

Opioid Mortality Surveillance Report

Analysis of Opioid-Related Deaths in Ontario
July 2017–June 2018



Surveillance Report
June 2019

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Contents

- Executive Summary..... 1
 - Key Findings 1
- Definitions..... 3
- Introduction 8
- Methods..... 9
 - Analysis 9
- Findings 11
 - Manner of Death..... 13
 - Substances Involved..... 17
 - Demographic Characteristics 22
 - Geographic Location 25
 - Employment Status and Industry of Employment..... 28
 - Health History 30
 - Length of Substance Use..... 31
 - Living Arrangement..... 32
 - Circumstances Surrounding Death 33
 - Alone at the Time of Incident 33
 - Incident Location..... 34
 - Resuscitation and Naloxone Use..... 36
 - Indication of Injection Drug Use 39
- Discussion..... 40
 - Summary of Findings..... 40
 - Trends in Ontario Data..... 40
 - Comparison to Other Provincial Findings 41
 - Comparison to Other Jurisdictions 42
 - Limitations 43
 - Future Directions 43
- Conclusion..... 45
- Appendix A..... 46
 - Methods for Classification of Origin of Opioids..... 46

Appendix B.....	48
Data Tables.....	48
References	56

List of Tables

Table 1.1. Number and rate of opioid-related deaths by calendar year quarter, January 2017 to June 2018	11
Table 1.2. Opioid-related deaths by sex and calendar year quarter, January 2017 to June 2018	12
Table 1.3. Opioid-related deaths by age and calendar year quarter, January 2017 to June 2018	12
Table 1.4. Opioid related deaths by substance type and calendar year quarter, January 2017 to June 2018	13
Table 2.1. Opioid-related deaths by sex and manner of death, July 2017 to June 2018	14
Table 2.2. Opioid-related deaths by age and manner of death, July 2017 to June 2018	14
Table 2.3. Opioid-related deaths by substance type and manner of death, July 2017 to June 2018	15
Table 3.1. Accidental opioid-related deaths by opioid type involved, July 2017 to June 2018	18
Table 3.2. Accidental opioid-related deaths by involvement of non-opioid non-pharmaceutical substances, July 2017 to June 2018	19
Table 3.3. Accidental opioid-related deaths by non-opioid pharmaceutical substance involved, July 2017 to June 2018	20
Table 4.1. Accidental opioid-related deaths by quintile of neighbourhood material deprivation (ON-Marg), July 2017 to June 2018	23
Table 4.2. Accidental opioid-related deaths by population centre and rural area classification of residence, July 2017 to June 2018	24
Table 4.3. Accidental opioid-related deaths by release from correctional facility in past four weeks, July 2017 to June 2018	24
Table 4.4. Accidental opioid-related deaths by marital status, July 2017 to June 2018	24
Table 5.1. Accidental opioid-related deaths by employment status, July 2017 to June 2018	28
Table 5.2. Accidental opioid-related deaths by industry of employment (services), July 2017 to June 2018	29
Table 5.3. Accidental opioid-related deaths by industry of employment (trades), July 2017 to June 2018	29
Table 6.1. Accidental opioid-related deaths by resuscitation attempt, July 2017 to June 2018	36

Table 6.2. Accidental opioid-related deaths by naloxone administration, July 2017 to June 2018	37
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List of Figures

Figure 1. Opioid-related deaths by origin of opioid (pharmaceutical/non-pharmaceutical) directly contributing to the death and by manner of death, July 2017 to June 2018	16
Figure 2. Opioid-related deaths by origin of non-opioid substances directly contributing to the death and by manner of death, July 2017 to June 2018.....	17
Figure 3. Accidental opioid-related deaths by single or multiple opioids contributing to death, July 2017 to June 2018	21
Figure 4. Accidental opioid-related deaths by age group and sex, July 2017 to June 2018	23
Figure 5. Heat map of the number of accidental opioid-related deaths, July 2017 to June 2018	26
Figure 6. Rate (per 100,000) of accidental opioid-related deaths by public health unit, July 2017 to June 2018	27
Figure 7. Accidental opioid-related deaths by health history, July 2017 to June 2018	30
Figure 8. Accidental opioid-related deaths by length of substance use, July 2017 to June 2018	31
Figure 9. Accidental opioid-related deaths by living arrangements and sex of the deceased person, July 2017 to June 2018	32
Figure 10. Accidental opioid-related deaths where the deceased person was alone at the time of incident, by age group and sex, July 2017 to June 2018	33
Figure 11. Accidental opioid-related deaths by incident location, July 2017 to June 2018	34
Figure 12. Accidental opioid-related deaths by incident location and whether the deceased person was alone at the time of incident, July 2017 to June 2018	35
Figure 13. Accidental opioid-related deaths by resuscitation attempt and naloxone administration and whether the person was alone at the time of incident, July 2017 to June 2018	38
Figure 14. Accidental opioid-related deaths with indication of injection drug use, by age group and sex, July 2017 to June 2018	39

Executive Summary

The number of fatal and non-fatal opioid-related toxicity events has risen dramatically over the past decade in Ontario. Information on the characteristics of deceased persons and the circumstances surrounding their deaths is summarized in this report to inform local, provincial and national prevention and response efforts. This information was obtained by the Office of the Chief Coroner/Ontario Forensic Pathology Services (OCC/OFPS) from completed investigations of confirmed opioid-related deaths in Ontario between July 1, 2017 and June 30, 2018.

Key Findings

Between July 2017 and June 2018, there were 1,337 confirmed opioid-related deaths in Ontario (data extracted on January 21, 2019). Investigations revealed that:

- The majority of opioid-related deaths were accidental (90.4%), occurred among males (72.0%) and most often occurred among individuals between the ages of 25 and 44 (50.2%).
- Among suicide deaths, nearly half (47.5%) occurred among females and more often occurred among individuals aged 45 to 64 (55.6%).
- Among accidental opioid-related deaths (N=1,209):
 - Fentanyl and fentanyl analogues directly contributed to death for almost three-quarters (71.2%).
 - The non-opioid substances that most often directly contributed to death were cocaine (33.9%), methamphetamine (14.6%), alcohol (13.2%) and benzodiazepines (11.0%).
 - Almost one-third (31.8%) of deaths occurred among people who resided in neighbourhoods with the highest material deprivation (measure of inability to attain basic resources and services).
 - 62.0% occurred among individuals who resided in large urban population centres.
 - The highest number (n=291) occurred in Toronto with the highest population-adjusted rate occurring in Thunder Bay District Health Unit (22.7 deaths per 100,000).
 - Nearly half (46.8%) occurred among people who were unemployed, whereas 18.1% were employed (32.9% with unknown employment status). Where employment industry information was available, nearly one-third (31.0%) of those employed worked in the construction industry.
 - 73.6% occurred among people living in a private dwelling and 9.8% occurred among people experiencing homelessness.

- Nearly half (48.6%) of deceased persons were alone at the time of incident.
- Most incidents occurred in a private residence: 59.6% occurred in a deceased person's own private residence and 16.8% occurred in another private residence. The proportion of deceased persons alone at the time of the incident was higher when the incident occurred in a person's own private residence (55.7%).
- 47.8% involved a resuscitation attempt and 22.2% had naloxone administered by a first responder, hospital staff or bystander.

The information presented in this report is intended to provide the reader with opportunities to examine circumstances surrounding opioid-related deaths to better understand and address the unique needs of Ontarians who may be exposed to opioids.

Definitions

Most definitions below were provided by the Office of the Chief Coroner/Ontario Forensic Pathology Service.¹ These are the definitions used during death investigations. In some instances, definitions are referenced from other sources.

Alone at time of incident: No other person with the ability to intervene was present at the time of the incident (a young child or someone asleep would not be considered as having the ability to intervene).

Employment status: Employment status was identified by family and friends during the death investigation.

- **Unemployed:** Includes people who may be looking for employment, on income assistance or unable to work due to injury or disability.
- **Employed:** Includes full-time, part-time, seasonal and temporary employment.

Indication of injection drug use: A syringe was found at the scene or the coroner/pathologist reported injection/intravenous opioid consumption. This may be determined by examination of the body or other information collected during the investigation.

Incident: An event of drug/substance consumption that precipitated the clinical effects that led to death. The location of incident may or may not be the same as the location of pronouncement of death.

Incident location:

- **Hospital:** An institution or establishment providing medical care.
- **Indoor public space:** Includes airports, public bathrooms, commercial/retail buildings, recreational buildings and other public buildings.
- **Other accommodation:** Includes hotels/motels/inns, rooming houses, shelters and supported living facilities.
- **Other's private residence:** Private residence that was not the home address of the deceased person. Includes apartments/condominiums, row houses/townhouses, trailers/mobile homes, single-detached houses, semi-detached houses and community housing.
- **Outdoors:** Includes streets, alleyways, forests, parks, conservation areas, in a vehicle, parking lot and commercial/retail lawns.
- **Own private residence:** Private residence that was the home address of the deceased person. Includes apartments/condominiums, row houses/townhouses, trailers/mobile homes, single-detached houses, semi-detached houses and community housing.

Living arrangement:

- **Collective dwelling:** May include lodging and rooming houses, hotels, motels, tourist establishments, campgrounds and parks, sober living facilities, school residences and training centre residences, work camps, religious establishments, military bases and commercial vessels.
- **Correctional facility:** May include federal correctional institutions, provincial and territorial custodial facilities, young offenders' facilities, jails and police lock-up facilities.
- **Homeless:** Without stable, permanent, appropriate housing or the immediate prospect, means and ability of acquiring it; includes no fixed address. This includes people who are unsheltered, emergency sheltered, provisionally accommodated or at immediate risk of homelessness.
- **Other:** Includes locations not applicable to other categories such as hospital, long-term care home or retirement home (including senior residences).
- **Private dwelling:** A separate set of living quarters designed for or converted for human habitation. Must include a source of heat or power and must be an enclosed space that provides shelter/protection from the elements. May include apartments/condominiums, row houses/townhouses, trailers/mobile homes, single-detached houses, semi-detached houses and community housing.
- **Residential care facility (including group homes):** Institutions or establishments that provide accommodation and potentially treatment to various groups (e.g., physically handicapped, children/youth, persons with psychiatric disorders or developmental disabilities).

Length of substance use: The approximate timeframe in which the deceased person used substances (could include occasional or regular use; does not include alcohol use). Information on the length of substance use is determined by family, friends and health care professionals during the death investigation.

Manner of death:

- **Accident:** Deaths with investigations where the coroner determined that the death involving opioids was unintentional, i.e., due to an occurrence, incident or event that occurred without foresight or expectation.
- **Natural:** A death due to a natural disease or a known complication thereof; or complication of treatment for the disease.
- **Suicide:** Deaths with investigations where the coroner determined that the opioids were consumed with the intent to die.²
- **Undetermined:** Deaths with investigations where a specific manner of death (e.g., accident, suicide) could not be assigned by the coroner based on available or competing information.³

Marital status:

- **Divorced/separated:** Persons who have obtained a legal divorce and have not remarried and those currently legally married, but no longer living together.
- **Married/common-law relationship:** Persons who are legally married or persons who are living with another individual as a couple, but who are not legally married (all ages), including same-sex spouses and same-sex common law partners.
- **Single:** Persons who have never married and were not living common law at time of death (all ages).
- **Widowed:** Persons who were legally married and lost their spouse through death and have not remarried.

Material deprivation: Inability for individuals and communities to attain basic resources and services.⁴ To measure material deprivation, the [Ontario Marginalization Index \(ON-Marg\)](#) includes indicators of income, quality of housing, educational attainment and family structures.⁴

Naloxone administration:

- **Naloxone:** Opioid antagonist used to block or reverse the effect of opioid overdoses.
- **Bystander:** A person who is present at the time of the incident (can include family, friends or others, but does not include first responders or hospital staff).
- **First responder:** Includes firefighters, police and emergency medical services.

Opioids: A family of substances that include pharmaceutical opioids available through prescription for the treatment of pain and opioid use disorder (e.g., oxycodone) and non-pharmaceutical opioids (e.g., heroin).

Opioid-related death: An acute intoxication/toxicity death resulting from the direct contribution of consumed substance(s), where one or more of the substances was an opioid, regardless of how the opioid was obtained.²

Pain condition: Includes acute and chronic pain or pain disorder (Diagnostic and Statistical Manual, 5th ed.) (DSM5 diagnosis).⁵

Population centres:⁶

- **Rural area:** Population less than 1,000.
- **Small population centre:** Population is 1,000 to 29,999.

- **Medium population centre:** Population is 30,000 to 99,999.
- **Large urban population centre:** Population is 100,000 or greater.

Resuscitation attempt: Provision of emergency measures in an attempt to sustain life that could include naloxone administration, as well as other methods, such as rescue breathing and/or chest compressions.

Substance involvement:

- **Detected:** Substances detected in toxicology testing, which may or may not have directly contributed to the death.
- **Directly contributing to death:** Substances determined by the pathologist and/or coroner to have directly contributed to the death based on the complete investigative findings, i.e., toxicology findings and the information obtained during the death investigation.
- **Non-opioid substances:** Includes pharmaceutical and non-pharmaceutical non-opioid substances.
- **Non-pharmaceutical origin of opioids:** Includes
 - Heroin, fentanyl analogues (including carfentanil), U-47700
 - Fentanyl without evidence of a patch and no/unknown evidence of prescription and evidence suggesting a non-pharmaceutical origin (e.g., other non-pharmaceutical substances detected on toxicology (e.g., carfentanil, cocaine) or drug paraphernalia on the scene)
 - Morphine without or unknown evidence of a prescription, with or without 6-Monoacetylmorphine (6-MAM) and with evidence suggesting non-pharmaceutical heroin use (e.g., other non-pharmaceutical substances detected on toxicology, such as carfentanil or cocaine or history of consuming or seeking heroin)
- **Pharmaceutical origin of opioids:** Includes buprenorphine/naloxone, codeine, fentanyl (with evidence of patch or prescription), hydrocodone, hydromorphone, methadone, morphine (with evidence of a morphine or codeine prescription) oxycodone, oxymorphone or tramadol. This category may include opioids that were prescribed to the deceased person or that were prescribed to someone else (i.e., diverted).

- **Origin of opioid could not be classified:** The opioid could not be clearly categorized as non-pharmaceutical or pharmaceutical including
 - Fentanyl without evidence of patch and no/unknown evidence of prescription and no evidence suggesting a non-pharmaceutical origin, morphine without or unknown evidence of a prescription for morphine and without 6-MAM and no evidence suggesting non-pharmaceutical heroin use.

Substance use disorder: History of a problematic pattern of use leading to clinically significant impairment or distress consistent with criteria from the DSM5.⁵ Alcohol use disorder and opioid use disorder are also specifically defined in the DSM5 applying these criteria for each substance.

Introduction

Over the past decade, Ontario has experienced an increase in fatal and non-fatal opioid-related toxicity events,⁷ which have had substantial impacts on the lives of many individuals, families and communities. From 2007 to 2017, the annual number of deaths related to opioids in Ontario increased from 468 to 1,265,⁷ with an estimated 46% increase in the number of deaths between 2016 and 2017.⁷ During this time, exposure to fentanyl and its analogues has become a major contributor to opioid-related deaths.⁷

Amid increasing rates of harms associated with opioids, there is a need to better characterize and understand the factors that lead to opioid-related deaths. This information is important to inform ongoing efforts to prevent and reduce opioid-related harms. In Ontario, the Office of the Chief Coroner (OCC), together with the Ontario Forensic Pathology Service (OFPS), conducts investigations of all deaths that appear to be from unnatural causes or natural deaths that occur suddenly or unexpectedly.⁸ In May 2017, the OCC/OFPS implemented an enhanced data collection tool for suspected substance-related deaths to allow for more comprehensive and consistent reporting across the province.

