications and other potentially poisonous products found in the home.

With respect to intentional self-harm poisonings, public education campaigns have primarily focused on improving public recognition of suicide risk and help-seeking behaviour, as well as promoting mental health issues and efforts to reduce the stigma associated with mental illness (van der Feltz-Cornelis et al., 2011). However, research has shown that ,with respect to suicide attempts among adolescents who deliberately ingest medications, parents who received counselling in the emergency department about restricting access to potential means of suicide at home were significantly more likely to restrict means than those who did not receive this educational intervention (McManus et al., 1997).

Education interventions have also been employed in response to the growing opioid crisis. In addition to providing individuals with a naloxone kit, take-home naloxone programs also typically include educational sessions teaching participants how to prevent, recognize and respond to opioid poisonings using the naloxone kits. These educational interventions have been shown to be an effective method of increasing participant knowledge and abilities to respond to poisoning events (Green et al., 2008; Bennett & Holloway, 2012; Giglio et al., 2015). Naloxone education programs have also been reported as having unanticipated positive effects of increasing participant self-determination and health consciousness (Maxwell et al., 2006; Wagner et al., 2014), as well as reports of decreased drug use among participants following the educational training (Maxwell et al., 2006; Wagner et al., 2010).

CURRENT POISONING PREVENTION INITIATIVES

Surveillance and Surveillance Systems

In Canada, surveillance is conducted by the federal, provincial and territorial governments as well as arms-length agencies such as the Canadian Institute for Health Information. The Public Health Agency and Health Canada's Canadian Surveillance System for Poison Information are the two main surveillance systems related to poisonings.

PUBLIC HEALTH AGENCY OF CANADA

As part of the Health Promotion and Chronic Disease Prevention Branch (HPCDP), the Centre for Surveillance and Applied Research (CSAR) reports to Canadians on chronic diseases and conditions, maternal and child health, substance use, injuries and protective and risk factors. Within CSAR is the Behaviour, Environment and Lifespan Division (BELD), which focuses on injuries both intentional and unintentional, family violence, child maltreatment, suicide and mental health, physical activity, sedentary behaviour and sleep. This division is responsible for the electronic **Canadian Hospitals Injury Reporting and Prevention Program (eCHIRPP)**, a sentinel injury and poisoning surveillance system that collects and analyzes data on injuries to people who are seen at the emergency rooms of 11 pediatric hospitals and nine general

hospitals in Canada. The CHIRPP has unique, richly detailed data of "pre-event" injury information obtained by asking:

- What was the injured person doing when the injury happened?
- What went wrong?
- Where did the injury occur?

Data collection began in April 1990 and currently contains more than 3.2 million records. Most of these records concern children and youth 19 years of age and younger; however, with more general hospitals being added recently, information on adults is also available. The CHIRPP database provides information for summary reports on injury occurrence and may also be used for more detailed research. Analysts can zero in on a specific set of records by searching the database for selected variables, key text words or a combination of these. These efforts help contribute to the CHIRPP's ultimate goal: to reduce the number and severity of injuries in Canada.

TOXICOVIGILANCE CANADA

The aim of Toxicovigilance Canada is to inform timely action on poison prevention, treatment, harm reduction and management of risks associated with toxic exposures of public health concern. This is achieved by building relationships between toxicovigilance partners, enabling information exchange, collaboration and identifying and bridging gaps. This network has close to 400 members (as of March 2020) including poison centres, clinical and forensic laboratories, provincial and territorial health partners, public safety law enforcement, border services, non-governmental organizations, academia, international counterparts as well as federal public health, regulatory and health security programs.

Background

In 2013, a requirement to aggregate data from Canada's five poison centres and establish the Canadian Surveillance System for Poison Information (CSSPI) was identified during a pan-Canadian needs assessment. Contributors to this assessment included Health Canada, the Canadian Association of Poison Control Centres, Provincial/Territorial Health Partners, academic institutions and non-governmental organizations. This resulted in the 2014 launch of the CSSPI initiative to enhance the timely detection of toxic exposure events of public health concern and to generate statistics based on poison centre information in order to inform prevention, treatment and harm reduction.

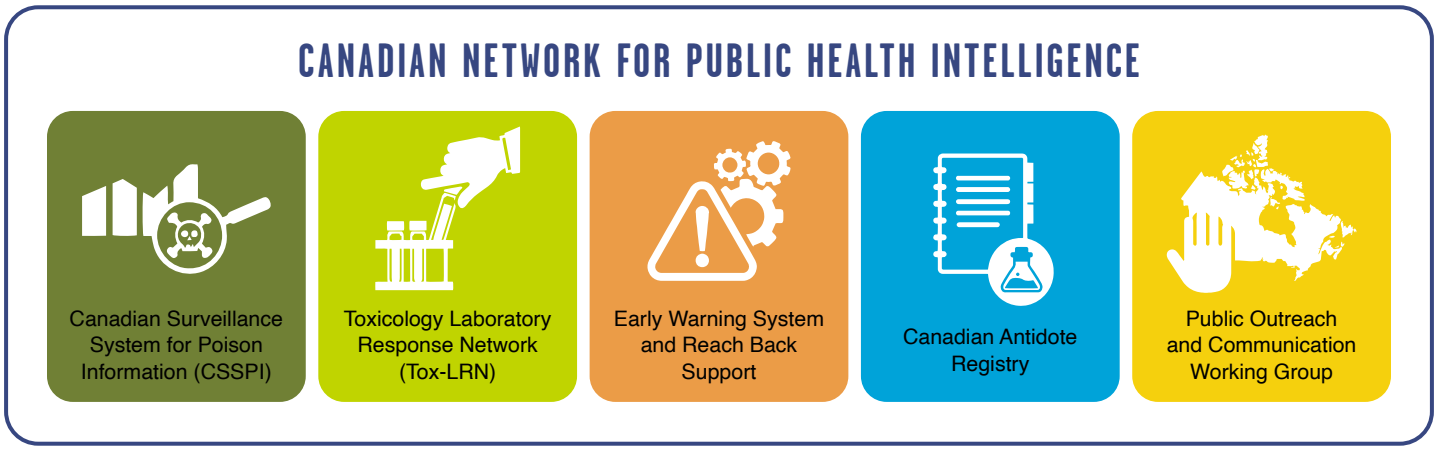
In 2015, a virtual Canadian Poison Control Community of Practice (CoP) was established on the Canadian Network for Public Health Intelligence (CNPHI), a secure scientific informatics and biosurveillance platform owned and operated by the Public Health Agency of Canada. This CoP facilitates multidisciplinary and jurisdictional collaboration among poison centre, public health, health security, regulatory, non-governmental organization and academic partners. Over time, this community grew to include collaborators from the emerging Toxicology Laboratory Response Network, public safety, law enforcement, border services, the United States and international counterparts.

