Opioid Toxicity and Access to Treatment among Adolescents and Young Adults in Ontario

The Ontario Drug Policy Research Network
Public Health Ontario
The Office of the Chief Coroner for Ontario /
Ontario Forensic Pathology Service

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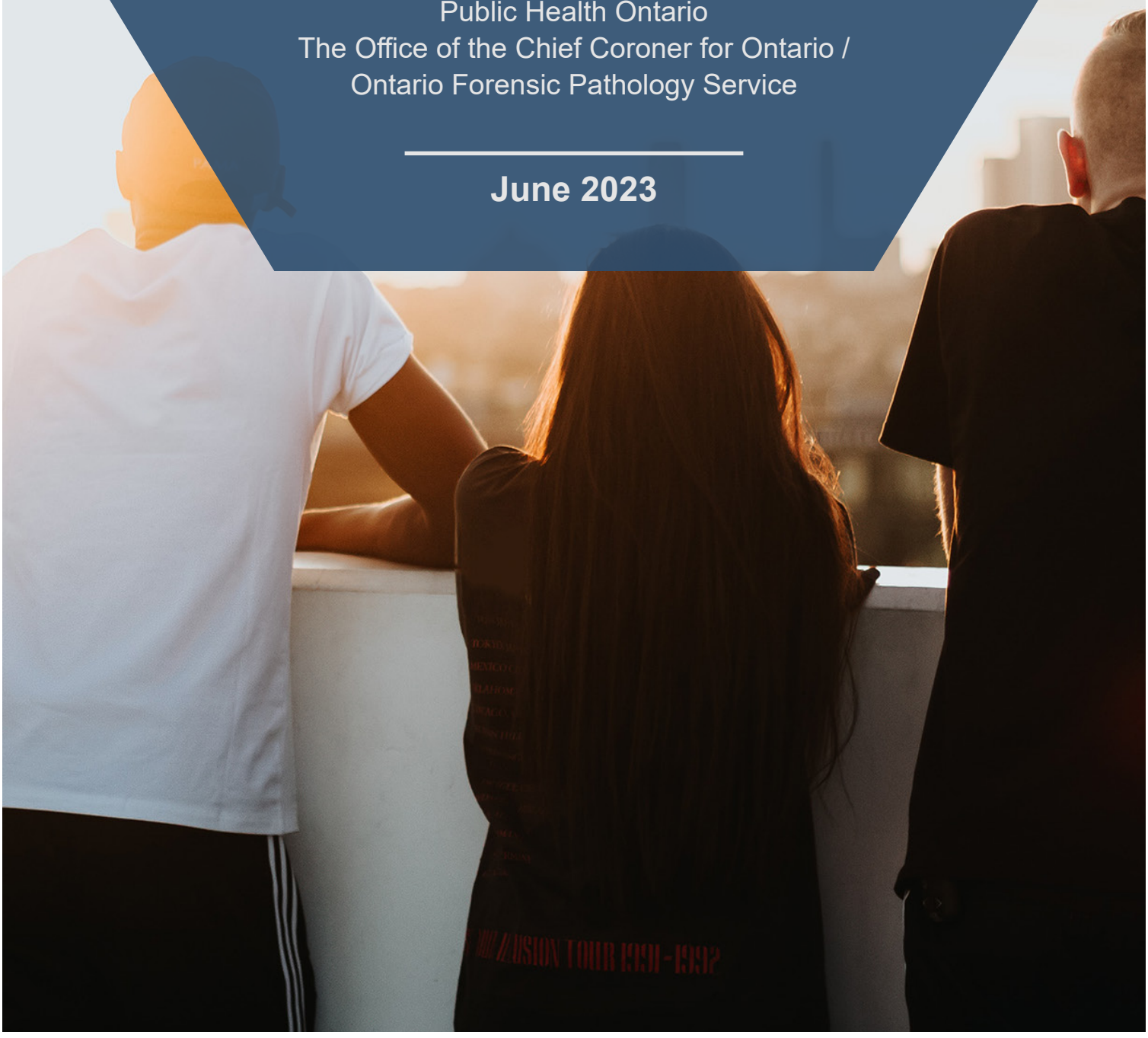