The information summarized in this report was obtained by the OCC/OFPS from completed investigations of confirmed opioid-related deaths that occurred between July 2017 and June 2018. While data on opioid-related morbidity,⁷ mortality⁷ and prescribing patterns⁹ in Ontario is publically available, this report provides more detailed information on the circumstances surrounding opioid-related deaths during this time period. It is hoped that this information will help fill knowledge gaps on opioid-related deaths in Ontario and inform practices to prevent and reduce opioid-related harms across the province.

Methods

This report includes information obtained by the OCC/OFPS from completed investigations of confirmed opioid-related deaths that occurred between July 1, 2017 and June 30, 2018 in Ontario, Canada (data was extracted on January 21, 2019). Following the national case definition,² an opioid-related death is an acute intoxication/toxicity death resulting from the direct contribution of consumed substance(s), where one or more of the substances was an opioid, regardless of how the opioid was obtained.² These deaths do not include those due to: 1) the medical effects of long-term substance use; 2) medical assistance in dying; 3) trauma where substance(s) contributed to the circumstances of the injury, but was not directly involved in the death; and 4) homicide. There were no reported opioid-related deaths resulting from homicide during the time period of interest. Thirteen opioid-related deaths were excluded, as investigations into these deaths were not complete at the time of this surveillance report.

The data used to produce this report reflects a collaborative effort of coroners, pathologists and forensic toxicologists across the province. To address the need for more timely and comprehensive data on substance-related deaths, the OCC/OFPS implemented the Opioid Investigative Aid on May 1, 2017. The Opioid Investigative Aid is completed by investigating coroners using multiple information sources (including, but not limited to, hospital and health records, family members, bystanders and emergency responders) and encompasses information on demographics, medical, mental health and substance use history, scene information and the circumstances surrounding the death. The cause and manner of death are determined after a thorough review of information collected through the Opioid Investigative Aid, in conjunction with post-mortem examinations by pathologists and toxicologic testing. The integrated investigation informs inclusion as a death resulting from opioid toxicity or exclusion as a non-opioid death. Additionally, this report used data from Public Health Ontario's (PHO) [Interactive Opioid Tool](#) to report on quarterly and longer-term trends of opioid-related deaths.⁷

Analysis

Mortality rates for opioid-related deaths were calculated using population projections for fiscal year 2017 (March 2017 to April 2018), which were obtained from the Ontario Ministry of Health and Long-Term Care.¹⁰ Population data were extrapolated for analysis by calendar year quarters. Age groups were defined as 0 to 14, 15 to 24, 25 to 44, 45 to 64 and 65 years and older. Characteristics of opioid-related deaths and those who died were examined using the following manner of death categories: accident (unintentional), suicide and undetermined.

The majority of the analysis focused on deaths classified as accidents, as these represent the highest number of deaths and interventions for prevention may differ when addressing accidental versus suicide deaths.

We analyzed these deaths by demographic information including sex,ⁱ age group, recent incarceration, marital status, living arrangement, employment status, employment industry, health history and substance use history. Information collected on ethnicity and race was not in the scope of this report.

The substances involved in the death were categorized as either opioid or non-opioid and further as pharmaceutical or non-pharmaceutical. Substances were either classified as detected or directly contributing to the death. Previous public reports on opioid-related deaths, including PHO's [Interactive Opioid Tool](#),⁷ reported and categorized deaths based upon substances detected by toxicology testing only (i.e., without specific reference to the cause of death determined by the coroner and pathologist). In contrast, this report documents the substances that the death investigation determined to directly contribute to the death. We characterized the origin of the opioid as non-pharmaceutical, pharmaceutical (includes prescribed to deceased person and diverted) or origin could not be classified, based on available toxicology results, scene evidence and additional death investigation information (see definitions list and [Appendix A](#)).

Information on the demographic characteristics of those who died and the circumstances surrounding their deaths was examined using descriptive statistics. When relevant, the results were stratified by age group and sex. Geographic variation in the number and rate of deaths are illustrated through maps by public health unit region. Postal codes of residence were used to determine the population centre of residence at the time of death and the associated neighbourhood material deprivation quintile using the 2016 [Ontario Marginalization Index \(ON-Marg\)](#).⁴ Postal codes were identified from the best information available to the coroner using multiple sources of information. In situations where no postal code of residence was identified, location of incident or death was used. Heat maps preferentially used postal code of incident location or if not available, the postal code of death or the postal code of residence. The circumstances surrounding death were also explored, specifically, incident location, indication of injection, presence of another individual, as well as resuscitation attempts and naloxone administration.

During a death investigation, information is sought from several sources (e.g., health care professionals, health records, family and friends); however, certain details on the history of the deceased person are sometimes unavailable. As such, there were several variables with unknown information. In these cases, minimum proportions were calculated, where the number with unknown information was included in the denominator. Therefore, proportions for characteristics with unknown information are considered the minimum estimate of that proportion.

Researchers, public health professionals, community health centre representatives and people with lived experience of substance use or chronic pain were consulted in the interpretation of the results presented in this report.

ⁱ There were fewer than 10 deaths where the biologically determined sex and self-reported gender differed. Sex was determined based on physical features at time of death assessed by the coroner and pathologist. Due to the small size of this population, no further analysis on gender was conducted.

Findings

There were a total of 1,350 opioid-related deaths in Ontario during July 2017 to June 2018, of which 1,337 were included in this report (annualized rate of 9.3 per 100,000 population, Table 1.1). Thirteen deaths occurred during this period, but were excluded from the analysis because the investigations were not complete at the time of the report. Below, the major findings for each analyses are presented and the data from figures are presented in [Appendix B](#). While the findings in this report focus on data between July 2017 and June 2018 (calendar year quarter 2017 Q3 to 2018 Q2), Tables 1.1 to 1.4 include data from January to June 2017 (2017 Q1 and Q2) for comparison purposes.

Between July 2017 and June 2018, opioid-related deaths were more frequent among males (72.0%) (Table 1.2) and individuals aged 25 to 44 (50.2%) and 45 to 64 (37.5%) years (Table 1.3), with similar trends by quarter. Fentanyl (pharmaceutical or non-pharmaceutical) and fentanyl analogues directly contributed to the death in about two-thirds (66.3%) of opioid-related deaths with an increase between Q1 and Q3 2017 (Table 1.4). The highest number of deaths occurred in Q3 2017 (July to September) along with the highest proportion of deaths where fentanyl directly contributed to the death (72.0%). Nearly two-thirds (62.2%) of deaths had a non-opioid substance directly contribute to the death along with one or more opioids.

Table 1.1. Number and rate of opioid-related deaths by calendar year quarter, January 2017 to June 2018

Rate	2017* Q1 n (rate)	2017* Q2 n (rate)	2017 Q3 n (rate)	2017 Q4 n (rate)	2018 Q1 n (rate)	2018 Q2 n (rate)	Total 2017 Q3 to 2018 Q2 n (rate)
Annualized Rate (per 100,000)**	238 (6.7)	311 (8.8)	414 (11.6)	302 (8.5)	306 (8.5)	315 (8.8)	1,337 (9.3)

Note: Data included was obtained on January 21, 2019 and the data reported in this table may change as a result of ongoing death investigations. Annual rates per 100,000 population are provided.

*2017 data for January to March (Q1) and April to June (Q2) are provided for comparison purposes only.

**Population rates for opioid-related deaths were calculated using population projections for the 2017-18 fiscal year obtained from the Ontario Ministry of Health and Long-Term Care.¹⁰

Table 1.2. Opioid-related deaths by sex and calendar year quarter, January 2017 to June 2018

Sex	2017 Q1* n (%)	2017 Q2* n (%)	2017 Q3 n (%)	2017 Q4 n (%)	2018 Q1 n (%)	2018 Q2 n (%)	Total 2017 Q3 to 2018 Q2 n (%)
Male	175 (73.5)	217 (69.8)	311 (75.1)	213 (70.5)	224 (73.2)	214 (67.9)	962 (72.0)
Female	63 (26.5)	94 (30.2)	103 (24.9)	89 (29.5)	82 (26.8)	101 (32.1)	375 (28.0)

*2017 data for January to March (Q1) and April to June (Q2) are provided for comparison purposes only.

Table 1.3. Opioid-related deaths by age and calendar year quarter, January 2017 to June 2018

Age group	2017 Q1* n (%)	2017 Q2* n (%)	2017 Q3 n (%)	2017 Q4 n (%)	2018 Q1 n (%)	2018 Q2 n (%)	Total 2017 Q3 to 2018 Q2 n (%)
Age 0 to 14	3 (1.3)	2 (0.6)	1 (0.2)	0 (0)	0 (0)	0 (0)	1 (0.1)
Age 15 to 24	20 (8.4)	34 (10.9)	35 (8.5)	28 (9.3)	22 (7.2)	29 (9.2)	114 (8.5)
Age 25 to 44	98 (41.2)	153 (49.2)	215 (51.9)	151 (50.0)	142 (46.4)	163 (51.7)	671 (50.2)
Age 45 to 64	104 (43.7)	108 (34.7)	150 (36.2)	116 (38.4)	124 (40.5)	112 (35.6)	502 (37.5)
Age 65+	13 (5.5)	14 (4.5)	13 (3.1)	7 (2.3)	18 (5.9)	11 (3.5)	49 (3.7)

*2017 data for January to March (Q1) and April to June (Q2) are provided for comparison purposes only.

Table 1.4. Opioid related deaths by substance type and calendar year quarter, January 2017 to June 2018

Substance type	2017 Q1* n (%)	2017 Q2* n (%)	2017 Q3 n (%)	2017 Q4 n (%)	2018 Q1 n (%)	2018 Q2 n (%)	Total 2017 Q3 to 2018 Q2 n (%)
Fentanyl^A directly contributed to death	111 (46.6)	201 (64.6)	298 (72.0)	194 (64.2)	188 (61.4)	207 (65.7)	887 (66.3)
Non-opioid substance^B directly contributed to death	NR	NR	236 (57.0)	189 (62.6)	200 (65.4)	206 (65.4)	831 (62.2)

Note: Some deaths were attributed to multi-drug toxicity where more than one substance can contribute to an individual death; therefore, the overall percentages may sum to greater than 100%.

NR = not reported based on different data collection methods.

*2017 data for January to March (Q1) and April to June (Q2) are provided for comparison purposes only.

^A Includes fentanyl (pharmaceutical or non-pharmaceutical), carfentanil and other fentanyl analogues.

^B Non-opioid substances include both pharmaceutical drugs (e.g., benzodiazepines, anti-histamines) and non-pharmaceutical substances (e.g., cocaine, methamphetamine, alcohol).

Manner of Death

Of the 1,337 deaths between July 2017 and June 2018, 1,209 (90.4%) were accidental and 99 (7.4%) were suicides. There are some notable differences in age group, sex and substances directly contributing to the death by manner of death.

The majority of accidental opioid-related deaths occurred among males (74.3%) and among persons between the age of 25 and 44 years (52.8%) (Table 2.1 and 2.2). When the manner of death was suicide, nearly half of deaths occurred among females (47.5%) and deaths were more likely to occur among individuals in the 45 to 64 (55.6%) age group. The majority of accidental deaths involved fentanyl (71.2%), compared to only 15.2% of suicide deaths (Table 2.3). Additionally, suicide deaths more frequently involved non-opioid substances (71.7%) in addition to one or more opioids.

**Table 2.1. Opioid-related deaths by sex and manner of death, July 2017 to June 2018
(N=1,337)**

Sex	Accident n (%)	Suicide n (%)	Undetermined^A n (%)
Male	898 (74.3)	51 (52.5)	13 (44.8)
Female	311 (25.7)	48 (47.5)	16 (55.2)
Total	1,209 (100.0)	99 (100.0)	29 (100.0)

^A Specific manner of death (e.g., accident, suicide) could not be assigned based on available or competing information.

**Table 2.2. Opioid-related deaths by age and manner of death, July 2017 to June 2018
(N=1,337)**

Age group	Accident n (%)	Suicide n (%)	Undetermined^A n (%)
Age 0 to 14	0 (0)	0 (0)	1 (3.4)
Age 15 to 24	107 (8.9)	5 (5.1)	2 (6.9)
Age 25 to 44	638 (52.8)	22 (22.2)	11 (37.9)
Age 45 to 64	433 (35.8)	55 (55.6)	14 (48.3)
Age 65+	31 (2.6)	17 (17.2)	1 (3.4)

^A Specific manner of death (e.g., accident, suicide) could not be assigned based on available or competing information.

Table 2.3. Opioid-related deaths by substance type and manner of death, July 2017 to June 2018 (N=1,337)

Substance type	Accident n (%)	Suicide n (%)	Undetermined n (%)
Fentanyl directly contributed to death^A	861 (71.2)	15 (15.2)	11 (37.9)
Non-opioid substance(s) directly contributed to death^B	742 (61.4)	71 (71.7)	18 (62.1)

Note: Some deaths were attributed to multi-drug toxicity where more than one substance can contribute to an individual death; therefore, the overall percentages may sum to greater than 100%.

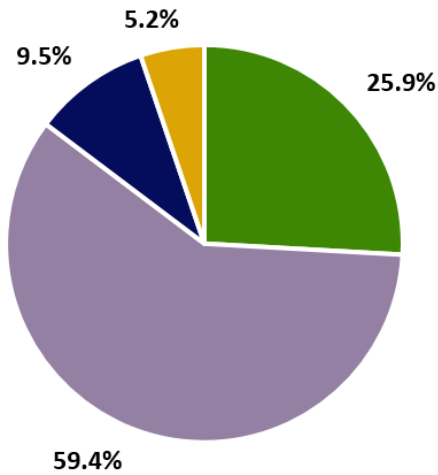
^A Includes fentanyl, carfentanil and other fentanyl analogues.

^B Non-opioid substances include both pharmaceutical substances (e.g., benzodiazepines, anti-histamines) and non-pharmaceutical substances (e.g., cocaine, methamphetamine, alcohol).

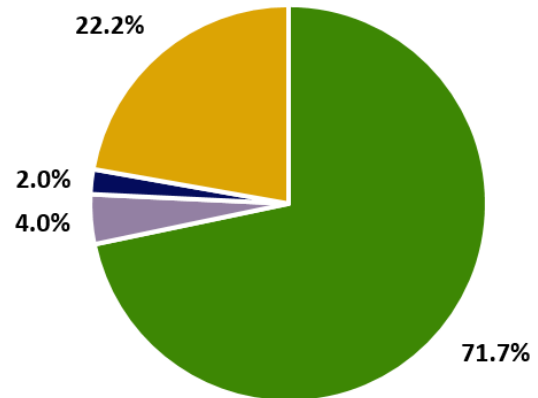
In over two-thirds (68.9%; combining 59.4% non-pharmaceutical only and 9.5% both pharmaceutical and non-pharmaceutical) of accidental opioid-related deaths, a non-pharmaceutical opioid directly contributed to the death, with the majority of these deaths not having additional contribution of pharmaceutical opioids (Figure 1). Pharmaceutical opioids alone (including both those prescribed to the deceased person and diverted) contributed to 25.9% of accidental deaths. In contrast, the vast majority (71.7%) of suicide deaths involved only pharmaceutical opioids, most commonly oxycodone and hydromorphone (data not shown).