In 2018, the CoP was rebranded to Toxicovigilance Canada to reflect the depth and diversity of its membership.

Goals of Toxicovigilance Canada includes fostering:

- Partnership and collaboration
- Common enhanced situational awareness
- Early warning – "If you see something say something"
- Targeted health threat monitoring (e.g. monitoring for cases that could be associated with specific threats)
- Subject Matter Expertise reach-back support.

Five Components of Toxicovigilance Canada:



While all components within Toxicovigilance Canada are currently under varying stages of development, value is already being recognized from the enhanced information exchange, trust and collaboration on the common goals of poison prevention, treatment and harm reduction. Toxicovigilance Canada promotes a comprehensive approach for risk assessment and management of toxic exposure events of public health concern by providing a trusted environment to facilitate the following activities:

- Timely detection, validation and notification of signals and trend data from Canadian poison centres on toxic exposure events of public health concern through CSSPI.
- Detection by means of laboratory analysis, data sharing and information exchange on analytical methods and mutual aid between clinical toxicology and forensic laboratories through the Toxicology Laboratory Response Network (Tox-LRN).
- Notification and alerting via an Early Warning System (EWS) and reach-back support from expertise within the Toxicovigilance Canada network.
- Access to a geographically searchable chemical Canadian Antidote Registry to support clinical treatment and antidote stockpiling.
- Enhanced public awareness of safety signals and guidance through the collaborative efforts of the Public Outreach and Communications Working Group.

CANADIAN SURVEILLANCE SYSTEM FOR POISON INFORMATION (CSSPI)

CSSPI is currently in year two of a four-year implementation plan (2018 to 2022). CSSPI is a pan-Canadian toxicovigilance system that will aggregate, analyze and interpret data from the five poison centres to provide near real-time surveillance and generate national statistics on poisonings, chemical intoxications and adverse drug reactions. CSSPI is led by a horizontal steering committee composed of poison centres, provincial and federal government representatives. Currently Health Canada is providing resources to every poison centre in Canada to support initiatives in data quality and comparability, training and surveillance. Health Canada is also in the process of deploying epidemiologists within every centre to support surveillance activities and to act as a liaison to connect toxicovigilance partners.

Working Groups

CSSPI currently has three working groups, which are composed of poison centre specialists, Health Canada epidemiologists within the Surveillance and Co-ordination Unit (SCU) and provincial

health partners. Below are brief descriptions of the objectives of these working groups.

- The Data Quality and Comparability Working Group (DQCWG) aims to identify challenges related to the capture of high-quality data and to reduce variability within and enhance comparability across poison centres.
- The Training and Knowledge Exchange Working Group (TKEWG) focuses on developing training materials relating to surveillance, data quality and coding for all Canadian Specialists in Poison Information (SPIs).
- The Toxicovigilance and Surveillance Working Group (TSWG) seeks to establish surveillance measures and case definitions, implement signal identification procedures and facilitate uptake of reported events.

Poison Prevention Week

National Poison Prevention Week (NPPW) was endorsed by the United States Congress in 1961 and was designated to take place annually during the third full week of March. Since the early 1980s, Poison Centres across Canada have also promoted Poison Prevention Week during this same week. This annual week provides an opportunity for those working to prevent poisonings to share key strategies with professionals and the public on the leading causes of poisonings as well as how they can be prevented.

Toxicovigilance Canada's Public Outreach and Communication Working Group

The Public Outreach and Communications Working Group is composed of representatives from poison centres, government agencies and injury-prevention-focused organizations that are dedicated to developing a consistent, co-ordinated Pan-Canadian approach to poison awareness and prevention messaging. Members are recognized as experts in their fields and the working group leverages that expertise to ensure dissemination of current, reliable information to all Canadians. Working group members come together to develop a forum for discussion and knowledge exchange among stakeholder groups with the intent of developing strong, cohesive messaging regarding poison-related issues facing Canadians today.

Canadian Collaborating Centres on Injury Prevention

Established in 1999, The Canadian Collaborating Centres for Injury Prevention (CCCIP) is a community of practice representing injury prevention centres throughout Canada. Its membership represents all of the provincial injury prevention centres and the leading national injury prevention organizations in Canada. The CCCIP provides a unique opportunity for leading injury prevention professionals to share knowledge and experiences, support individual and collective initiatives, policies, and research, and further the work of injury prevention throughout Canada. The CCCIP is a facilitator of action and a leader in the field of injury prevention. Its members work collectively and individually to improve injury prevention policies, programs and surveillance and to translate research into practice. There are five CCCIP members located in / work with the provinces that have poison centres:

- Nova Scotia
  - Child Safety Link
  - IWK Poison Centre
- Ontario
  - Parachute
  - Ontario Poison Centre
- Saskatchewan
  - Saskatchewan Prevention Institute
  - PADIS
- Alberta
  - Injury Prevention Centre (IPC)
  - PADIS

- British Columbia
  - BC Injury Research & Prevention Unit (BCIRPU)
  - Drug and Poison Information Centre (DPIC)

The CCCIP injury centres work both provincially and collectively to build partnerships and amplify messages for poison prevention.

Parachute's #PotCanPoisonKids Program

With funding through Health Canada's Substance Use and Additions Program (SUAP), Parachute has developed and launched a program called #**PotCanPoisonKids**.

#PotCanPoisonKids centres on a comprehensive, evidence-based national education and awareness campaign over five years about the potential harms of unintentional child poisoning from cannabis edibles and effective prevention strategies. The primary target audience for this campaign is parents/caregivers of Canadian children, up to age 14. The theme of the first campaign launched in March 2020 focuses on safe storage of cannabis in the home, under the theme #HighAndLocked, based on research that discovered only one quarter of parents who are cannabis users in Canada know proper storage methods for a potential poisonous substance such as cannabis edibles (Ipsos, 2020).