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Background

The drug toxicity crisis is a growing public health issue among adolescents and young adults. Opioid toxicity deaths in Ontario are rising at alarming rates, driven by the increasingly toxic unregulated drug supply (dominated by fentanyl) and exacerbated by the COVID-19 pandemic.[1-3] In 2021, adolescents and young adults (aged 15 to 24) represented 9% of all opioid-related ED visits and 8% of opioid toxicity deaths in Ontario.[1] Opioid-related emergency department (ED) visits[4] and deaths[1] increased during the COVID-19 pandemic (2020/2021) among adolescents and young adults in Ontario, and substance-related ED visits have become increasingly emergent or life-threatening in this demographic.[4] These trends are not unique to Ontario, with rising opioid-related harms among adolescents and young adults also observed elsewhere in Canada[5] and across the United States.[6,7] Substance use is common in adolescents and young adults; however, limited knowledge on risk and harm reduction due to less experience using substances, increasing mental health challenges and increased impulsivity may predispose this demographic to higher risk of substance-related harms.[8, 9] Further, many adolescents and young adults are relatively new users of opioids[10, 11] and thus are less likely connected with community-based treatment, harm reduction programs, and other support. New and occasional use of non-prescribed opioids is increasingly more lethal due to increasing fentanyl exposure in the unregulated drug supply.[3,12]

Although opioid toxicity deaths are highest among adults aged 25 to 44 years,[1] opioid use disorder (OUD) typically onsets during late adolescence and young adulthood,[13] thus providing the opportunity for upstream prevention of opioid-related harms. In Canada, the full range of opioid agonist treatments (OAT) for use in adults are also indicated for treating OUD in youth, with buprenorphine/naloxone recommended as first-line and methadone as second-line in moderate to severe cases.[11] However, many providers are hesitant to prescribe OAT to young people due to lack of resources and education[8,10,14] as well as the limited research regarding treatment for OUD in this population.[11] Also, adolescents and young adults have identified barriers to starting and remaining on OAT, such as a lack of youth-specific opioid treatment services and peer support, stigma, fear of precipitated withdrawal, pressure to use buprenorphine/naloxone over methadone, and fears around long-term OAT use and its implications on quality of life.[15-17]

Despite increasing rates of opioid-related harms, there is evidence that treatment rates for OUD are decreasing among adolescents and young adults in Ontario[18] and the United States.[19,20] Our report aims to further investigate this trend in Ontario, prior to and during the COVID-19 pandemic, given the need for timely data and the lack of epidemiological research on the use of non-regulated opioids among adolescents and young adults.[8] We specifically examined (i) trends in opioid toxicity and treatment for OUD (ii) demographic characteristics and circumstances surrounding opioid toxicity deaths; and (iii) interactions with the healthcare system prior to opioid toxicity death among adolescents and young adults aged 15 to 24 compared to individuals aged 25 to 44 years old. Policymakers, school boards, public health units, healthcare providers and community-level organizations can use this information to inform opioid toxicity prevention and harm reduction strategies for adolescents and young adults.

Methods

Setting

We conducted a descriptive cross-sectional study to describe trends, characteristics, and patterns of healthcare use among adolescents and young adults aged 15 to 24 years compared to individuals aged 25 to 44 years in Ontario, Canada. For admissions to residential treatment centres (i.e., DATIS data), age was determined on the date of admission. For all other trends, age was determined at the beginning of the time period (quarter, year) which the event occurred. We defined an opioid toxicity death as an acute toxicity death that was confirmed (as opposed to suspected), accidental and resulted 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.

Data Sources

We obtained the data from ICES and the Drug and Alcohol Treatment Information System (DATIS). ICES is an independent, non-profit research institute whose legal status under Ontario's health information privacy law allows it to collect and analyze health care and demographic data, without consent, for health system evaluation and improvement.[21] The Drug and Alcohol Treatment Information System (DATIS) is a program of the Centre for Addiction and Mental Health (CAMH) and includes admissions to residential treatment for opioid use. DATIS data are not held at ICES.