Figure 1. Opioid-related deaths by origin of opioid (pharmaceutical/non-pharmaceutical) directly contributing to the death and by manner of death, July 2017 to June 2018

Accidental (n=1,209)



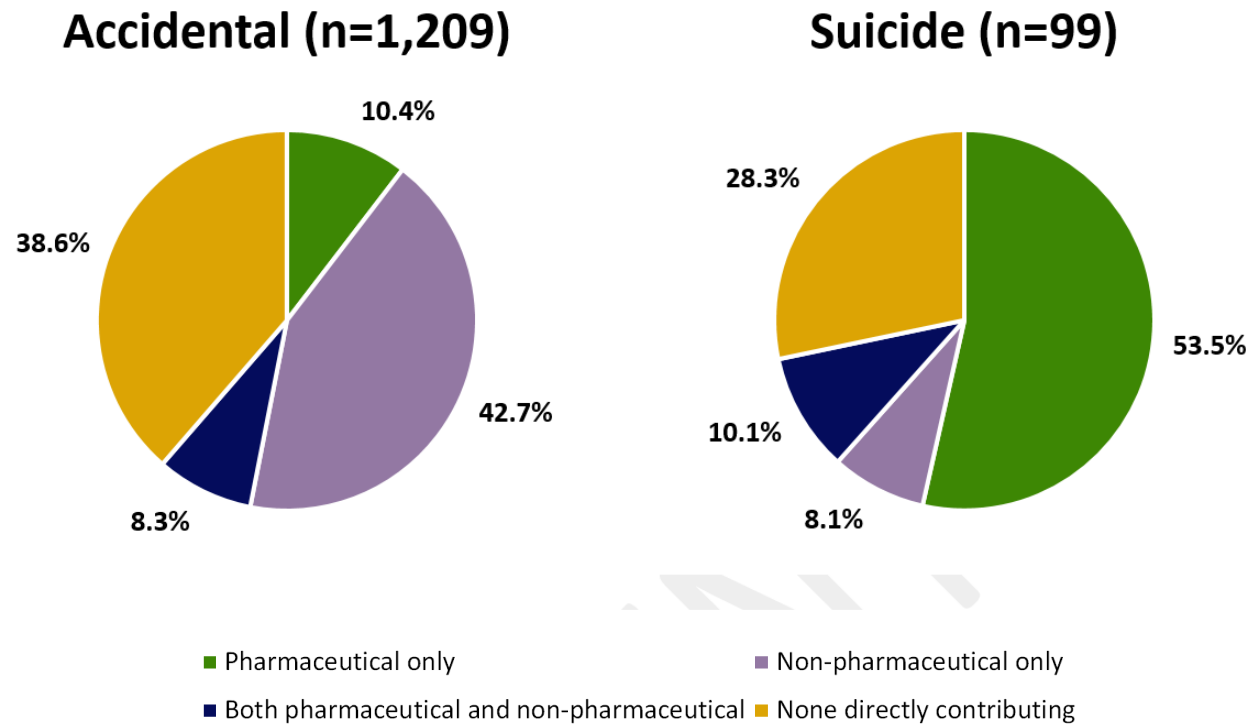
Suicide (n=99)



- Pharmaceutical only
- Non-pharmaceutical only
- Both pharmaceutical and non-pharmaceutical
- Could not be classified

When considering non-opioid substances, non-pharmaceutical substances (without contribution of pharmaceutical substances) contributed more frequently to accidental deaths (42.7%) compared to suicide deaths (8.1%) (Figure 2). In contrast, pharmaceutical non-opioid substances alone contributed most commonly to suicide deaths (53.5%), with benzodiazepines and anti-depressants identified most often (data not shown).

Figure 2. Opioid-related deaths by origin of non-opioid substances directly contributing to the death and by manner of death, July 2017 to June 2018



The remainder of this report will focus on the 1,209 accidental opioid-related deaths. Accidental opioid-related deaths represent the majority of deaths in this report period and interventions for prevention may differ when addressing accidental versus suicide deaths.

Substances Involved

Fentanyl and fentanyl analogues (pharmaceutical or non-pharmaceutical) were the most prevalent opioids identified in post-mortem toxicology, and directly contributed to nearly three-quarters of deaths (71.2%) (Table 3.1). Nearly 15% of deaths involved carfentanil or other fentanyl analogues.

Pharmaceutical opioids such as methadone (14.1%), morphine (10.3%), hydromorphone (10.3%) and oxycodone (10.3%) were commonly identified as directly contributing to the death. Non-opioid non-pharmaceutical substances such as cocaine (33.9%), methamphetamine (14.6%) and ethanol (i.e., from alcohol consumption) (13.2%) as well as non-opioid pharmaceutical benzodiazepines (11.0%) often directly contributed to deaths (Tables 3.2 and 3.3).

Less potent opioids such as codeine were less likely to directly contribute to the death when detected, compared to more potent opioids, such as fentanyl, heroin and hydromorphone. For example, codeine directly contributed to the death in 46.1% of cases where it was detected (35/76), whereas fentanyl and its analogues directly contributed to the death in 99.8% of cases where it was detected (861/863). Compared with potent opioids, other pharmaceutical substances, such as benzodiazepines, were found

to directly contribute to the death less often when detected. Benzodiazepines were found to directly contribute to the death in 30.6% of cases when detected (133/434).

Table 3.1. Accidental opioid-related deaths by opioid type involved, July 2017 to June 2018 (N=1,209)

Substance type ^A	Detected in post-mortem toxicology n (%)	Directly contributed to the death n (%)
Fentanyl and fentanyl analogues	863 (71.4)	861 (71.2)
Fentanyl	769 (63.6)	758 (62.7)
Carfentanil	151 (12.5)	150 (12.4)
Other fentanyl analogues^B	35 (2.9)	32 (2.6)
Methadone	187 (15.5)	171 (14.1)
Heroin	173 (14.3)	152 (12.6)
Morphine	163 (13.5)	125 (10.3)
Hydromorphone	148 (12.2)	124 (10.3)
Oxycodone	143 (11.8)	124 (10.3)
Codeine	76 (6.3)	35 (2.9)
Oxymorphone	28 (2.3)	5 (0.4)
U47700^C	25 (2.1)	23 (1.9)
Hydrocodone	10 (0.8)	6 (0.5)
Tramadol	5 (0.4)	4 (0.3)
Buprenorphine	8 (0.7)	0 (0)
Mitragynine^D	6 (0.5)	3 (0.2)

^ASome deaths were attributed to multi-drug toxicity where more than one substance can contribute to an individual death; therefore, the overall percentages may sum to greater than 100%. Deaths in which heroin and morphine were both present are considered heroin toxicity deaths, whereby heroin is rapidly metabolized to morphine. The presence of 6-Monoacetylmorphine (6-MAM), the intermediary metabolite, confirms consumption of heroin; however, 6-MAM is rapidly cleared from the body such that the absence does not allow determination if morphine was the substance consumed or was a metabolite of heroin. Heroin deaths may therefore be underreported. Morphine can be a metabolite of codeine, more typically at higher codeine concentrations.

Oxymorphone is a metabolite of oxycodone and hydrocodone is a metabolite of codeine and should be interpreted with caution.

^B Includes despropionyl fentanyl, para-fluorobutyryl fentanyl, furanylfentanyl, cyclopropyl/crotonyl fentanyl, methoxyacetyl fentanyl.

^C U47700 is a non-pharmaceutical synthetic analgesic opioid.

^D Commonly known as kratom.

Table 3.2. Accidental opioid-related deaths by involvement of non-opioid non-pharmaceutical substances, July 2017 to June 2018 (N=1,209)

Substance type	Detected in post-mortem toxicology n (%)	Directly contributed to the death n (%)
Cocaine	633 (52.4)	410 (33.9)
Methamphetamine^A	274 (22.7)	176 (14.6)
Ethanol^B	361 (29.9)	159 (13.2)
Amphetamines	177 (14.6)	111 (9.2)
Ketamine^C	7 (0.6)	3 (0.2)

Note: Some deaths were attributed to multi-drug toxicity where more than one substance can contribute to an individual death.

^A Includes Methyl-enedioxy-methamphetamine (MDMA).

^B Includes all deaths where ethanol was detected, including deaths where alcohol was consumed or ethanol was related to post-mortem endogenous ethanol production. Ethanol directly contributing to death represents alcohol consumption, while detection can be due to post-mortem and endogenous ethanol production and should be interpreted with caution.

^C Ketamine is included as a non-pharmaceutical substance, as it is mainly used in hospital and not available through prescription.

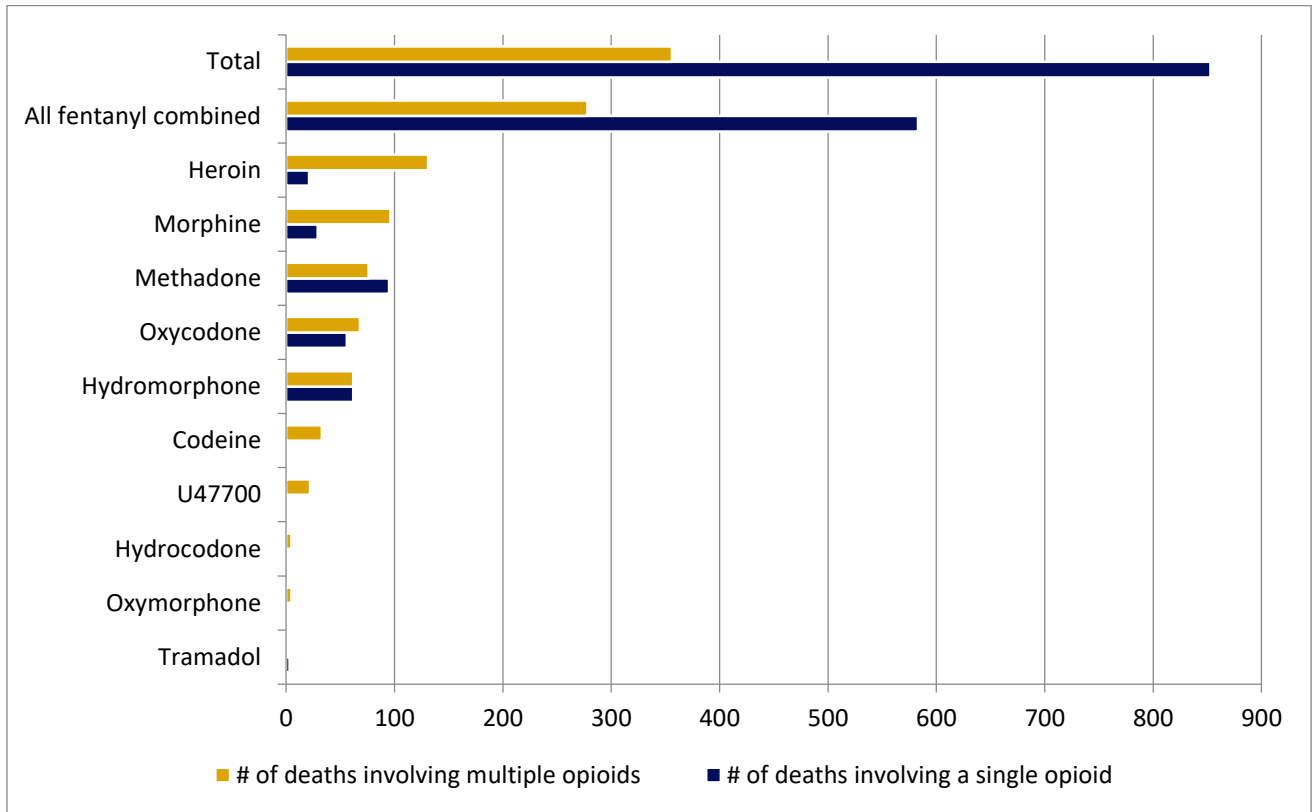
Table 3.3. Accidental opioid-related deaths by non-opioid pharmaceutical substance involved, July 2017 to June 2018 (N=1,209)

Substance type	Detected in post-mortem toxicology n (%)	Directly contributed to the death n (%)
Benzodiazepines	434 (35.9)	133 (11.0)
Non-tricyclic antidepressants	282 (23.3)	39 (3.2)
Antipsychotics	161 (13.3)	17 (1.4)
Antihistamines	158 (13.1)	60 (5.0)
Anticonvulsant	138 (11.4)	17 (1.4)
Tricyclic Antidepressants	82 (6.8)	21 (1.7)
Stimulants	41 (3.4)	3 (0.2)

Note: Some deaths were attributed to multi-drug toxicity where more than one substance can contribute to an individual death.

More than one opioid may be consumed by choice or another substance may be contaminated and opioid exposure may not be recognized. Most deaths involved a single opioid and the majority of these deaths had fentanyl contribute to the death (68.3%, n=583) (Figure 3). When multiple opioids contributed to the death, fentanyl was also most commonly identified as contributing to the death, followed by heroin and morphine.

Figure 3. Accidental opioid-related deaths by single or multiple opioids contributing to death, July 2017 to June 2018 (N=1,209)



Note: Deaths in which heroin and morphine were both present are considered heroin toxicity deaths. Heroin is rapidly metabolized to morphine, which produces the clinical effects. The presence of 6-Monoacetylmorphine (6-MAM), the intermediary metabolite, confirms consumption of heroin; however, 6-MAM is rapidly cleared from the body such that the absence does not allow determination if morphine was the substance consumed or was a metabolite of heroin.

Demographic Characteristics

Between July 2017 and June 2018, there were 1,209 accidental opioid-related deaths (8.37 per 100,000). The average age among people with an accidental opioid-related death was 41 years (40.8 years; standard deviation 12.4). Although males represented a higher number of deaths in all age groups, the largest difference between males and females occurred in the age 25 to 44 age group (Figure 4). Nearly one-third of deceased persons (31.8%) lived in the fifth ON-Marg quintile of neighbourhood material deprivation (most deprived) (Table 4.1)ⁱⁱ and the majority (62.0%) of deaths occurred among people who resided in large urban centres (Table 4.2). Individuals with a missing postal code of residence include people whose postal code could not be identified, who had no fixed address or were not from Ontario. Deceased persons for whom a residential postal code was not available were more likely to experience the incident leading to death in the highest materially deprived neighbourhoods and in larger urban centres. When considering deaths by incident location, incidents occurred in large urban population centres in 72.2% of deaths (data not shown).

There were 33 (2.7%) deceased persons identified as having been released from a correctional facility within the previous four weeks; however, information on recent incarceration was not available for 35.0% of accidental opioid-related deaths (Table 4.3). Therefore, these data should be interpreted with caution since they could underestimate the prevalence of recent incarceration. About half (47.1%) of deceased persons had a recorded marital status as single at the time of death (Table 4.4) and this was more frequently reported among males (data not shown). Information about the marital status was unknown for one-quarter (24.3%) of deceased persons.

ⁱⁱ Material deprivation was identified as a neighbourhood-level characteristic. It may not reflect the characteristics of deceased persons who resided in that neighbourhood.

Figure 4. Accidental opioid-related deaths by age group and sex, July 2017 to June 2018 (N=1,209)

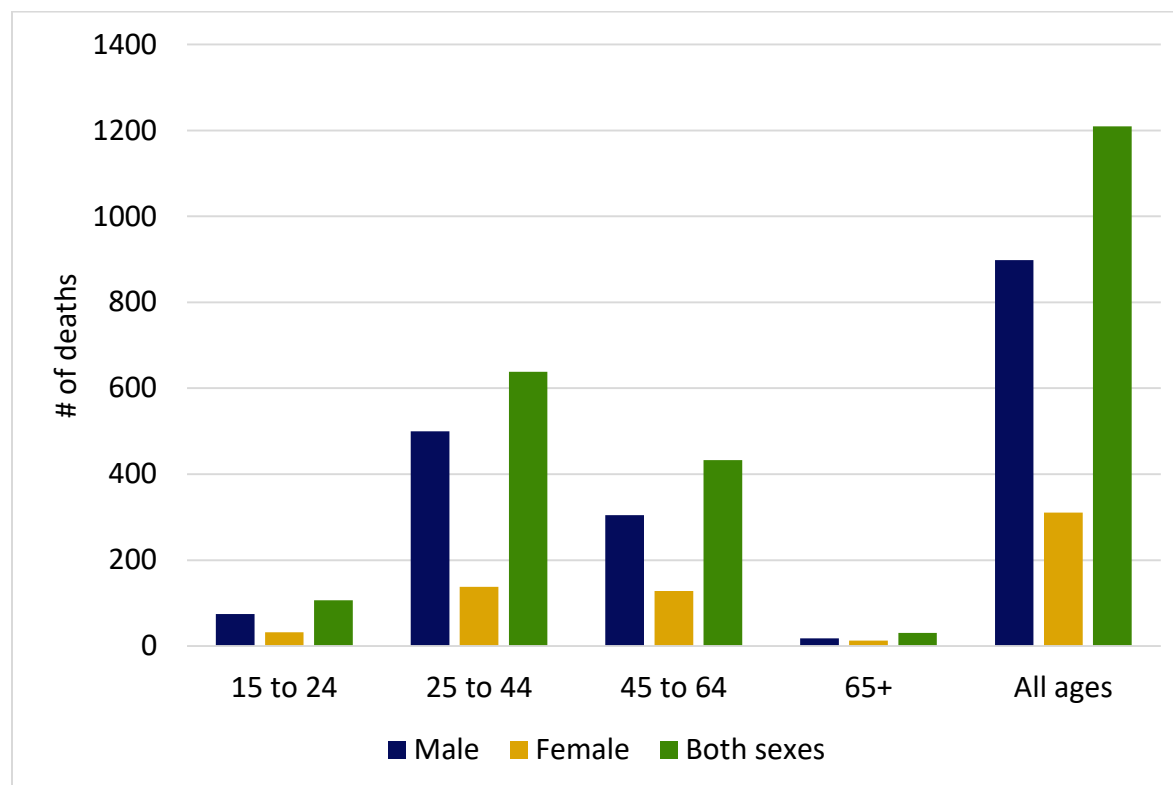


Table 4.1. Accidental opioid-related deaths by quintile of neighbourhood material deprivation (ON-Marg), July 2017 to June 2018 (N=1,209)

ON-Marg quintile of material deprivation	Number of deaths n (%)
Quintile 1 (least deprived)	143 (11.8)
Quintile 2	167 (13.8)
Quintile 3	170 (14.1)
Quintile 4	207 (17.1)
Quintile 5 (most deprived)	385 (31.8)
Missing postal code of residence*	137 (11.3)

* There were seven records included in this category that were linked to suppressed ON-Marg information.