Government of Canada: Federal Actions on Opioids

In 2016, the Government of Canada announced a collaborative initiative to address the growing opioid crisis in the country. By working with provinces, territories and other partners across the country, the *Joint Statement of Action to Address the Opioid Crisis* (Canadian Centre on Substance Use and Addiction, 2017) outlines the commitment of the Government of Canada and more than 30 partner organizations to respond to this crisis. Importantly, some of the several actions taken by the Federal Government of Canada as of 2019 are outlined here.

Government of Canada, Federal Actions on Opioids as of June 2019

INCREASING ACCESS TO TREATMENT

- Facilitating methadone prescribing and the use of medical heroin
- Funding pilot projects on injectable opioid agonist treatment
- Supporting the development of a national treatment guideline for injectable opioid agonist treatment
- Enhancing the delivery of culturally appropriate substance use treatment and prevention services to Indigenous communities

IMPROVED ACCESS TO HARM REDUCTION

- Approved more than 39 supervised consumption sites
- Supported the Good Samaritan Drug Overdose Act, which provides legal protection for individuals who seek emergency help during an overdose
- Launched a pilot project to examine needle exchange programs in federal correctional facilities and allow overdose prevention programs to operate in these facilities
- Facilitating access to naloxone, including for remote and isolated communities

INCREASING AWARENESS AND PREVENTION

- Expanding public awareness around opioids and the harms of stigma (e.g. Know More Campaign aimed at teenagers and young adults)
- Supporting the development of opioid prescribing guidelines and national treatment guidelines for opioid use disorder
- Updating opioid product monographs

DECREASING THE TAINTED DRUG SUPPLY

- Equipping border agents with tools to intercept fentanyl at the border
- Making amendments to restrict importation of chemicals used to produce fentanyl
- Supporting education and training for law enforcement
- Working with private sector partners to address the laundering of the proceeds of fentanyl and illicit drug trafficking

Source: Government of Canada, Federal Actions on Opioids – Overview. Available at: https://www.canada.ca/en/health-canada/services/substance-use/problematic-prescription-drug-use/opioids/federal-actions/overview.html

REMAINING CHALLENGES

National Poison Centre Access (1-800 Number)

Currently, each of the poison centres in Canada have separate phone numbers (both local and toll-free numbers). In contrast, poison centres across the United States share the same toll-free phone number that automatically connects callers with their local poison centre. Having a singular toll-free phone number for Canadians to connect with their local poison centre can eliminate the need for individuals to find new numbers when moving from one area of the country to another, simplify public education materials across the country and overall create a seamless poison control centre system nationally.

Products Database

Canada, unlike the EU or U.S., does not have a national products database. This limits access to product information to inform medical treatment when exposures occur and the ability to conduct product level surveillance. This may result in missed signals and does not enable comparisons between similar products. For example, some brands of bleach have child-resistant closures while many value brands do not. With product-level coding, comparisons could be done looking at rates of exposures factoring in market share. This type of analysis could drive evidence-informed regulatory practices to better protect Canadians. Further, without product-level coding, outbreak events may not be detected in a timely manner. For example, if a product line of a manufacturer becomes contaminated with a hazardous substance but the coding only allows for generic-level coding such as "energy drink with caffeine", it is very difficult to know, of the many products on the market, which one is responsible for a particular outbreak.

Integrated Surveillance Systems

The creation of the Canadian Surveillance System for Poison Information (CSSPI) is a huge step forward. Once this is launched, the ability to report on national data without compiling data from all the separate poison centres and identify emerging issues and trends will be greatly enhanced, allowing timely access to poison information that can guide policy and prevention efforts. This system will need to be integrated with other data sources such as mortality, hospitalizations and emergency visits in order to present a comprehensive picture of the burden of poisonings in Canada as well as point to priority areas. In addition, integration to existing structures that collect data should be linked to a national poison surveillance system, e.g. the National Ambulatory Care Reporting System (NACRS), the Alberta Ambulatory Care Classification System (AACCS), trauma registries and Canadian Hospital Injury Reporting and Prevention Program (CHIRPP) in the collection of information for poisoning.

Emerging Poisoning Issues

As discussed earlier in this Evidence Summary, several emerging poisoning issues remain a challenge moving forward. The recent opioid crisis has led to several initiatives aimed at rapidly decreasing the number of deaths due to opioid poisoning. More work remains to be done, however, in order to develop long-term, sustainable solutions to this incredibly complex issue. The recent legalization of cannabis in Canada has also presented its own challenges as it is unknown how rates of poisoning will be affected. This is especially the case as cannabis edibles have just recently been legalized as of October 2019, with the possible repercussion of increases in unintentional poisonings among children and youth.