To capture data on opioid toxicity deaths, we used the Drug and Drug/Alcohol Related Death Database, which contains records from coronial investigations completed by the Office of the Chief Coroner/Ontario Forensic Pathology Service. To capture data on sociodemographic characteristics, we used the Registered Persons Database. Income quintile and rurality were determined using Statistics Canada's standard geographical areas using the Postal Code Conversion File and reference file. For investigating medications dispensed prior to death, we used the Narcotics Monitoring System, a database that captures all claims for controlled medications (e.g., opioids, benzodiazepines and stimulants) dispensed from community pharmacies in Ontario, regardless of payer. For visits to outpatient care, we used the OHIP Claims Database and the Community Health Centre (CHC) Database. To capture information on emergency department (ED) visits, inpatient hospital admissions, day surgeries, and mental health-related hospital admissions, we used the Canadian Institute for Health Information's National Ambulatory Care Reporting System, Discharge Abstract Database, Same Day Surgery Database, and Ontario Mental Health Reporting System, respectively. We generated drug lists using the Drug Identification Number (DIN) database. ICES datasets were linked using unique encoded identifiers and analyzed at ICES. The use of data in this project was authorized under section 45 of Ontario's Personal Health Information Protection Act, which does not require review by a Research Ethics Board.

Measures

1. Trends in Treatment for OUD and Opioid Toxicity

Using DATIS data, we reported the total rate of new admissions to residential treatment for opioid use per 100,000 of the overall Ontario population. In this report, residential treatment captures both new admissions to substance use treatment services and withdrawal management centre visits, which can vary in duration from several days to several weeks. An admission was considered new when the date of the admission was within the reporting period. Age was determined at the time of admission. To preserve anonymity, cell counts of ≤10 for substance abuse treatment services and withdrawal management centre visits were masked when received,

and corresponding totals were therefore also masked. We reported DATIS data at the admission-level, not the individual-level.

Using ICES data, we reported trends in opioid toxicity events (ED visits, inpatient hospitalizations, deaths) and unique individuals dispensed OAT (overall and by type: methadone vs. buprenorphine) per 100,000 of the overall Ontario population. Overall OAT included methadone or buprenorphine only. We reported trends from 2014 to 2021. Where there were large enough cell counts according to ICES privacy policies (N>5), we reported quarterly rates – otherwise, rates were reported yearly. Note that for ED visits and inpatient hospitalizations, visits that ended in death were not included.

We stratified admissions to residential treatment by gender (women vs. men) using DATIS data, and all other analyses by sex (male vs. female) using ICES data.

2. Demographic Characteristics and Circumstances Surrounding Opioid Toxicity Deaths

Using ICES data, we reported the following demographic characteristics: age group (adolescents aged 15 to 17 years; young adults aged 18 to 24 years; adults aged 25 to 44 years), sex, neighbourhood income quintile, location of residence (urban/rural, Northern/Southern) and living arrangement. See **Appendix A** for definitions.

Using ICES data, we reported measures related to circumstances surrounding deaths, including the origin of opioids (pharmaceutical only, non-pharmaceutical only, both), the specific types of opioids (non-pharmaceutical, pharmaceutical – indicated for pain or OAT) and other substances directly contributing to death (alcohol, stimulants, benzodiazepines) based on toxicology results and information about pharmaceuticals approved for use in Canada. We undertook the following steps to exclude potential metabolites from post-mortem toxicology for all analyses throughout: removing the indication of morphine and flagging as heroin in instances where there was a presence of both morphine and 6-monoacetylmorphine (6-MAM); removing the indication of oxymorphone (which is not prescribed in Ontario) and flagging as oxycodone if its metabolite oxymorphone was present; and removing the indication of hydrocodone if both hydrocodone and codeine were present, as there are few deaths with both hydrocodone and codeine as either a direct contributor or detected. We also described the incident location where the death occurred (private residence, outdoors, hotel/motel/inn, rooming house and other collective dwelling, other, unknown), naloxone administration where an individual was present to intervene, and mode of drug use (inhalation/smoking, injection, both, missing). See **Appendix A** for definitions.

3. Recent Interactions with the Healthcare System Prior to Opioid Toxicity Death

For healthcare encounters in the 7 days prior to and including death, we reported individuals with outpatient visits and hospital encounters. Any healthcare encounter included outpatient visits or hospital encounters. See **Appendix B, Table B1** for details. We reported individuals with an OUD in the 5 years prior to and including death, defined as either a healthcare encounter for an OUD or a dispense for OAT (see **Appendix B, Table B2**). We determined individuals who received OAT (overall and by type) prior to and including death, only among those with an OUD. Lastly, we reported individuals with mental healthcare encounters in the 5 years prior to death (see **Appendix B, Table B3**), including ED visits or hospitalizations, CHC visits and other outpatient visits. We also reported individuals with an outpatient visit by type of mental disorder (psychotic, mood and anxiety, substance use, behavioural and neuro-developmental, other). Note that ED visits and inpatient hospitalizations that ended in death were not included in these analyses.