Table 4.2. Accidental opioid-related deaths by population centre and rural area classification of residence, July 2017 to June 2018 (N=1,209)

Population centre and rural area classification	Number of deaths n (%)
Rural area (<1,000)	112 (9.3)
Small population centre (1,000 to 29,999)	82 (6.8)
Medium population centre (30,000 to 99,999)	135 (11.2)
Large urban population centre (100,000 or greater)	750 (62.0)
Missing postal code of residence	130 (10.8)

Table 4.3. Accidental opioid-related deaths by release from correctional facility in past four weeks, July 2017 to June 2018 (N=1,209)

Release from correctional facility in past four weeks	Number of deaths n (%)
Yes	33 (2.7)
No	753 (62.3)
Unknown	423 (35.0)

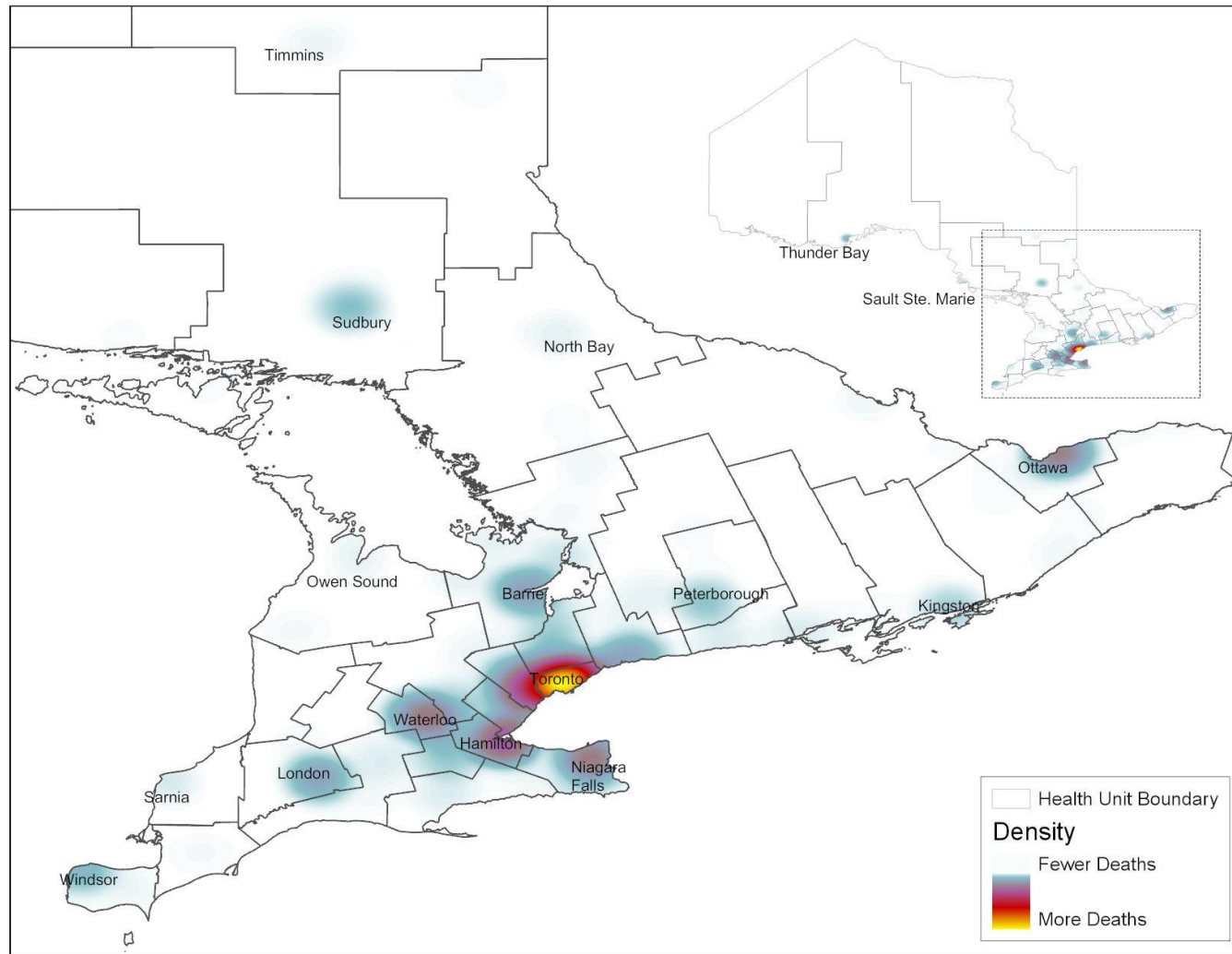
Table 4.4. Accidental opioid-related deaths by marital status, July 2017 to June 2018 (N=1,209)

Marital status	Number of deaths n (%)
Single	570 (47.1)
Married/common-law	180 (14.9)
Divorced/separated	146 (12.1)
Widowed	19 (1.6)
Unknown	294 (24.3)

Geographic Location

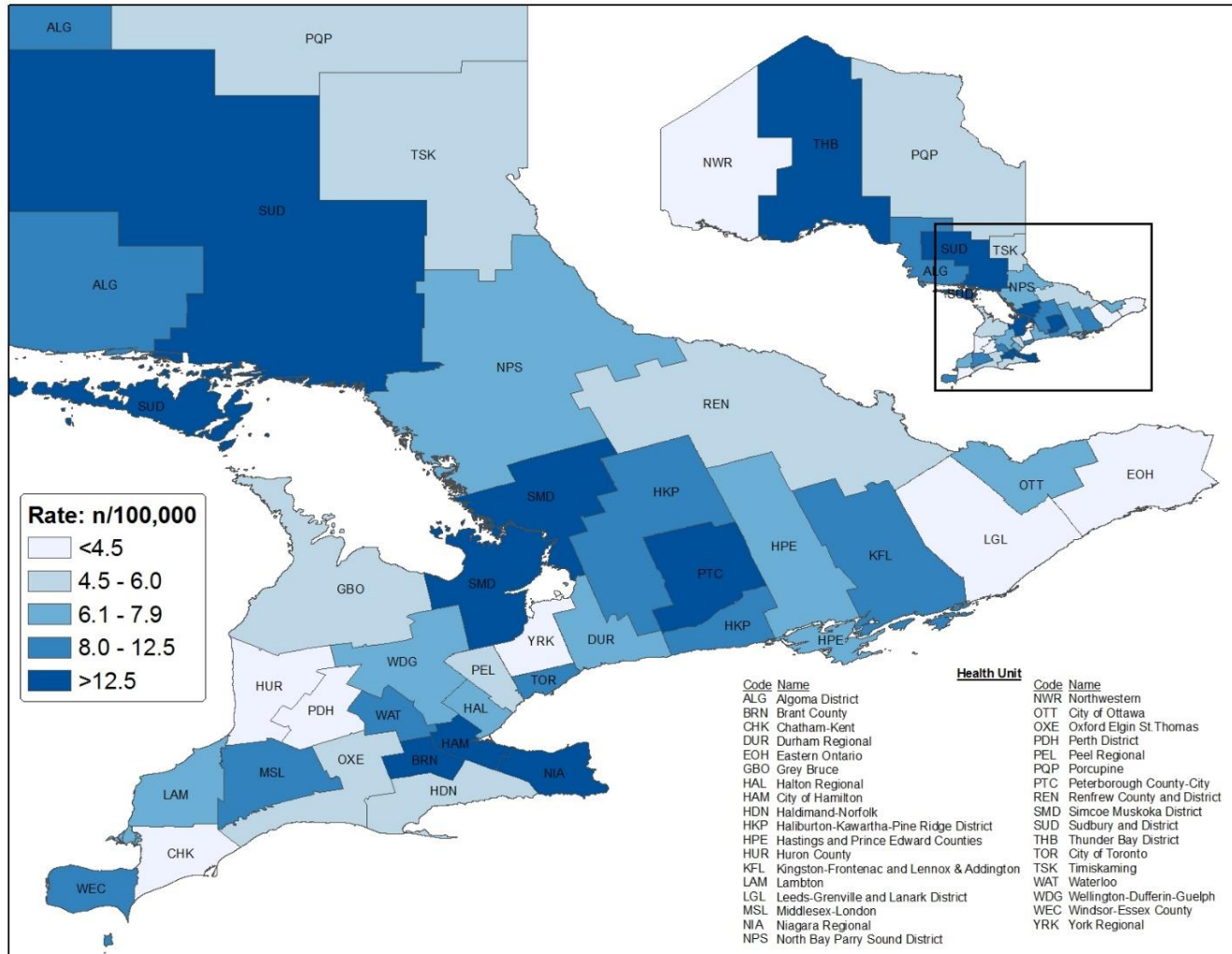
Accidental opioid-related deaths occurred across the entire province; however, there was geographic variation in the numbers and rates of deaths. In Figure 5, the highest number of deaths occurred in Toronto (n=291), followed by Peel (n=90), Hamilton (n=84) and Niagara (n=83). The highest population-adjusted rates of death by public health unit occurred in Thunder Bay Public Health Unit (22.7 per 100,000), Niagara Region Public Health (18.1 per 100,000) and Peterborough Public Health (15.4 per 100,000) (Figure 6). The overall rate of accidental opioid-related deaths in Ontario during this time period was 8.4 per 100,000.

Figure 5. Heat map of the number of accidental opioid-related deaths, July 2017 to June 2018



Note: Postal codes were linked to the centroid of the 2016 dissemination area. The postal code selected to be mapped prioritized incident location, followed by death location and then residence location.

Figure 6. Rate (per 100,000) of accidental opioid-related deaths by public health unit, July 2017 to June 2018 (N=1,209)



Note: Death data were geocoded to public health units by joining the postal code of the deceased person with Statistics Canada Postal Code Conversion File (PCCF) and health-region boundary correspondence files using the single-link indicator (SLI). The postal code used for mapping prioritized residence location, followed by incident location and then death location.

Employment Status and Industry of Employment

Nearly half (46.8%) of deceased persons had their employment status recorded as unemployed at the time of death and almost one-third (32.9%) had an unknown employment status (Table 5.1). Among those who had a confirmed employment status at the time of death (18.1%), the most common industry of employment was construction (68/219; 31.0%) (Tables 5.2 and 5.3). Of those employed, the industry of employment was unknown for 10% of deaths (22/219). Of those deceased persons who were unemployed at the time of death, the most commonly reported previous industry of employment was also construction (data not shown).

Table 5.1. Accidental opioid-related deaths by employment status, July 2017 to June 2018 (N=1,209)

Employment status	Number of deaths n (%)
Employed	219 (18.1)
Unemployed	566 (46.8)
Retired	26 (2.2)
Unknown	398 (32.9)

Table 5.2. Accidental opioid-related deaths by industry of employment (services), July 2017 to June 2018 (n=219)

Industry of employment: services	Number of deaths among those employed n (%)
Accommodation and food services	12 (5.5)
Retail trade	12 (5.5)
Professional, scientific and technical services	8 (3.7)
Art, entertainment and recreation	7 (3.2)
Health care and social assistance	7 (3.2)
Finance and insurance	6 (2.7)
Information and cultural industries	3 (1.4)
Public administration (i.e., police and military)	3 (1.4)
Real estate and rental and leasing	3 (1.4)
Other services ^A	30 (13.7)

^AOther services included, but were not limited to, landscaping, hairdressing and tattoo artist.

Table 5.3. Accidental opioid-related deaths by industry of employment (trades), July 2017 to June 2018 (n=219)

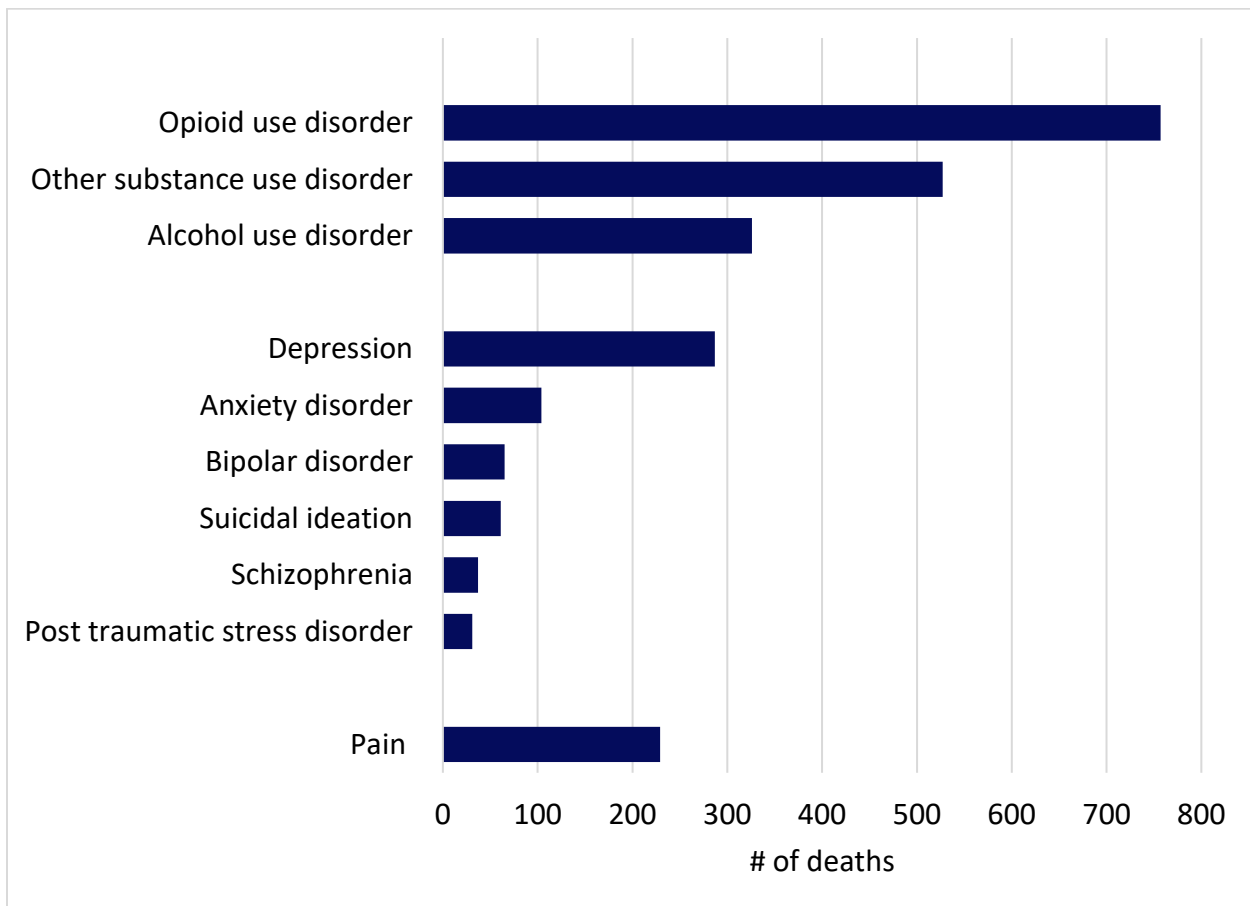
Industry of employment: trades	Number of deaths among those employed n (%)
Construction	68 (31.0)
Transportation and warehousing	14 (6.4)
Manufacturing	16 (7.3)
Utilities	4 (1.8)
Other trades ^A	4 (1.8)

^AOther trades include mining and forestry.