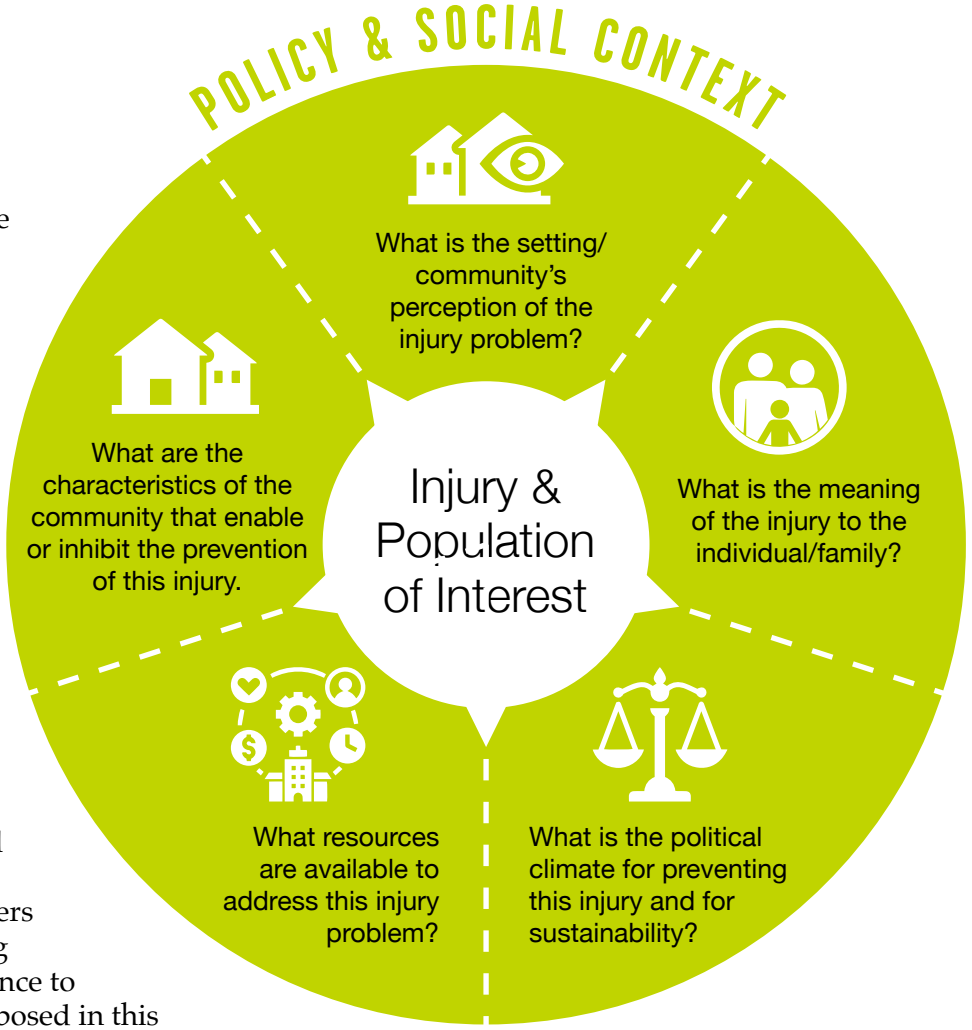
Similarly, e-cigarettes have experienced a recent surge in popularity in Canada and are now formally legalized. However, e-cigarettes are becoming increasingly popular among teenagers despite a ban on sales to individuals under the age of 18, which raises the question as to whether more needs to be done to protect Canada's youth. The U.S. Food and Drug Administration has recently taken decisive steps to curtail e-cigarette use among youth by banning the sale of prefilled, flavoured liquid nicotine capsules used in e-cigarettes, including fruit and mint flavours, as of February 1, 2020 (US FDA, 2020). This is in hope of both reducing use of e-cigarettes among youth, as

well as preventing unintentional poisonings among young children who may find certain flavours appealing. Though it is still too early to determine whether this policy change will have any measurable impact on poisoning rates or any other additional effects, it does however present an interesting example of a possible future approach that may be used in Canada.

The emerging role of social media and the internet has also gained attention as both a potential contributor to poisonings as well as a possible medium for prevention and advocacy. As in the case of the viral laundry detergent pod challenge, social media can play a significant role in perpetuating dangerous activities at an incredibly rapid pace. In contrast, media initiatives can also be employed to spread awareness and prevention strategies to a wider audience in hopes of reducing poisonings. As in the case of National Poison Prevention week, providing a media spotlight for poisoning issues can raise awareness among the general public about strategies to prevent poisonings and reasons to contact their local poison centre for information.

RECOMMENDATIONS AND FUTURE STEPS

As this Evidence Summary demonstrates, addressing the issue of poison prevention is complex. While data on the number of individuals affected by poisoning are essential, the context in which poisoning occurs needs to be considered as a key component when planning and implementing poison prevention strategies; how establishing community and political support, understanding other community health issues and existing public health resources, all create the necessary pre-conditions to advance injury prevention practice. Important questions surround how the social and political context serve as the underpinning, as these are the levers that are most effective in achieving prevention goals. Gathering evidence to answer each of the five questions posed in this model provides the important information about the context in which injury prevention works to select, implement and monitor evidence-informed practice.



Those working in the field to prevent poisoning require access to current best practices so that scarce resources are used effectively.

Advocating for Best Practices

Advocacy needs to play a significant role in ensuring there is support and resources (such as human, financial, jurisdictional) dedicated to identified priorities in poisoning prevention. Developing an advocacy plan and identifying who can act as champions is critical to achieve the level of awareness needed to garner the resources required to address this often-forgotten injury and public health issue.

Groups that could have a role in advocating about poisoning prevention issues include injury organizations, poison control centres, public health departments and individuals whose lives have been touched by poisoning. There are many issues related to poison prevention that could benefit from advocacy efforts. The recommendations within this Evidence Summary each require concerted advocacy efforts if they are to be achieved.

Prevention of poisoning is best accomplished through a multifaceted approach combining education, engineering and environmental modifications (safer packaging, limitations on quantities), enactment and enforcement of regulations and legislation (mandatory CO alarms), economic incentives, involvement of local healthcare providers, community empowerment and program evaluation. While public education is necessary in poisoning prevention, it is not sufficient to prevent poisoning on its own. Integrating public education with other aspects of the public health system will improve the success of the efforts. For example, many provincial health programs have an injury prevention program that might serve as a focal point for co-ordinating poison prevention and education programs. In addition, poison control centres are experienced at providing secondary poisoning prevention and data from the centres can direct primary poisoning prevention initiatives.

Access to Canadian-Specific Product Information

It is recommended that Canada consider introducing legislation similar to the European Union that requires manufactures and industry partners to provide product-level information to a national database. This database would then be accessible to poison centres and other partners to inform treatment and enable product-level surveillance. Currently, poison centres do not have access to Canadian product information and rely heavily on an American database. However, product formulations can vary greatly, limiting the ability of the specialist to provide treatment advice. It is also recognized that, by not coding the exact product involved in the exposure and simply grouping similar products into generic categories, safety issues will be missed and there is no mechanism to conduct comparisons across products.

Understanding Emerging Issues

With the rapid increase in rate of cannabis use and vaping/e-cigarettes among the Canadian population, it is imperative that public health initiatives aimed at preventing cannabis and vaping/e-cigarette related poisonings be based on solid evidence and ideally, research conducted locally with a Canadian perspective. In particular, given that these two products (cannabis and vaping/e-cigarettes) have only recently been legalized in Canada, there is much to be learned about the potential long-term consequences, benefits and harms of legalization with respect to poisonings.