Analysis

We reported rates over time from 2014 to 2021, adjusted based on the overall Ontario population. For demographic characteristics, circumstances surrounding death and healthcare utilization prior to death, several cohorts were created based on the time when the opioid toxicity death occurred (pandemic vs. pre-pandemic period) and the age at time of death (adolescents and young adults aged 15 to 24 years vs. adults aged 25 to 44 years). We categorized opioid toxicity deaths in the pandemic period as those which occurred between March 17th, 2020 and March 16th, 2021, and deaths in the pre-pandemic period as those which occurred between March 17th, 2019 and March 16th, 2020. We used descriptive statistics to describe patterns, and chi-square/Fisher's exact tests to compare independent proportions among the cohorts, where the reference group was always those who died between the ages of 15 to 24 years in the pandemic period.

Key Findings

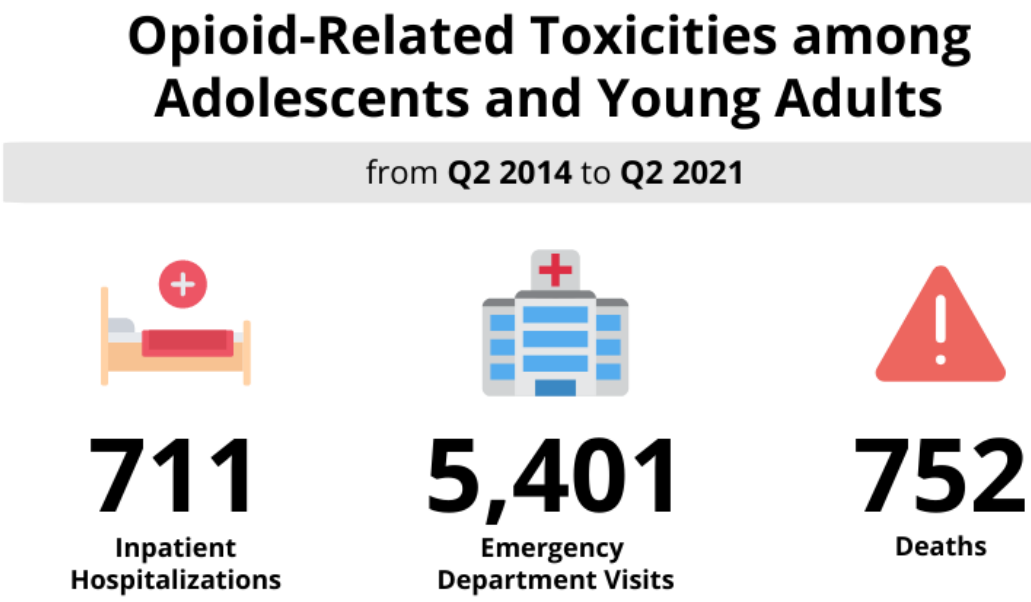
This report investigates trends in opioid-related harms and treatment among **adolescents** (aged 15 to 17 years) and **young adults** (aged 18 to 24 years) in Ontario. Comparisons are also made with **adults** aged 25 to 44 years.

Calendar quarters (Q1-4) are categorized as following:

- Q1: January, February, March
- Q2: April, May, June
- Q3: July, August, September
- Q4: October, November, December