Health History

Opioid use disorder (62.6%, n=757), other substance use disorder (43.6%, n=527), alcohol use disorder (27.0%, n=326), depression (23.7%, n=287) and pain (18.9%, n=229) were common health conditions identified over the course of the death investigations (Figure 7). Among individuals with substance use disorder, there were 14.8% who did not have an opioid use disorder (data not shown). Of the deceased persons, almost one-third (28.2%) had a substance use disorder concurrent with another mental health condition and 15.6% had a pain condition and a substance use disorder (data not shown). There were a considerable number of deaths for which the coroner could not determine health status information during the investigation. Specifically, this information was unknown with regards to substance use disorder for about 10% of deaths, history of pain for 20% of deaths and history of another mental health diagnosis for 40% of deaths.

Figure 7. Accidental opioid-related deaths by health history, July 2017 to June 2018 (N=1,209)

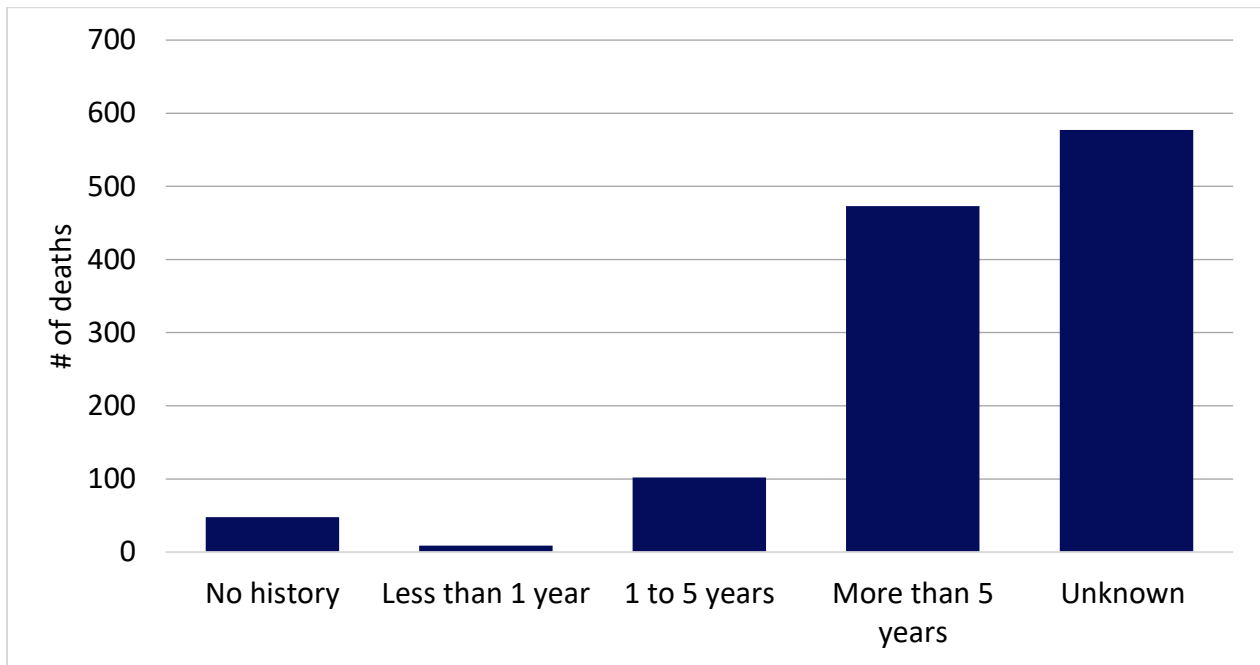


Note: Pain conditions included acute and chronic pain or pain disorder (DSM5 diagnosis). As a person may have multiple health conditions, these categories are not mutually exclusive and the investigation may have identified more than one of these conditions for a single person.

Length of Substance Use

Information about the length of substance use was unknown for almost half (47.7%, n=577) of deceased persons (Figure 8); however, 39.1% (n=473) had more than a five-year history of substance use recorded and 4.0% (n=48) had no known history of substance use. The substance used is not specified in the data collected, although it does not include alcohol use.

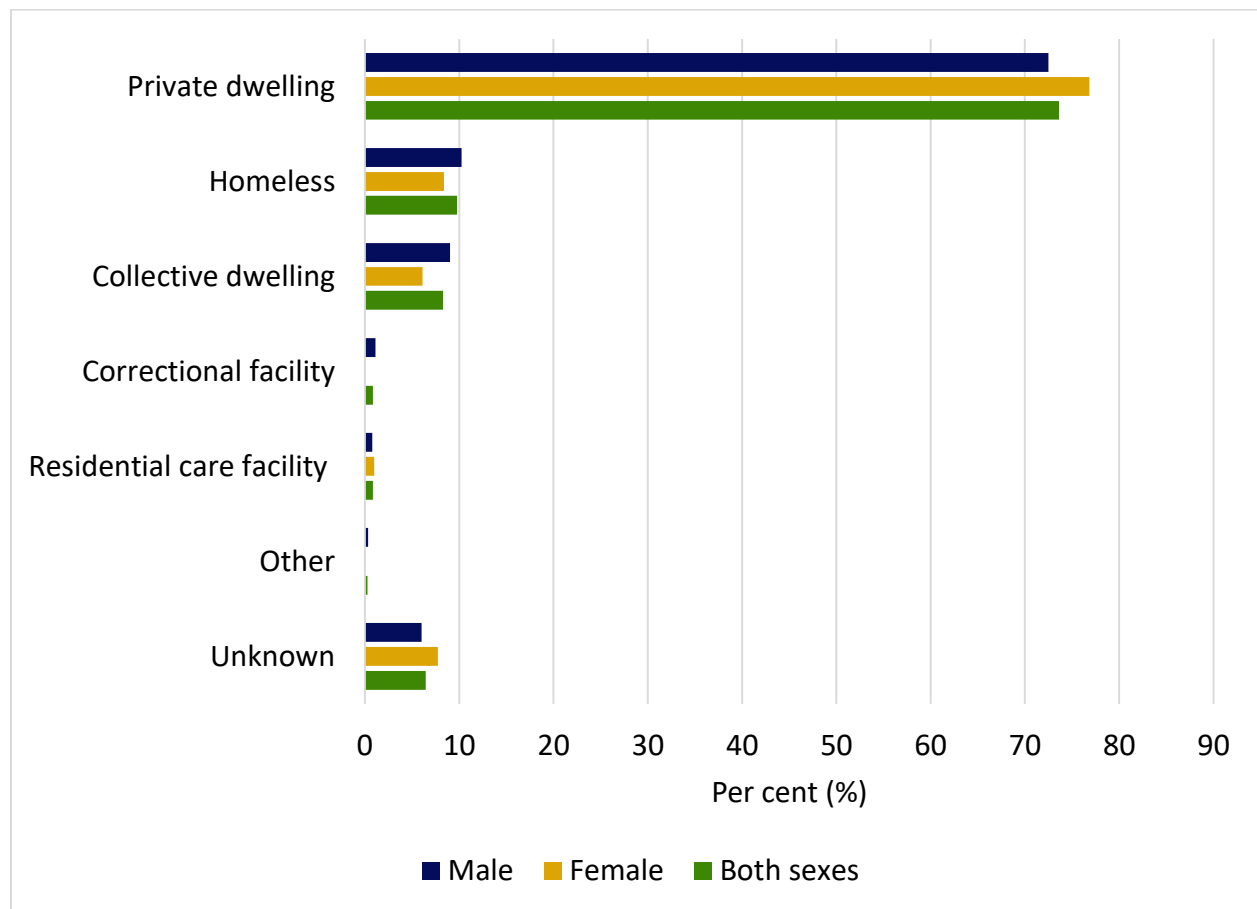
Figure 8. Accidental opioid-related deaths by length of substance use, July 2017 to June 2018 (N=1,209)



Living Arrangement

Nearly three-quarters (73.6%) of accidental opioid-related deaths occurred among people living in a private dwelling at the time of death and there was not a substantial difference by sex (Figure 9). People experiencing homelessness represented 9.8% of deaths. Information about the living arrangement was unknown for 6.5% of deceased persons.

Figure 9. Accidental opioid-related deaths by living arrangements and sex of the deceased person, July 2017 to June 2018 (N=1,209)

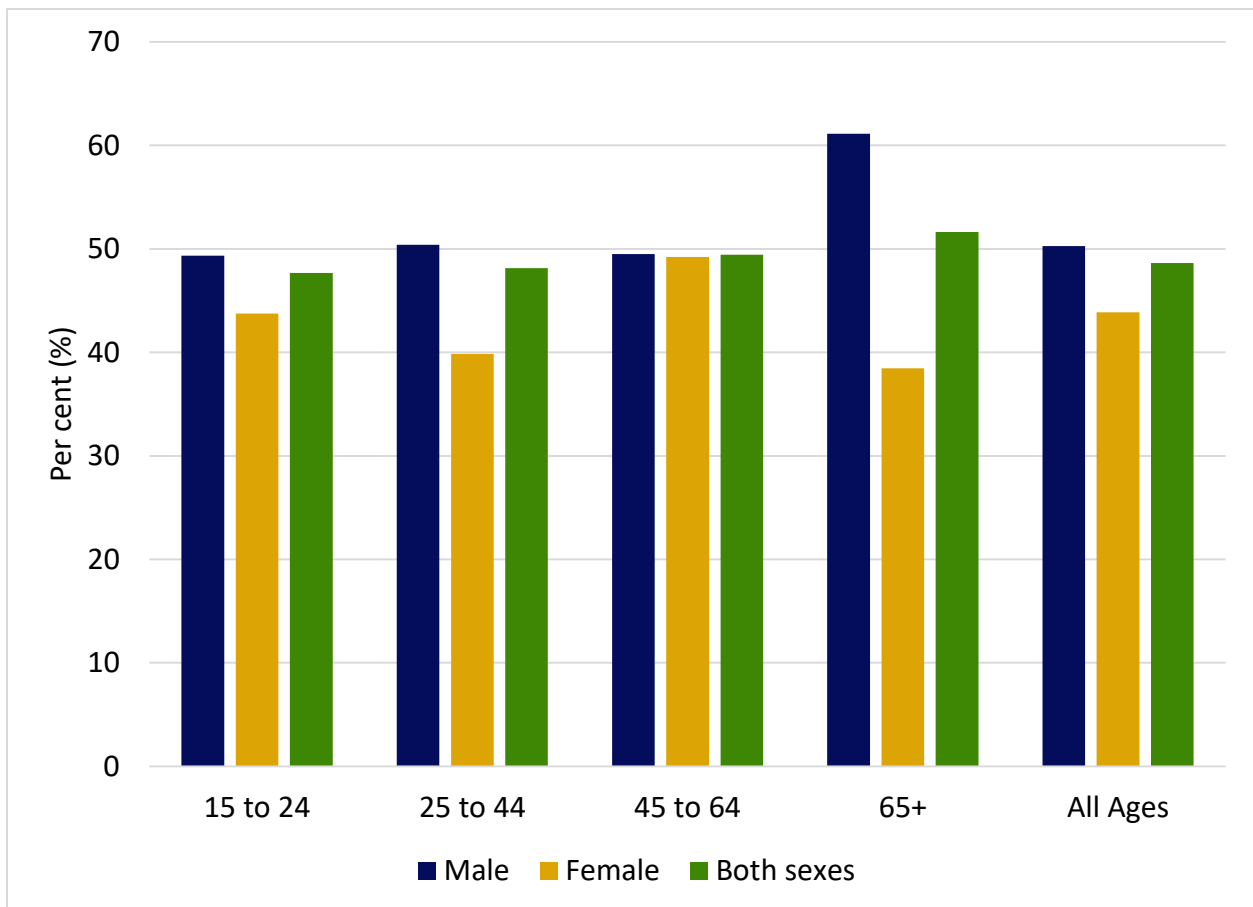


Circumstances Surrounding Death

Alone at the Time of Incident

A person was considered alone at the time of incident if there was no other adult present with the ability to intervene and seek help. Approximately half (48.6%) of the deaths involved a person who was alone at the time of incident (Figure 10). In most age groups, males were more often alone than females, and there was a larger difference among deceased persons 65 years and older. Overall, there were 272 deaths (22.5%) where information on being alone at the time of the incident was unknown.

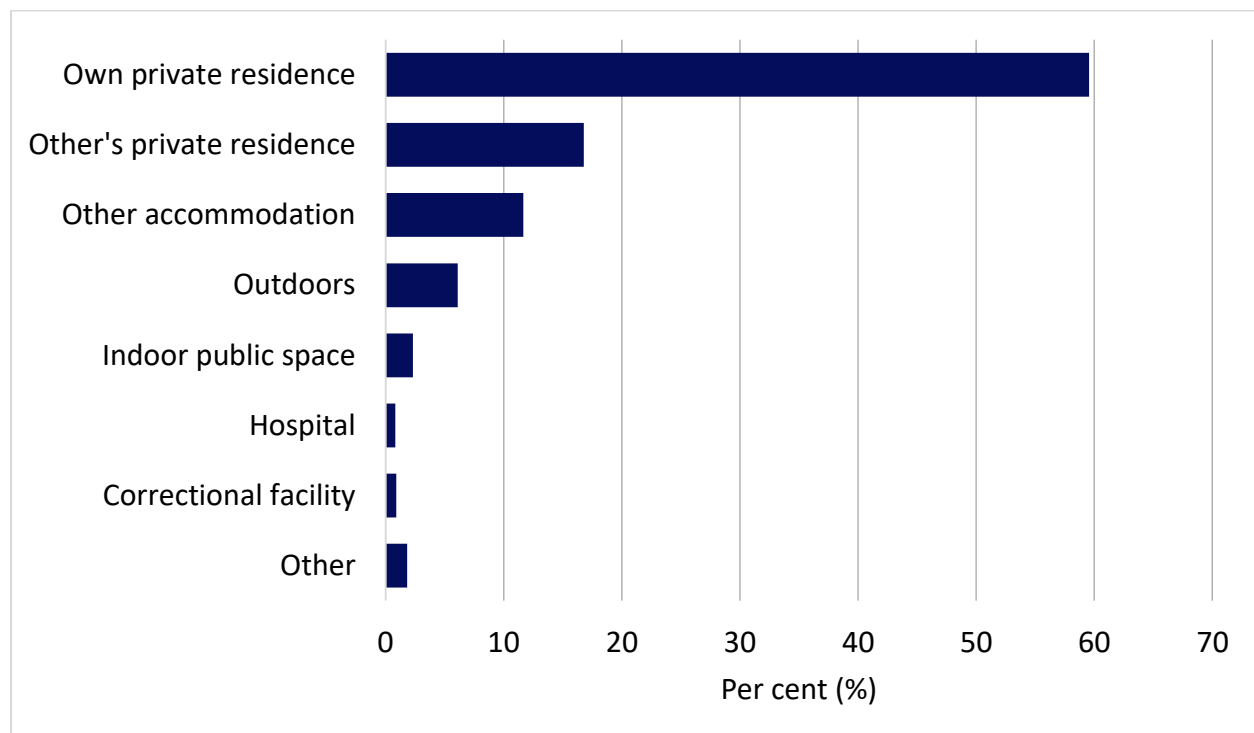
Figure 10. Accidental opioid-related deaths where the deceased person was alone at the time of incident, by age group and sex, July 2017 to June 2018 (n=588)



Incident Location

Over half (59.6%) of the incident locations for accidental opioid-related deaths occurred at the private residence of the deceased person and an additional 16.8% occurred at the private residence of another person (Figure 11). The majority of deaths where the incident occurred in the private residence of the deceased person took place in an apartment/condo or single-detached house, while a small proportion (1%) were reported to be in a community housing complex (data not shown). In approximately 10% of deaths, the incident occurred in other accommodations (141/1209; 11.7%), including rooming houses (71/141; 50.3%), hotel/motels (50/141; 35.5%), shelters (16/141; 11.3%) and supported housing (2/141; 1.4%) (data not shown). Incidents occurring outdoors (6.1%) and in indoor public spaces (e.g., commercial/retail building) (2.3%) were less frequent.