Furthermore, there is a growing need to understand the increases in intentional self-harm- associated poisonings. The trends in self-harm-related poisonings, especially among youth and young adults in Canada, suggests a growing need to examine how to best approach mental health issues and prevent suicide and self-harm in Canada. Mental health has increasingly been

recognized as an important issue to address in Canada. Understanding the relationship between unintentional and intentional poisonings, along with mental health and substance use, may be vital in preventing deaths, hospitalizations and emergency room visits due to suicide/self-harm poisonings. Importantly, self-harm poisonings can be seen as only one symptom of a greater mental health issue in Canada.

Carbon Monoxide Detectors

Carbon monoxide detectors save lives and reduce the burden on the first responder and health care system. It is recommended they should be made mandatory in all homes, schools and public spaces.

National Leadership

As the Collective Impact model points out, "no single organization is responsible for any major social problem, nor can any single organization cure it" (Kania and Kramer, 2011). This model posits that creating and managing collective impact requires a separate organization and staff with a very specific set of skills to serve as the backbone for the entire initiative. Co-ordination takes time and none of the participating organizations has any to spare. The expectation that collaboration can occur without a supporting infrastructure is one of the most frequent reasons why it fails (Kania and Kramer, 2011).

The successes that have been achieved since the first Evidence Summary was written are largely the result of collaboration between and among key stakeholders such as the federal government, provincial poison and injury centres, and NGOs. This collective action needs to continue so that different perspectives and expertise can be integrated into these efforts moving forward.

Identifying a national organization to provide leadership will move the agenda of poison prevention forward. There is potential for the Canadian Association of Poison Control Centres (CAPCC) to take on this role so that it can work both inside and outside of government with resources and a broad scope to champion the development, implementation and evaluation of national poison data collection and surveillance, which would significantly improve the ability for Canada to understand and report on poisonings. This would be in tandem with Toxicovigilance Canada as well as Canadian Surveillance System for Poison Information (CSSPI) and associated federal, provincial/territorial, and local partners. The CAPCC would require sufficient financial and human resources to be effective in taking on this national leadership role.

CONCLUSION

Poisonings remain a major public health concern in Canada, especially in light of recent trends in both unintentional and self-harm poisonings, and emerging causes of poisoning. While major achievements have been made since the publication of the first Evidence Summary on the prevention of poisonings in Canada in 2011, it is vital to recognize that there remains a significant number of challenges in the road moving ahead. Through surveillance, research, multi-level collaboration, and evidence-based interventions and prevention initiatives, we can reduce the burden of poisonings to the Canadian healthcare system and society as a whole.

APPENDICES

APPENDIX A - Poison Control Centres

BC DRUG AND POISON INFORMATION CENTRE (DIPC)

The BC Drug and Poison Information Centre (DPIC) was established in 1975 through the co-operative efforts of the Hospital Programs Branch of the BC Ministry of Health and the Faculty of Pharmaceutical Sciences at the University of British Columbia (UBC). It is located at the BC Centre for Disease Control in Vancouver and is staffed with pharmacists, nurses and physicians who have specific expertise in the provision of drug and poison information services. The original mandate of the Centre called for the development of centralized services to assist health professionals throughout BC in providing optimal levels of drug therapy and poison management. Considerable progress has been made in this respect through expansion of DPIC programs over the ensuing years. Notably, the Centre has assumed provision of poison information services to the BC public, a population of approximately 5 million. Since 2002 DPIC has been affiliated with the BC Centre for Disease Control, an agency of the Provincial Health Services Authority (PHSA) and continues its affiliation with UBC. It is a member of the Canadian Association of Poison Control Centres (CAPCC) and the American Association of Poison Control Centers (AAPCC).

ALBERTA POISON, DRUG AND INFORMATION SERVICE (PADIS)

Alberta established the toll-free provincial Poison and Drug and Information Service (PADIS) in 1986 at the Calgary Foothills Hospital. The Centre was established to replace five regional centres and to link the provision of poison information services with that of drug information services already established and operating out of the pharmacy department at Foothills. Both registered nurses and pharmacists now answer these information lines. In 1993, a toll-free poison information number for southern Saskatchewan was established in Regina and another in Saskatoon for northern Saskatchewan, but with no dedicated staffing. In 2001, Saskatchewan contracted with the Poison and Drug Information Service (PADIS) to provide comprehensive poison service to Saskatchewan through a dedicated toll-free number.

ONTARIO POISON CENTRE

In 1968, the Ottawa Civic Hospital Poison Information Centre was opened. During the day, a dedicated registered nurse answered cases from the public; at night, the intern staffing the emergency department answered these cases. Similarly, a dedicated registered nurse answered cases in the emergency department at the Hospital for Sick Children starting in 1977. Both centres were staffed 24/7 with full-time medical directors from 1981 forward. In 2005, the Regional Centre at the Children's Hospital of Eastern Ontario closed. The Ontario Poison Centre (OPC) is operated and supported by The Hospital for Sick Children (SickKids) in Toronto. At its inception in the late 1970s, poison cases were answered by a registered nurse (RN) in the emergency department. Beginning in 1979 the Poison Centre was formally recognized as one of two regional poison centres in the province by the provincial Ministry of Health. At that time the Ministry of Health provided direct funding to these two regional centres. Initially the Poison Centre managed approximately 8,000 cases annually. Since late in 2005, the OPC has been the sole provider of poison services to the province of Ontario. The centre currently manages more than 100,000 cases a year. Although these numbers are significant, the true magnitude of poison exposures is unknown as poisonings are not considered a reportable event. The OPC poison statistics

are based on poison exposures that are voluntarily reported to the centre.

On July 1, 2012, the Ontario Poison Centre was chosen to provide enhanced poison services to the province of Manitoba. Healthcare providers across Manitoba, as well as the general public, now have access to bilingual poison services via a new toll-free number (1-855-7POISON). These enhanced services, while branded locally as the "Manitoba Poison Centre," are led by the interdisciplinary team at the Ontario Poison Centre. In 2015, the OPC was contracted by the Government of Nunavut to provide enhanced poison services to healthcare providers in the territory. In addition to being a member of the Canadian Association of Poison Control Centres (CAPCC) the Ontario Poison Centre is an affiliate member of the American Association of Poison Control Centers (AAPCC).

CENTRE ANTIPOISON DU QUÉBEC

In 1986, three regional poison centres in Quebec were amalgamated as one provincial centre at le Centre Hospitalier de l'Université Laval in Québec City. Specialist nurses are located in the Centre in Québec. Toxicologists throughout the province remained on staff. In 2003, the Centre was moved and came under the jurisdiction of the CLSC-CHSLD Haute-Ville-Des-Rivières. Since 1986, the Centre antipoison du Québec collects data on new drugs and products. Their database (TOXIN (1) up to Feb. 6, 2019 and ToxiQc (2) from Feb. 6, 2019) included 82,164 products in January 2020 and is updated on a regular basis.

IWK REGIONAL POISON CENTRE

In 1993, the IWK Regional Poison Centre (RPC) was established at the IWK Hospital in Halifax, Nova Scotia, replacing the red phones in the pediatric emergency department. Specialist-trained nurses and pharmacists answer the poison information lines. A physician toxicologist joined the Centre in 2005 and a complement of emergency physicians offer medical backup. The IWK Regional Poison Centre provides full service to Nova Scotia and P.E.I. and has contracts with New Brunswick and Newfoundland and Labrador for calls from healthcare professionals. The RPC provides a 24-hour phone consultation service to both the public and healthcare professionals. It is able to provide information on a real or potential exposure to toxins.

YUKON, NUNAVUT AND NORTH WEST TERRITORIES

The Yukon, North West Territory and Nunavut access poison information through regional poison centre agreements. The Ontario Poison Centre receives calls from Nunavut medical professionals only. British Columbia provides services to the Yukon and Alberta provides services to the North West Territory.

APPENDIX B - Data Sources and Methodology

Data Sources:

1. Statistics Canada – Vital Statistics Death database
2. Canadian Institute for Health Information's Discharge Abstract Database (DAD) Quebec Data not included.
3. Canadian Institute for Health Information's National Ambulatory Care Reporting System (NACRS) Albert and Ontario only.
4. Canadian Injury Research and Prevention Program (CHIRPP)

Data Extraction Methodology

1. ICD-10 or ICD-10-CA codes used to define and classify poisoning:
   a. X40 – X49: unintentional poisoning
   b. X60 – X69: suicide by poisoning or self-inflicted poisoning
   c. X85 – X90: homicide by poisoning or assault by poisoning
   d. Y10 – Y19: poisoning with undetermined intent
2. For death, the underlying cause of death was used to define and classify poisonings. For DAD and NACRS, all external cause codes in diagnoses were searched. If multiple groups of poisonings existed for one record, only one group was selected in the following priority order: assault by poisoning, self-inflicted poisoning, unintentional poisoning and poisoning with undetermined intent.
3. For DAD and NACRS, counts represent the numbers of records, not the numbers of individual patients
4. All rates are per 100,000 population. Age-standardized rates are based on the 2011 Canadian population.
5. For death rates, the July 1 population estimates were used, while the October 1 population estimates were used for hospitalization and emergency visit rates.
6. The statistics presented exclude a very small portion of records with unknown age and/or sex reported as neither male nor female.

APPENDIX C - Top Causes for Poison Centre Cases

BRITISH COLUMBIA

Top 10 pharmaceutical causes and top five non-pharmaceutical causes for cases recorded by the Drug and Poison Information Centre, 2012 to 2018.

Top 10 Pharmaceutical Causes	Number
Analgesics	23733
Sedative, Hypnotics and Antipsychotics	10264
Antidepressants	9315
Stimulants and Street Drugs	6641
Vitamins	5278
Hormones and Hormone Antagonists	5171
Cardiovascular Drugs	4629
Antihistamines	4607
Topical Preparations	3982
Dietary Supplements, Herbals, Homeopathics	3891

Top 5 Non-Pharmaceutical Causes	Number
Household Cleaners	17678
Cosmetics and Personal Care Products	12358
Foreign Bodies/Toys/Miscellaneous	9441
Plants	7793
Alcohols	7350

NOVA SCOTIA

Top 10 pharmaceutical causes and top five non-pharmaceutical causes for cases recorded by the IWK Poison Control Centre, 2008 to 2018.

Top 10 Pharmaceutical Causes	Number
Analgesics	28884
Sedative, Hypnotics, and Antipsychotics	26116
Antidepressants	19343
Cardiovascular Drugs	13682
Hormones and Hormone Antagonists	11134
Stimulants and Street Drugs	6379
Anticonvulsants	5680
Antihistamines	4916
Gastrointestinal Preparations	4302
Antimicrobials	4034

Top 5 Non-Pharmaceutical Causes	Number
Household Cleaners	11010
Alcohols	10833
Cosmetics and Personal Care Products	6361
Foreign Bodies/Toys/Miscellaneous	4403
Pesticides	3408

QUEBEC

Top 10 pharmaceutical causes and top five non-pharmaceutical causes for cases recorded by the Centre antipoison du Québec, 2012 to 2018.

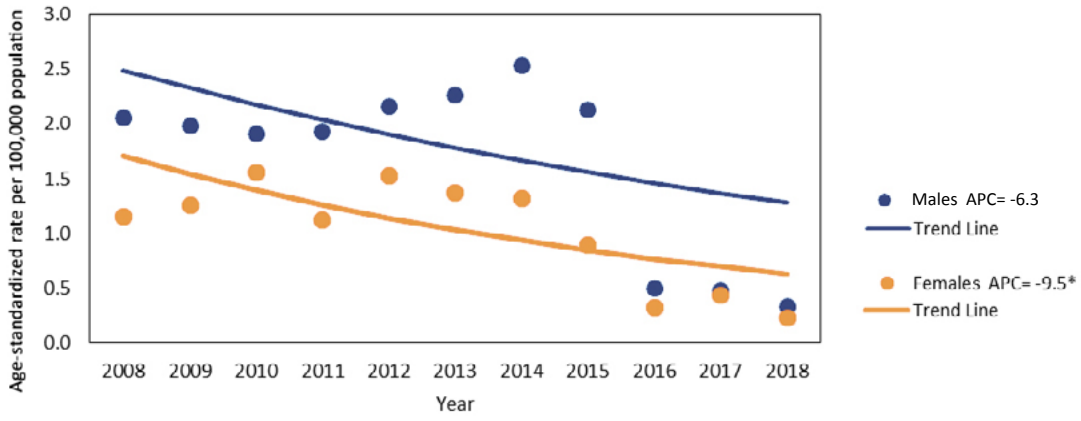
Top 10 Pharmaceutical Causes	Number
Analgesics (without opioids or acetaminophen)	47438
Acetaminophen	31429
Antidepressants	22827
Benzodiazepines	18417
Antipsychotics	17606
Cardiovascular Drugs	13848
Topical Preparations	10668
Opioids	9932
Hormones and Hormone Antagonists	9265
Antihistamines	6847