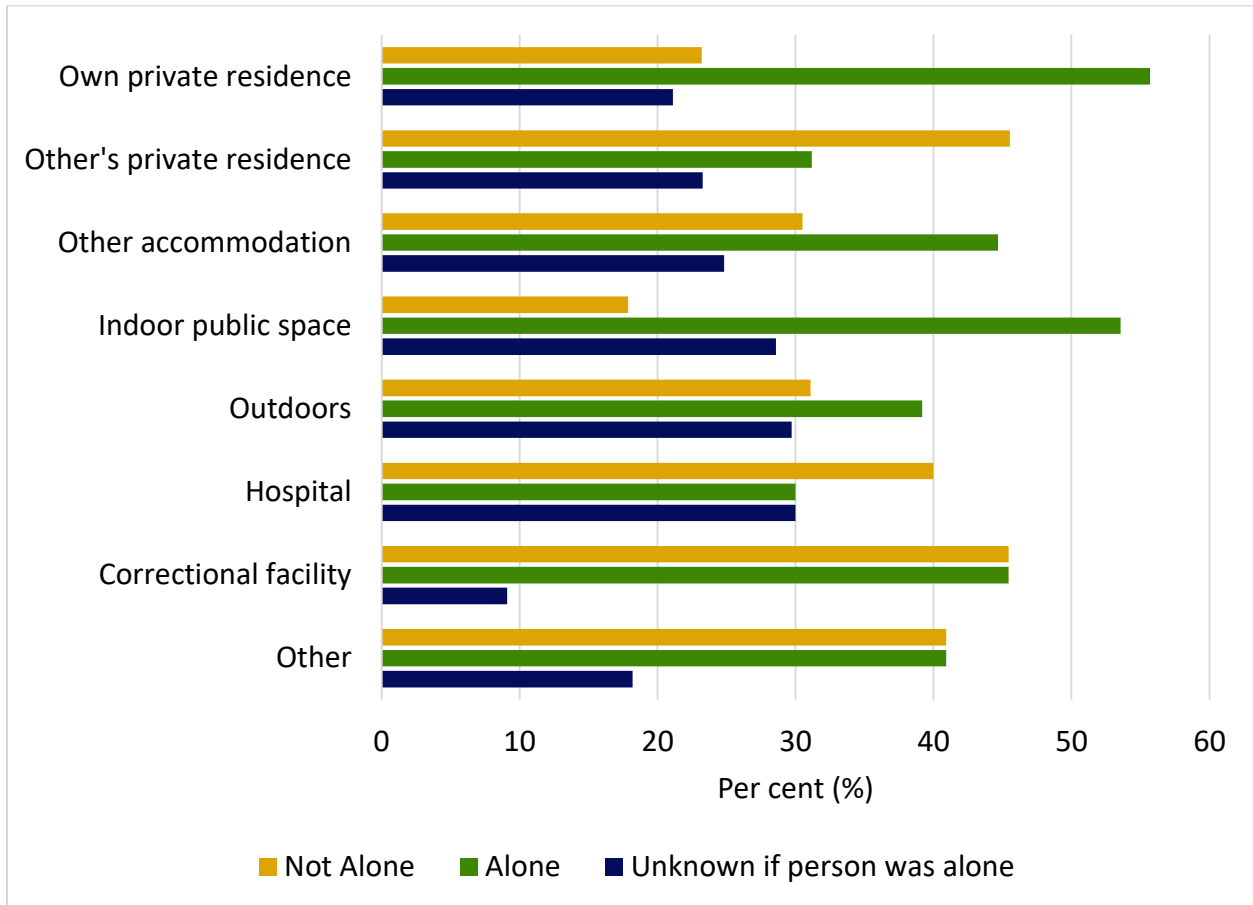
Figure 11. Accidental opioid-related deaths by incident location, July 2017 to June 2018 (N=1,209)



Note: Other includes locations not applicable to other categories such as workplace, methadone clinic, detox centre, doorway of religious institution

Among incidents that occurred at the private residence of the deceased person, more than half (401/720; 55.7%) occurred with no other adult with the ability to intervene present (Figure 12). Incidents that occurred in the residence of another person less frequently occurred without another person present (63/202; 31.2%). Deceased persons who had an incident location in indoor public spaces were frequently alone (15/28; 53.6%).

Figure 12. Accidental opioid-related deaths by incident location and whether the deceased person was alone at the time of incident, July 2017 to June 2018 (N=1,209)



Note: Other includes locations not applicable to other categories such as workplace, methadone clinic, detox centre, doorway of religious institution

Resuscitation and Naloxone Use

Resuscitation was attempted in nearly half (47.8%) of the deaths, mainly by first responders (84.1%) (Table 6.1 and 6.2). Naloxone was administered in approximately one of every five deaths (22.2%), with similar proportions of administration by first responders, hospital staff and bystanders. Information related to resuscitation attempt and naloxone administration was unknown for seven deaths and 123 deaths, respectively.

Table 6.1. Accidental opioid-related deaths by resuscitation attempt, July 2017 to June 2018 (N=1,209)

Resuscitation attempt*, by whom	Number of deaths n (%)
Yes	578 (47.8)
First responder	486 (84.1)
Hospital staff	225 (38.9)
Bystander	214 (37.0)
Unknown who attempted resuscitation	8 (1.4)
No	624 (51.6)
Unknown	7 (0.6)

* A resuscitation attempt could include naloxone, as well as other methods, such as rescue breathing and/or chest compressions. Naloxone may not have been provided if the person was evidently dead when found, the first responders did not know it was an overdose or they may have provided CPR, without administering naloxone. Resuscitation may have been attempted by more than one person; therefore, the sum of values above for each responder may be greater than the total.

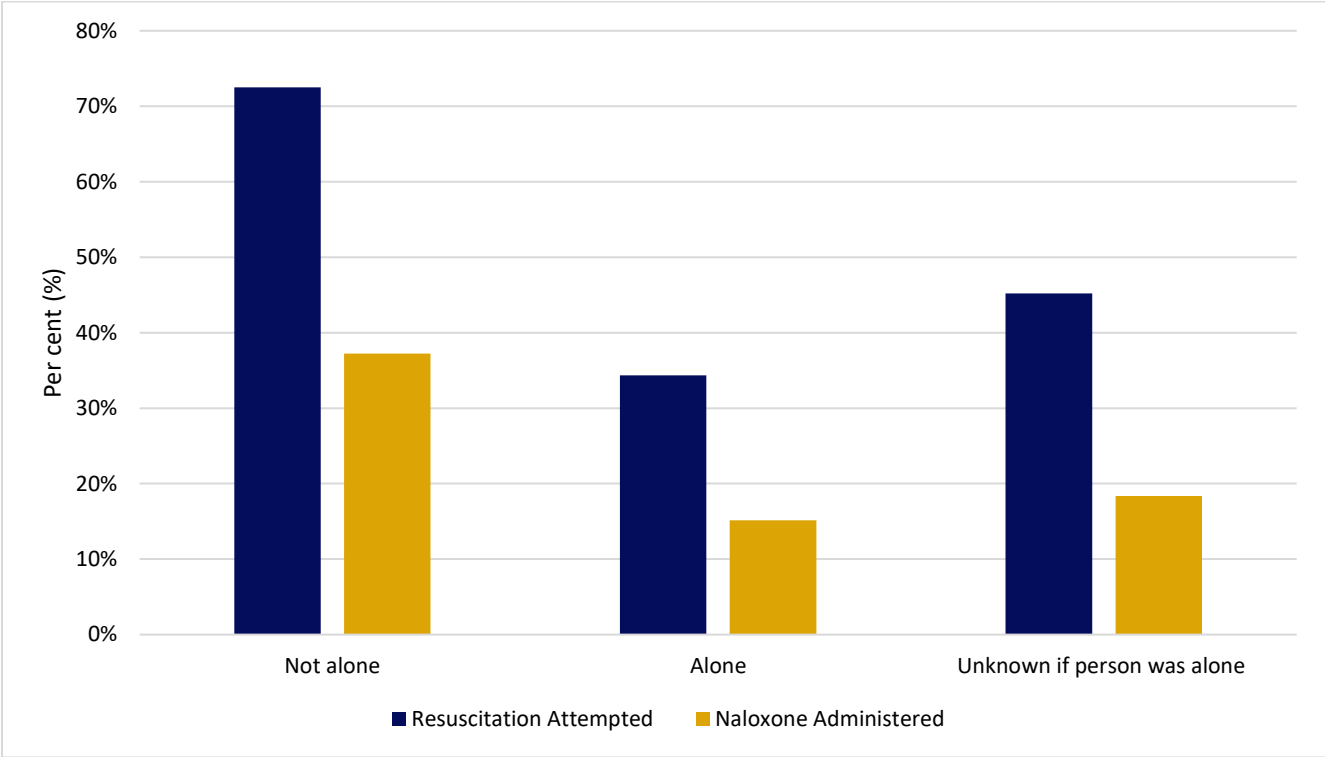
Table 6.2. Accidental opioid-related deaths by naloxone administration, July 2017 to June 2018 (N=1,209)

Naloxone administration, by whom	Number of deaths n (%)
Yes	269 (22.2)
First responder	106 (39.4)
Hospital staff	97 (36.1)
Bystander	78 (29.0)
Unknown who administered naloxone	41 (15.2)
No	817 (67.6)
Unknown	123 (10.2)

Note: Naloxone may have been administered by more than one person; therefore, the sum of values above for each responder may be greater than the total.

Resuscitation and naloxone administration were more frequent when the deceased person was not alone (Figure 13). Almost three-quarters (72.5%) of persons who were not alone had a resuscitation attempt and 37.2% had naloxone administered. In comparison, about one-third (34.4%) of persons who were alone had a resuscitation attempt and 15.1% had naloxone administered. When the deceased person was alone, bystanders or first responders may have attempted resuscitation or administered naloxone after the individual was found.

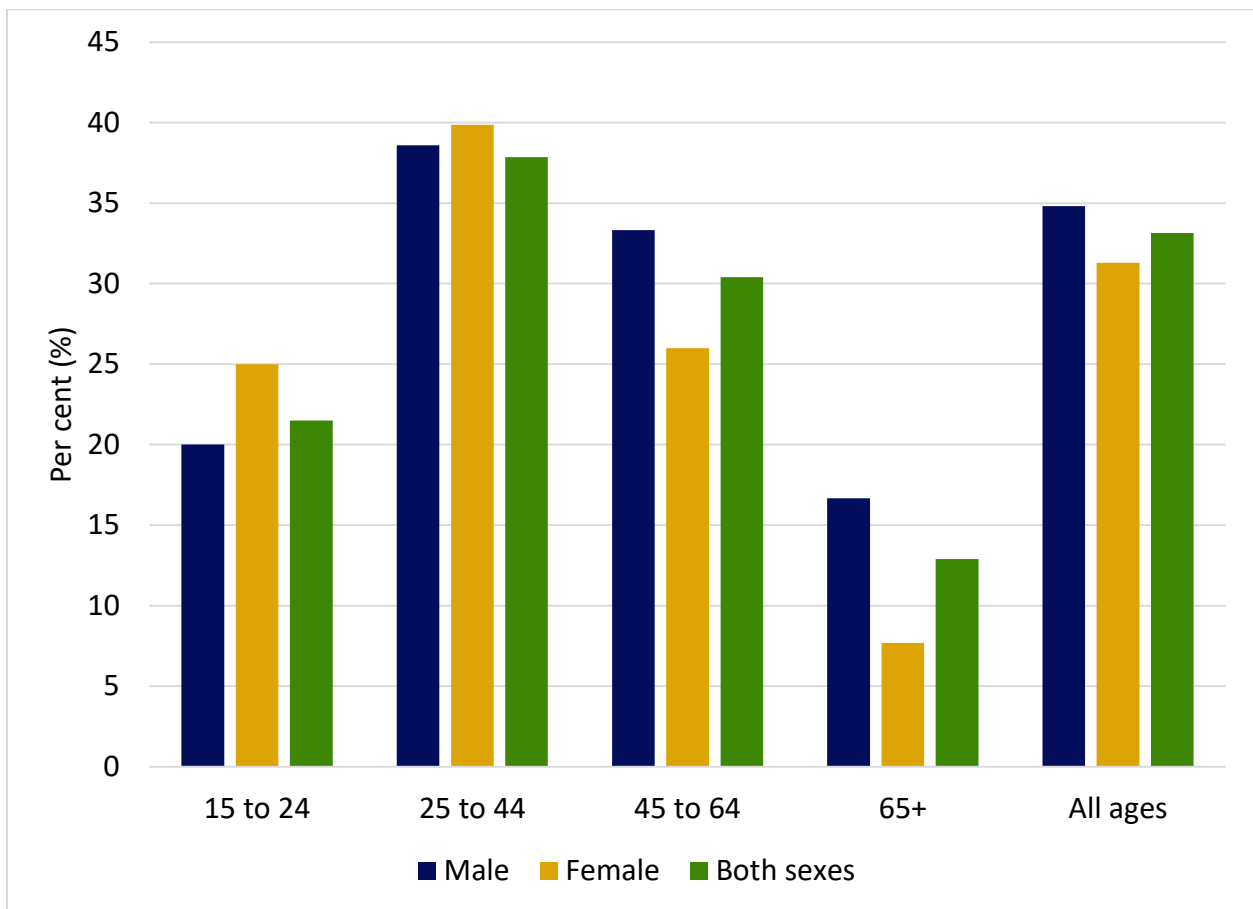
Figure 13. Accidental opioid-related deaths by resuscitation attempt and naloxone administration and whether the person was alone at the time of incident, July 2017 to June 2018 (N=1,209)



Indication of Injection Drug Use

There were 410 deaths with indication of injection drug use (33.9%), while 799 deaths had no indication or had missing information (66.1%) (Figure 14). Males more frequently had indication of injection drug use compared to females in the older age groups, while those aged 15 to 24 were more likely to be female. Overall, injection drug use was most frequent among deceased persons aged 25 to 44 and was similar between sexes in this age group. Sufficient information on other modes of use (i.e., smoking, inhalation, oral) was not available for inclusion in this report. Of those deaths with indication of injection, the most common drugs contributing to death were fentanyl, heroin and methadone (data not shown).