Top 5 Non-Pharmaceutical Causes	Number
Household Cleaners	25638
Alcohols	16675
Cosmetics and Personal Care Products	12583
Hydrocarbons	10491
Pesticides	9561

APPENDIX D – Undetermined Poisonings

Mortality due to undetermined intent poisonings in Canada by intent and sex, 2008 to 2018. Age-standardized mortality rates per 100,000 population.

Undetermined Intent

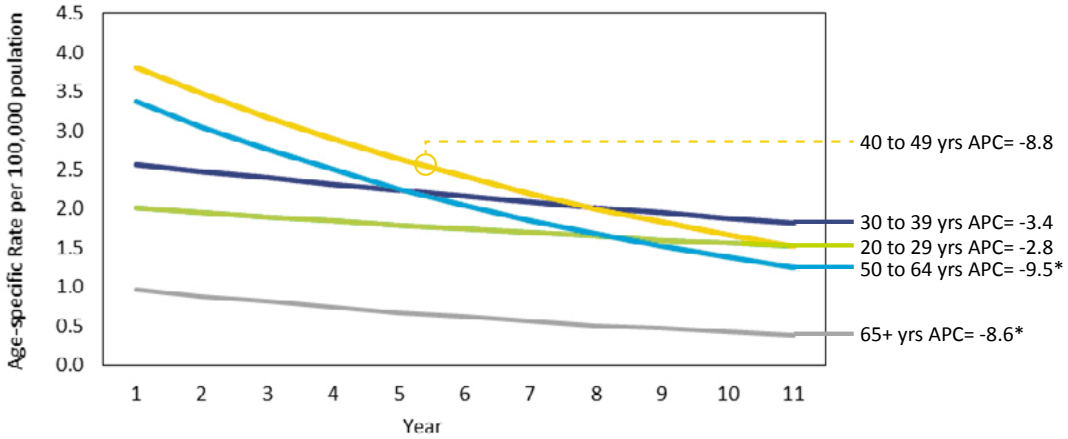


*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the 11-year period from 2008 to 2018, both males and females had a decrease in the death rate due to undetermined intention of poisonings. Males had an average decrease of undetermined intent poisoning death rate of 6.3 per cent each year and females had a statistically significant average decrease in undetermined intent poisoning death rate of 9.5 per cent each year.

Mortality due to undetermined intent poisonings in Canada by age group (years), 2008 to 2018 Age-specific rates per 100,000.

Undetermined Intent

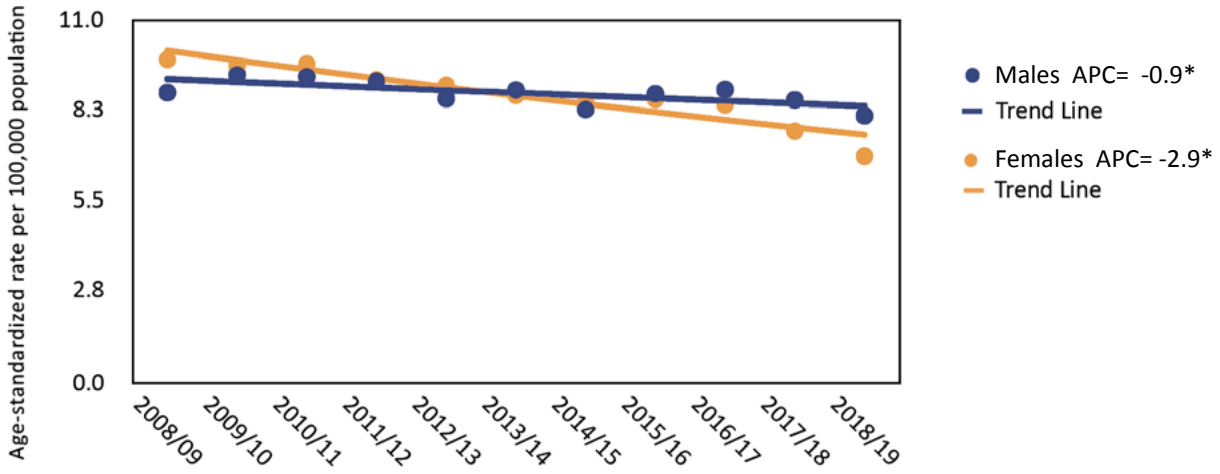


*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the 11-year period from 2008 to 2018, all age groups had a decrease in the undetermined intent poisoning death rate. Canadians 50 to 64 years of age had the largest average annual decrease of 9.5 per cent each year. Due to small numbers, undetermined poisoning deaths of Canadians under the age of 19 are not presented.

Hospitalizations due to undetermined intent poisonings in Canada by intent and sex, fiscal years 2008 to 2018. Age-standardized rates, Hospitalization per 100,000 population, excludes Quebec.

Undetermined Intent

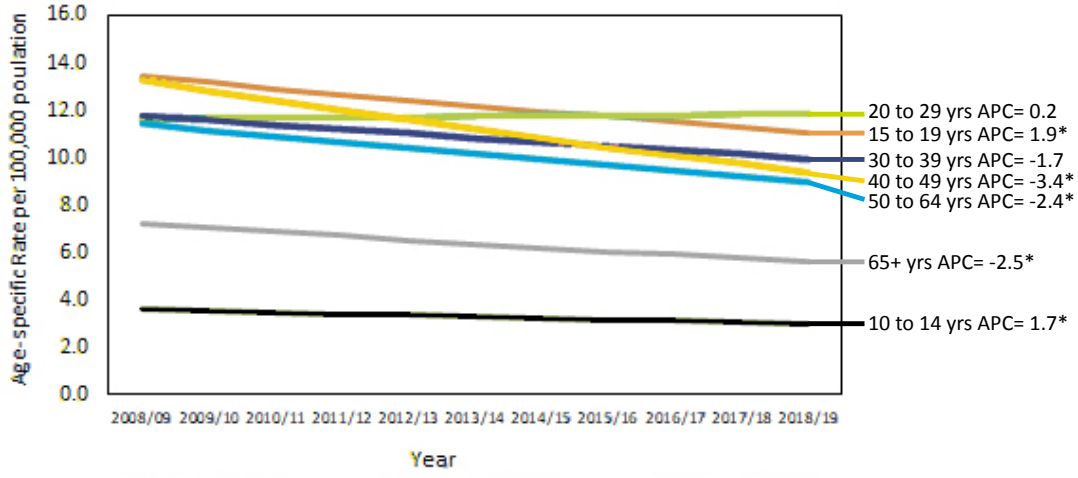


*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the 11 year period from 2008/09 to 2018/19 both males and females had a statistically significant decrease in the undetermined intent poisoning hospitalization rate. Males had an average decrease of 0.9 per cent each year and females had a statistically significant average decrease in the hospitalization rate of 2.9 per cent each year.

Hospitalizations due to undetermined intent poisonings in Canada by age group (years), fiscal years 2008 to 2018. Age-specific rates per 100,000 population.

Undetermined Intent

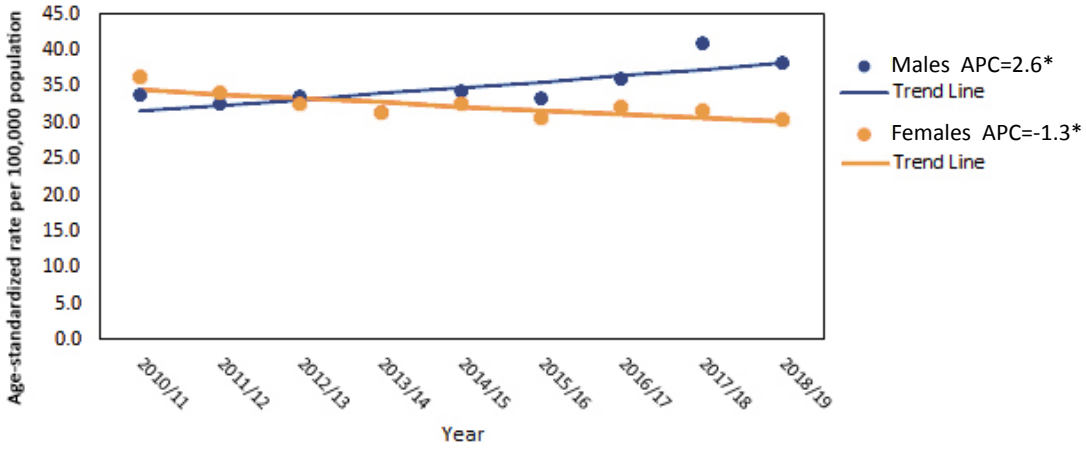


*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the 11-year period from 2008/09 to 2018/19, younger age groups, 10 to 29 years of age, experienced a decrease of undetermined intention of poisoning hospitalization rate; those 30 years of age and older had a decrease in the undetermined intent poisoning hospitalization rate. Due to small numbers, undetermined intention poisoning hospitalizations of Canadians under the age of 10 are not presented.

Emergency department visits due to poisonings in Alberta and Ontario by intent and sex, fiscal years 2010 to 2018. Age-standardized rates per 100,000 population.

Undetermined Intent

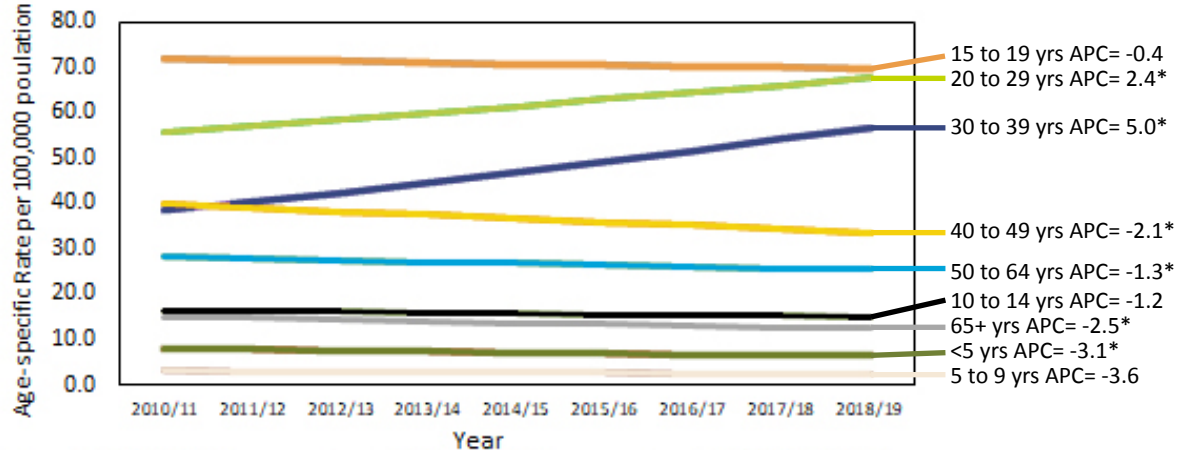


*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the 9 year period from 2010/11 to 2018/19 males and female residents of Alberta and Ontario had a statistically significant change in emergency department visit rate for poisoning of undetermined intent. Males had a statistically significant average increase in emergency department visit rate of 2.6 per cent each year and females had a statistically significant average decrease in emergency department visit rate of 1.3 per cent each year.

Emergency department visits due to unintentional poisonings in Alberta and Ontario by age group (years), fiscal years 2010 to 2018. Age-specific rate per 100,000 population.

Undetermined Intent



*= The annual per cent change (APC) is significantly different from zero at alpha=.05

Over the nine-year period from 2010/11 to 2018/19, the majority of the age groups had a decrease in the emergency department visit rate due to undetermined intent except residents 20 to 29 years of age and those 30 to 39 years of age. Both these age groups experienced a statistically significant average increase in the visit rate of 2.4 per cent and 5.0 per cent, respectively.

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