Figure 14. Accidental opioid-related deaths with indication of injection drug use, by age group and sex, July 2017 to June 2018 (n=410)



Discussion

Summary of Findings

Between July 2017 and June 2018, there were 1,337 opioid-related deaths in Ontario, of which the majority were deemed to be accidental deaths (90.4%, n=1,209) and a smaller proportion were suicide (7.4%, n=99) and undetermined deaths (2.2%, n=29). Accidental opioid-related deaths often involved fentanyl (71.2%) and occurred more frequently among males, young and middle-aged adults, unemployed individuals, those living in a private dwelling and materially deprived neighbourhoods or large population centres. Non-opioid substances that most often directly contributed to opioid-related deaths were cocaine, methamphetamine, alcohol and benzodiazepines. The region experiencing the highest rate of deaths was Thunder Bay District Health Unit, while City of Toronto had the highest number of deaths. Substance use disorder, depression and pain conditions among the deceased were commonly identified during the death investigations. Where data were available, the majority of deceased persons had a history of more than five years of substance use. Indication of injection drug use was more common among males and those aged 25 to 44. A majority of the incident locations occurred inside the private residence of the deceased person. Additionally, nearly half of deceased persons were alone at the time of incident. Resuscitation was attempted in almost half of the deaths and naloxone was administered in about one-fifth of deaths.

Below, we will review these findings in the context of other data from Ontario, including longer-term trends in opioid-related mortality and other data sources on morbidity and prescribing. Additionally, we will discuss our findings in the context of previous reports, research and population statistics based in Ontario and compare with data from other jurisdictions. Finally, we present limitations and future considerations for practice, data collection, ongoing surveillance and data linkage to further advance understanding of, and response to, opioid-related harms in Ontario.

Trends in Ontario Data

Over time, the rates of opioid-related mortality, morbidity, opioid involvement and prescribing have changed. The rate of opioid-related deaths increased almost three-fold between 2003 and 2017, from 3.0 to 8.9 per 100,000.⁷ Similarly, the rate of opioid-related emergency department visits increased from 15.2 to 54.6 per 100,000⁷ and hospitalization for opioid poisoning increased from 9.7 to 15.1 per 100,000,⁷ with greater increases observed between 2016 and 2017. The rates of suicide deaths involving opioids remained relatively unchanged during this period (0.68 and 0.69 per 100,000, respectively) (Office of the Chief Coroner).

Changes in oxycodone formulation occurred in 2012, which influenced prescribing patterns.¹¹ Between 2012 and 2015, Ontario observed increases in the detection of fentanyl, hydromorphone and heroin among opioid-related deaths and a decline in oxycodone involvement.⁷ In 2014, fentanyl detection in deaths became more common than any other opioid. About one-third of opioid-related deaths occurred

among people with an active opioid prescription between 2013 and 2016.¹² Between 2013 and 2018, the prescribing of opioid agonist therapies, including methadone and buprenorphine, increased from 3.4 to 4.4 individuals per 1,000 population.⁹ Since pharmacy-dispensed naloxone began in 2016, dispensing has increased from 0.5 to 7.7 kits dispensed per 1,000 population.⁹ Information on naloxone dispensing trends from other settings in Ontario (e.g., harm reduction programs, correctional facilities) is unavailable.

Comparison to Other Provincial Findings

The findings presented in this report on the manner of death, age, sex and material deprivation, as well as increasing fentanyl detection, appear to be consistent with previous provincial data reports of opioid-related deaths between January 1991 and December 2015.¹³ The distribution of deaths by population centre (rural area classification) follows a similar distribution as the population of Ontario in 2016, with the largest proportion of Ontario's population living in large urban centres (62.0% of deaths vs. 68.2% Ontario population);¹⁴ however, in comparison to Ontario's population, there was a lower proportion of deaths in rural (9.3% vs 13.8%) and small population centres (6.8% vs. 9.9%) and higher proportion in medium population centres (11.2% vs. 8.1%).¹⁴

It is difficult to interpret our findings and compare them to the marital status reported in the general Ontario population,¹⁵ given the high degree of unknown information on marital status. Compared to the overall Ontario population, persons who suffered an opioid-related death were more likely to have been unemployedⁱⁱⁱ (at least 46.8% vs. 7.4%) or worked in the construction industry (31.0% vs. 6.7%).¹⁶

Studies have found that individuals who are recently released from incarceration are at increased risk of opioid-related death,¹⁷ which may relate to decreased opioid tolerance. Our report identified 33 deaths that occurred within four weeks of release, although this information was missing for 35.0% of deaths. A previous provincial study based on death investigations found that one in 10 adults who had died of a drug poisoning between April 2006 and March 2013 had been released from incarceration within the previous year, that the majority of deaths were due to opioids and that the highest rate of deaths occurred soon after release (20% within one week of release).¹⁷ Our findings may reflect an underestimation, as there was no linkage established with provincial corrections data systems at the time of report. For this report, information was not available regarding others who may experience reduced opioid tolerance, such as those recently released from abstinence-based residential treatment programs¹⁸ or an inpatient hospital stay.

The information presented in this report is consistent with recent research on the complex contribution and role of pharmaceutical (i.e., prescribed to the deceased person or diverted) and non-pharmaceutical opioids in deaths in Ontario.¹² While the analysis in this surveillance report was not able to clarify whether a deceased person had an active opioid prescription, hydromorphone and oxycodone were

ⁱⁱⁱ There are differences in the calculation for the unemployment rate. The Ontario unemployment rate of 7.4% is based on the number of unemployed divided by the number in the labour force. The number of people in the labour force is the total of employed and unemployed.

potent opioids from a pharmaceutical origin that each contributed to approximately 10% of deaths. Buprenorphine was detected in eight deaths (0.7%) during the time period for this report, yet it did not directly contribute to the cause of any deaths – despite the fact that prescribing of buprenorphine increased.⁹ We also found methadone was detected in 15.5% of deaths and contributed to 14.1% of deaths, which is consistent with evidence on the superior safety profile of buprenorphine compared to methadone.¹⁹⁻²¹ Our report found that ethanol contributed to 13.2% of opioid-related deaths.²² With respect to ethanol detection, this report is not comparable to previous research due to different methodology.²² Our report did not use a threshold for ethanol concentration to report ethanol detection, whereas previous research used a blood alcohol concentration (i.e., ethanol) above 0.0371 g/dL to report deaths involving alcohol consumption.²²

Comparison to Other Jurisdictions

Rates of accidental opioid-related deaths continue to rise nationally, from 7.3 per 100,000 in 2016 to 10.2 per 100,000 in 2017. In 2018 (January to September), the national rate of accidental opioid-related deaths was 11.0 per 100,000, while the rate in Ontario was 8.6 per 100,000.² At the national level, most opioid-related deaths from January to September 2018 were accidental, involved fentanyl, occurred among males and in those 20 to 59 years of age,² which is comparable to the findings of this report.

For comparison to other jurisdictions, it is important to note that there is variation in case definitions and data collection among provinces and territories. Between January and September of 2018, provinces such as British Columbia^{iv} (B.C.) (28.8 per 100,000) and Alberta (18.1 per 100,000), experienced higher rates of accidental opioid-related deaths than Ontario (8.6 per 100,000);² however, there have been similar patterns in the sex and age of deceased persons, with a slightly older age distribution in B.C. and Ontario.² In 2018 (January to September), the proportion of accidental opioid-related deaths with fentanyl detected was slightly higher in Alberta (88%) and British Columbia (86%) compared to Ontario (71%);² however, Ontario experienced a greater increase in the proportion of deaths with fentanyl detected from 2016 to 2017.²

A B.C. report on illicit drug overdose deaths includes similar findings to Ontario for unemployment status, involvement in trades and transport, as well as mental health and pain history among deceased persons.²³ In contrast to the findings in this report, injection drug use was a more frequent mode of consumption in B.C. and more common among females who had an illicit drug overdose death.²³ Consistent with our findings, a review of 615 illicit drug overdose deaths in B.C. (not limited to opioids) between January 2016 and July 2017 found that the majority of deaths occurred indoors in a private residence and among those who used substances when alone.²⁴ Although information on responses by emergency medical services is available in Alberta,²⁵ an analysis on resuscitation attempts and naloxone administration has not appeared in previous provincial reports. Our findings suggest that people who are not alone are more likely to have resuscitation attempted. This information can help improve

^{iv} British Columbia reports all deaths due to an illicit drug overdose, which include, but are not limited to, opioids.

understanding of the circumstances around deaths for people who were alone at the time of the incident.

Limitations

Information presented in this report is based on the best available evidence at the time of the death investigations; however, some variables may be underreported if the information was not documented or available to the coroner/pathologist. This may contribute to the underreporting of certain characteristics (e.g., less formalized employment, community housing status). Overall, there was a large proportion of unknown information for several of the reported variables described in this report. As such, the proportions described should be interpreted with caution. For example, information on the health history of deceased persons and the duration of their substance use, was largely unknown, meaning it is likely an underestimate of mental health, pain and substance use disorder history in this population. Importantly, the duration of previous substance use is challenging information to collect and there is potential for variability in reporting.

Mortality data provided in this report was not linked with healthcare administrative datasets to validate the information collected on medical history. As such, additional research linking Ontario's mortality data with other available data sources is needed to understand the impacts of antecedent physical and psychological pain, mental health and substance use among deceased persons. In addition, linkage to prescription records would enhance understanding of the source of opioids contributing to the death. Further, we acknowledge the lack of information presented on ethnicity, race and other identities in this report and the need for future partnerships with appropriate stakeholders to analyze with other datasets. Finally, the analysis on neighbourhood material deprivation may be subject to misclassification, as the characteristics of the deceased persons may not be reflective of the assigned neighbourhood quintile.

Future Directions

Our analysis of Ontario's opioid-related death investigations revealed circumstances that demonstrate the need for further prevention and response efforts related to: non-pharmaceutical fentanyl and fentanyl analogues, people who use drugs alone in a private residence and non-injection modes of consumption. This information can inform how public health and healthcare respond to and support people who may experience unwanted exposure or toxicity related to non-pharmaceutical fentanyl – the major contributor to accidental opioid-related deaths. In addition, data presented on the administration of naloxone and prevalence of opioid use disorder suggests a need to further explore barriers to the implementation of naloxone and treatment programs.

Reference group members suggest that future data collection and surveillance focus on better understanding opioid-related deaths by suicide, details of the geospatial distribution of opioid-related deaths, health history (including pain conditions) and health service use, circumstances of those with no known substance use history, as well as the prevalence of poly-substance use. The current version of the data collection tool does not include some variables that are of interest to practitioners or communities

(e.g., people with lived experience of drug use and their families and the families of deceased persons). Opportunities to enhance the Opioid Investigative Aid to allow for more comprehensive surveillance of opioid-related deaths and risk factors should also be considered. Finally, there are opportunities for researchers to conduct additional studies using linkage between the enhanced death investigation data and other data sources available in Ontario.

Conclusion

This report summarizes characteristics and circumstances of 1,209 accidental opioid-related deaths between July 2017 and June 2018. This information may help inform the tailoring of preventative interventions to better address the unique needs of Ontarians who may be exposed to opioids. There is a continued need to monitor patterns of opioid-related deaths to inform response efforts. Ongoing surveillance and comprehensive, multifaceted public health approaches are needed to reach all Ontarians to reduce opioid-related harm and prevent further deaths.

Appendix A

Methods for Classification of Origin of Opioids

The origin of the opioid(s) directly contributing to the death as non-pharmaceutical, pharmaceutical (includes prescribed to deceased person and diverted) or undetermined is based on available toxicology results, scene evidence (e.g., drug paraphernalia) and death investigation information (e.g., available prescription information).

Definitions

Non-pharmaceutical opioids:

- Fentanyl analogues (including carfentanil), U-47700, heroin
- Fentanyl without evidence of patch and no/unknown evidence of prescription and evidence suggesting a non-pharmaceutical origin (e.g., other non-pharmaceutical substances detected on toxicology, such as carfentanil or cocaine or drug paraphernalia on the scene)
- Morphine without or unknown evidence of a prescription, with or without 6-Monoacetylmorphine (6-MAM) and with evidence suggesting non-pharmaceutical heroin use (e.g., other non-pharmaceutical substances detected on toxicology, such as carfentanil or cocaine or history of consuming or seeking heroin)

Pharmaceutical origin of opioids: Includes buprenorphine/naloxone, codeine, fentanyl (with evidence of patch or prescription), hydrocodone, hydromorphone, methadone, morphine (with evidence of a morphine or codeine prescription) oxycodone, oxymorphone or tramadol. This category may include opioids that were prescribed to the deceased person or that were prescribed to someone else (diverted).

Origin of opioid could not be classified: The opioid could not be clearly categorized as non-pharmaceutical or pharmaceutical including

- Fentanyl without evidence of patch and no/unknown evidence of prescription and evidence suggesting a non-pharmaceutical origin, morphine without or unknown evidence of a prescription for morphine and without 6-MAM and no evidence suggesting non-pharmaceutical heroin use

Categorizations of origin of opioids were based on several assumptions:

- Evidence of fentanyl patch or prescription as recorded by coroner (reported in 5% of total fentanyl cases)

- The detection (on toxicology) of non-pharmaceutical opioids (e.g., carfentanil) and non-pharmaceutical, non-opioid substances (e.g., cocaine) may indicate non-pharmaceutical origin of an opioid.
- Evidence of drug paraphernalia found at the scene is suggestive of a non-pharmaceutical origin for fentanyl (assumption that injection of fentanyl from fentanyl patches is limited).
- Heroin is rapidly metabolized to morphine, which produces the clinical effects. The presence of 6-Monoacetylmorphine (6-MAM), the intermediary metabolite, confirms consumption of heroin; however, 6-MAM is rapidly cleared from the body such that the absence does not allow determination if morphine was the substance consumed or was a metabolite of heroin. Therefore, if morphine was identified in the absence of 6-MAM, other toxicology information, history of heroin use and available prescription information was used to support classification.
- Morphine can be a metabolite of codeine, more typically at higher codeine concentrations; therefore, codeine prescription was also used to support classification of morphine-related deaths.

Limitations:

- Some prescription information may be missing and further work for linkage with prescription data will enhance the quality of this approach and classification of the source of pharmaceutical opioids (prescribed to the deceased person or diverted).
- The ability to assign the origin of certain opioids (e.g., fentanyl) is limited by the availability of evidence to point to one origin or another.

Appendix B

Data Tables

Figure 1. Opioid-related deaths by origin of opioid (pharmaceutical/non-pharmaceutical) directly contributing to the death and by manner of death, July 2017 to June 2018

Origin of opioid	Accidental n (%)	Suicide n (%)
Pharmaceutical only	313 (25.9)	71 (71.7)
Non-pharmaceutical only	718 (59.4)	4 (4.0)
Both pharmaceutical and non-pharmaceutical	115 (9.5)	2 (2.0)
Could not be classified	63 (5.2)	22 (22.2)
Total	1,209 (100.0)	99 (100.0)

Figure 2. Opioid-related deaths by origin of non-opioid substances directly contributing to the death and by manner of death, July 2017 to June 2018

Origin of substance	Accidental n (%)	Suicide n (%)
Pharmaceutical only	126 (10.4)	53 (53.5)
Non-pharmaceutical only	516 (42.7)	8 (8.1)
Both pharmaceutical and non-pharmaceutical	100 (8.3)	10 (10.1)
Not directly contributing	467 (38.6)	28 (28.3)
Total	1,209 (100.0)	99 (100.0)

Figure 3. Accidental opioid-related deaths by single or multiple opioids contributing to death, July 2017 to June 2018 (N=1,209)

Opioid	Deaths involving a single opioid n (%)	Deaths involving multiple opioids n (%)
Fentanyl and fentanyl analogues	583 (68.3)	278 (78.1)
Methadone	95 (11.1)	76 (21.3)
Hydromorphone	62 (7.3)	62 (17.4)
Oxycodone	56 (6.6)	68 (19.1)
Morphine	29 (3.4)	96 (27.0)
Heroin	21 (2.5)	131 (36.8)
Tramadol	3 (0.4)	2 (0.6)
Codeine	2 (0.2)	33 (9.3)
Hydrocodone	1 (0.1)	5 (1.4)
U47700	1 (0.1)	22 (6.2)
Oxymorphone	0 (0.0)	5 (1.4)
Total	853 (100.0)	356 (100.0)

Figure 4: Accidental opioid-related deaths by age group and sex, July 2017 to June 2018

Age group	Male n (%)	Female n (%)	Both n (%)
Age 15 to 24	75 (8.4)	32 (10.3)	107 (8.9)
Age 25 to 44	500 (55.7)	138 (44.4)	638 (52.8)
Age 45 to 64	305 (34.0)	128 (41.2)	433 (35.8)
Age 65+	18 (2.0)	13 (4.2)	31 (2.6)
All ages	898 (100.0)	311 (100.0)	1,209 (100.0)

Figure 6. Rate (per 100,000) of accidental opioid-related deaths by public health unit, July 2017 to June 2018 (N=1,209)

Public health unit	Number of deaths	2017 population	Rate (per 100,000)
Algoma Public Health	13	115,027	11.3
Brant County Health Unit	22	149,249	14.7
Chatham-Kent Public Health	3	105,392	2.8
City of Hamilton Public Health Services	84	569,908	14.7
Durham Region Health Department	48	682,151	7.0
Eastern Ontario Health Unit	4	207,381	1.9
Grey Bruce Health Unit	9	165,405	5.4
Haldimand-Norfolk Health Unit	6	111,618	5.4
Haliburton, Kawartha, Pine Ridge District Health Unit	18	183,331	9.8
Halton Region Public Health	35	582,683	6.0
Hastings Prince Edward Public Health	11	164,577	6.7
Huron County Health Unit	0	59,113	0.0
Kingston, Frontenac and Lennox & Addington Public Health	20	206,548	9.7
Lambton Public Health	8	129,960	6.2
Leeds, Grenville & Lanark District Health Unit	7	170,000	4.1
Middlesex-London Health Unit	43	484,354	8.9
Niagara Region Public Health	83	458,615	18.1
North Bay Parry Sound District Health Unit	10	128,404	7.8
Northwestern Health Unit	2	81,752	2.4
Ottawa Public Health	64	996,651	6.4
Peel Public Health	90	1,507,069	6.0

Public health unit	Number of deaths	2017 population	Rate (per 100,000)
Perth District Health Unit	1	79,169	1.3
Peterborough Public Health	22	142,510	15.4
Porcupine Health Unit	4	85,157	4.7
Public Health Sudbury & Districts	28	199,811	14.0
Region of Waterloo Public Health and Emergency Services	69	557,446	12.4
Renfrew County and District Health Unit	5	107,236	4.7
Simcoe Muskoka District Health Unit	73	566,423	12.9
Southwestern Public Health	10	204,970	4.9
Thunder Bay District Health Unit	35	153,988	22.7
Timiskaming Health Unit	2	33,543	6.0
Toronto Public Health	291	2,952,051	9.9
Wellington-Dufferin-Guelph Public Health	20	295,018	6.8
Windsor-Essex County Health Unit	33	412,432	8.0
York Region Public Health	36	1,180,629	3.0

Figure 7. Accidental opioid-related deaths by health history, July 2017 to June 2018 (N=1,209)

Health history	Number of deaths n (%)
Opioid use disorder	757 (62.6)
Other substance use disorder	527 (43.6)
Alcohol use disorder	326 (27.0)
Depression	287 (23.7)
Pain	229 (18.9)
Anxiety disorder	104 (8.6)

Health history	Number of deaths n (%)
Bipolar disorder	65 (5.4)
Suicidal ideation	61 (5.0)
Schizophrenia	37 (3.1)
Post-traumatic stress disorder	31 (2.6)

Note: Deceased persons may have more than one condition or disorder captured at time of death; therefore, percentages may sum to greater than 100%.

Figure 8. Accidental opioid-related deaths by length of substance use, July 2017 to June 2018 (N=1,209)

Length of substance use history	Number of deaths n (%)
No history	48 (4.0)
Less than 1 year	9 (0.7)
1 to 5 years	102 (8.4)
More than 5 years	473 (39.1)
Unknown	577 (47.7)

Figure 9. Accidental opioid-related deaths by living arrangements and sex of the deceased person, July 2017 to June 2018 (N=1,209)

Living arrangements	Male n (%)	Female n (%)	Both Sexes n (%)
Private dwelling	651 (72.5)	239 (76.8)	890 (73.6)
Homeless	92 (10.2)	26 (8.4)	118 (9.8)
Collective dwelling	81 (9.0)	19 (6.1)	100 (8.3)
Residential care facility	7 (0.8)	3 (1.0)	10 (0.8)
Correctional facility	10 (1.1)	0 (0.0)	10 (0.8)
Other	3 (0.3)	0 (0.0)	3 (0.2)
Unknown	54 (6.0)	24 (7.7)	78 (6.5)

Figure 10. Accidental opioid-related deaths where the deceased person was alone at the time of incident, by age group and sex, July 2017 to June 2018 (n=588)

Age Group	Male n (%)	Female n (%)	Both Sexes n (%)
15 to 24	37 (49.3)	14 (43.8)	51 (47.7)
25 to 44	252 (50.4)	55 (39.9)	307 (48.1)
45 to 64	151 (49.5)	63 (49.2)	214 (49.4)
65+	11 (61.1)	5 (38.5)	16 (51.6)
All Ages	452 (50.3)	136 (43.9)	588 (48.6)

Note: Percentages were calculated using the number of deceased persons who were alone at the time of incident within the sex and age group. Denominator values are included in Figure 4.

Figure 11. Accidental opioid-related deaths by incident location, July 2017 to June 2018 (N=1,209)

Incident location	Number of deaths n (%)
Own private residence	720 (59.6)
Other's private residence	203 (16.8)
Other accommodation	141 (11.7)
Indoor public space	28 (2.3)
Outdoors	74 (6.1)
Hospital	10 (0.8)
Correctional facility	11 (0.9)
Other	22 (1.8)

Figure 12. Accidental opioid-related deaths by incident location and whether the deceased person was alone at the time of incident, July 2017 to June 2018 (N=1,209)

Incident location	Not Alone n (%)	Alone n (%)	Unknown if person was alone n (%)
Own private residence (n=720)	167 (23.2)	401 (55.7)	152 (21.1)
Other's private residence (n=203)	93 (45.8)	63 (31.2)	47 (23.3)
Other accommodation (n=141)	43 (30.5)	63 (44.7)	35 (24.8)
Indoor public space (n=28)	5 (17.9)	15 (53.6)	8 (28.6)
Outdoors (n=74)	23 (31.1)	29 (39.2)	22 (29.7)
Hospital (n=10)	4 (40.0)	3 (30.0)	3 (30.0)
Correctional facility (n=11)	5 (45.5)	5 (45.5)	1 (9.1)
Other (n=22)	9 (40.9)	9 (40.9)	4 (18.2)

Figure 13. Accidental opioid-related deaths by resuscitation attempt and naloxone administration and whether the person was alone at the time of incident, July 2017 to June 2018 (N=1,209)

Deceased person alone	Not alone n (%)	Alone n (%)	Unknown if person was alone n (%)
Resuscitation attempted	253 (72.5)	202 (34.4)	123 (45.2)
No	94 (26.9)	385 (65.5)	145 (53.3)
Unknown	2 (0.6)	1 (0.2)	4 (1.5)
Total	349 (100.0)	588 (100.0)	272 (100.0)
Naloxone administered	130 (37.2)	89 (15.1)	50 (18.4)
No	171 (49.0)	463 (78.7)	183 (67.3)
Unknown	48 (13.8)	36 (6.1)	39 (14.3)

Deceased person alone	Not alone n (%)	Alone n (%)	Unknown if person was alone n (%)
Total	349 (100.0)	588 (100.0)	272 (100.0)

Figure 14: Accidental opioid-related deaths with indication of injection drug use, by age group and sex, July 2017 to June 2018 (n=410)

Age Group	Male n (%)	Female n (%)	Both Sexes n (%)
Age 15 to 24	15 (20.0)	8 (25.0)	23 (21.5)
Age 25 to 44	193 (38.6)	55 (39.9)	248 (38.9)
Age 45 to 64	102 (33.4)	33 (25.8)	135 (31.2)
Age 65+	3 (16.7)	1 (7.7)	4 (12.9)
All ages	313 (34.9)	97 (31.2)	410 (33.9)

Note: Percentages were calculated using the number of deceased persons with indication of injection drug use within the sex and age group. Denominator values are included in Figure 4.

References

1. Office of the Chief Coroner. Opioid investigative aid user guide. Toronto, ON: Queen's Printer for Ontario; 2017.
2. Special Advisory Committee on the Epidemic of Opioid Overdoses. National report: apparent opioid-related deaths in Canada (January 2016 to September 2018). Ottawa, ON: Her Majesty the Queen in Right of Canada; 2019 [cited 2019 Apr 24]. Available from: <https://infobase.phac-aspc.gc.ca/datalab/national-surveillance-opioid-mortality.html>
3. Interpretation bulletin: classification of "By What Means". 3rd ed [Internet]. Toronto, ON: Office of the Chief Coroner for Ontario; 2010 [updated 2010 Jul 13; cited 2019 Apr 8].
4. Matheson FI; Ontario Agency for Health Protection and Promotion (Public Health Ontario). 2016 Ontario marginalization index: user guide [Internet]. Toronto, ON: Providence, St. Joseph's and St. Michael's Healthcare; 2018 [cited 2019 Apr 8]. Joint publication with Public Health Ontario. Available from: <https://www.publichealthontario.ca/-/media/documents/on-marg-userguide.pdf?la=en>
5. American Psychiatric Association. Diagnostic and statistical manual of mental disorders (DSM-5). 5th ed. Washington, DC: American Psychiatric Association; 2013.
6. Statistics Canada. Population centre (POPCTR) [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2018 [updated 2018 Sep 17; cited 2019 Apr 8]. Available from: <https://www150.statcan.gc.ca/n1/pub/92-195-x/2011001/geo/pop/pop-eng.htm>
7. Ontario Agency for Health Protection and Promotion (Public Health Ontario). Interactive opioid tool: opioid-related morbidity and mortality in Ontario [Internet]. Toronto, ON: Queen's Printer for Ontario; 2018 [cited 2019 Apr 8]. Available from: <https://www.publichealthontario.ca/en/dataandanalytics/pages/opioid.aspx>
8. Ministry of the Solicitor General. Death investigations [Internet]. Toronto, ON: Queen's Printer for Ontario; 2018 [updated 2018 May 8; cited 2019 Feb 22]. Available from: https://www.mcscs.jus.gov.on.ca/english/DeathInvestigations/Ourcommitment/DI_our_commitment.html
9. Ontario Drug Policy Research Network. Ontario prescription opioid tool. Toronto, ON: Ontario Drug Policy Research Network; 2018 [cited 2019 Apr 4]. Available from: <http://odprn.ca/ontario-opioid-drug-observatory/ontario-prescription-opioid-tool/>
10. Statistics Canada. Population projections, 2017–2018 [data file]. Ottawa, ON: Government of Canada [producer], Toronto, ON: Ontario. Ministry of Health and Long-Term Care, IntelliHealth Ontario [distributor]; 2017 [data extracted 2019 Apr 9].

11. Gomes T, Jain S, Paterson J, Sketris I, Caetano P, Henry D, et al. Trends and uptake of new formulations of controlled-release oxycodone in Canada. *Pharmacoepidemiol Drug Saf.* 2018;27(5):520-5. Available from: <https://doi.org/10.1002/pds.4390>
12. Gomes T, Khuu W, Martins D, Tadrous M, Mamdani MM, Paterson JM, et al. Contributions of prescribed and non-prescribed opioids to opioid related deaths: population based cohort study in Ontario, Canada. *BMJ.* 2018;362:k3207. Available from: <https://doi.org/10.1136/bmj.k3207>
13. Gomes T, Greaves S, Martins D, Bandola D, Tadrous M, Singh S, et al. Latest trends in opioid-related deaths in Ontario: 1991 to 2015 [Internet]. Toronto, ON: Ontario Drug Policy Research Network; 2017 [cited 2019 Apr 9]. Available from: https://odprn.ca/wp-content/uploads/2017/04/ODPRN-Report_Latest-trends-in-opioid-related-deaths.pdf
14. Statistics Canada. Population and dwelling count highlight tables, 2016 census [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2019 [updated 2019 Feb 20; cited 2019 Apr 8]. Available from: <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/hlt-fst/pd-pl/Table.cfm?Lang=Eng&T=703&SR=1&S=55&O=A&RPP=25>
15. Statistics Canada. Estimates of population as of July 1st, by marital status or legal marital status, age and sex [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2019 [cited 2019 Mar 1]. Available from: <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1710006001&pickMembers%5B0%5D=1.7&pickMembers%5B1%5D=3.1&pickMembers%5B2%5D=4.1>
16. Statistics Canada. Census profile, 2016 census [Internet]. Ottawa, ON: Her Majesty the Queen in Right of Canada; 2019 [cited 2019 Feb 27]. Available from: <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=PR&Code1=35&Geo2=PR&Code2=35&Data=Count&SearchText=&SearchType=Begins&SearchPR=01&B1=Labour>
17. Groot E, Kouyoumdjian F, Kiefer L, Madadi P, Gross J, Prevost B, et al. Drug toxicity death after release from incarceration in Ontario, 2006-2013: review of coroner's cases. *PLoS One.* 2016;11(7):e0157512. Available from: <https://doi.org/10.1371/journal.pone.0157512>
18. Pierce M, Bird S, Hickman M, Marsden J, Dunn G, Jones A, et al. Impact of treatment for opioid dependence on fatal drug-related poisoning: a national cohort study in England. *Addiction.* 2016;111(2):298-308. Available from: <https://doi.org/10.1111/add.13193>
19. Sordo L, Barrio G, Bravo MJ, Indave BI, Degenhardt L, Wiessing L, et al. Mortality risk during and after opioid substitution treatment: systematic review and meta-analysis of cohort studies. *BMJ.* 2017;357:j1550. Available from: <https://doi.org/10.1136/bmj.j1550>
20. Health Quality Ontario. Opioid use disorder care for people 16 years of age and older. Toronto, ON: Queen's Printer Ontario; 2018. Available from:

<http://www.hqontario.ca/portals/0/documents/evidence/quality-standards/qs-opioid-use-disorder-clinician-guide-en.pdf>

21. CRISM National Guideline Review Committee. CRISM national guideline for the clinical management of opioid use disorder [Internet]. Ottawa, ON: Canadian Institute for Health Research (CIHR); 2017 [cited 2019 Apr 9]. Available from: https://crism.ca/wp-content/uploads/2018/03/CRISM_NationalGuideline_OUD-ENG.pdf
22. Gomes T, Juulink D, Mamdani M, Paterson J, van den Brink W. Prevalence and characteristics of opioid-related deaths involving alcohol in Ontario, Canada. *Drug Alcohol Depend.* 2017;179:416-23.
23. Ministry of Public Safety and Solicitor General, British Columbia Coroners Service. Illicit drug overdose deaths in BC: findings of coroners' investigations. Vancouver, BC: Ministry of Public Safety and Solicitor General; 2018 [cited 01 Mar 19]. Available from: <https://www2.gov.bc.ca/assets/gov/birth-adoption-death-marriage-and-divorce/deaths/coroners-service/statistical/illicitdrugoverdosedeadsinbc-findingsofcoronersinvestigations-final.pdf>
24. BC Coroners Service Death Review Panel. BC Coroners Service Death Review Panel: a review of illicit drug overdoses [Internet]. Vancouver, BC: British Columbia Coroners Service; 2018 [cited 2019 Mar 1]. Available from: https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/death-investigation/death-review-panel/bccs_illicit_drug_overdose_drp_report.pdf
25. Alberta Health Services. Alberta opioid response surveillance report: 2018 Q3 [Internet]. Edmonton, AB: Government of Alberta; 2018 [cited 2019 Mar 1]. Available from: <https://www.alberta.ca/assets/documents/opioid-substances-misuse-report-2018-q3.pdf>

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