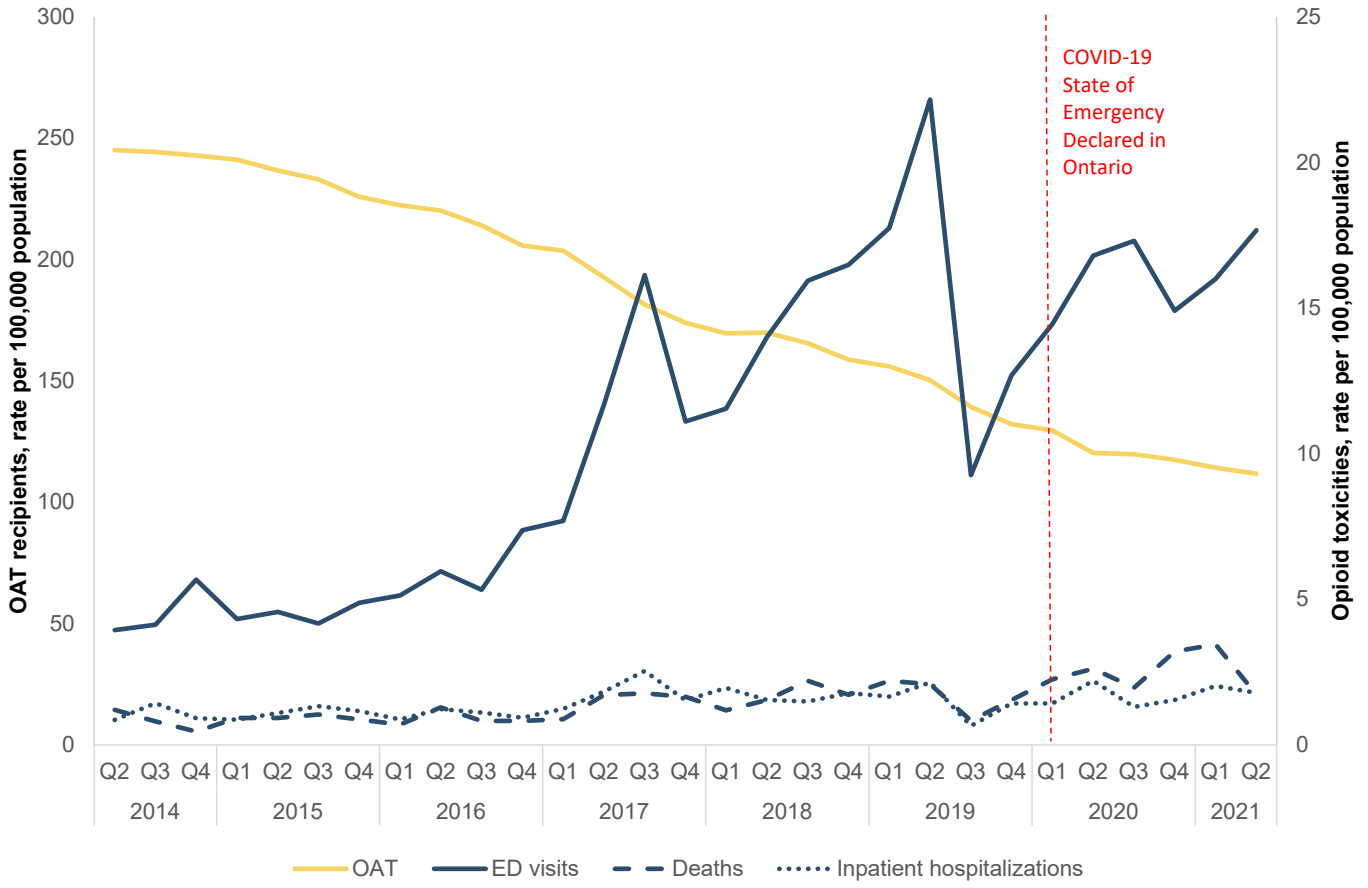
NOTE

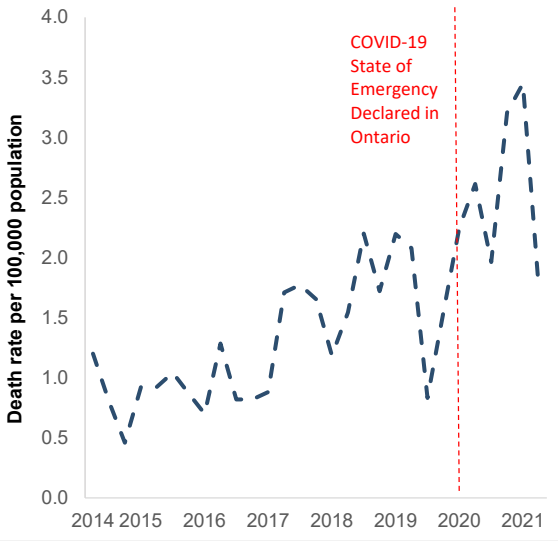
The presence of an asterisk indicates statistical significance ($p<0.05$).



1. Trends in Treatment for OUD and Opioid Toxicity

Figure 1. Quarterly OAT recipients and opioid toxicity outcomes among individuals aged 15 to 24, Q2 2014 to Q2 2021

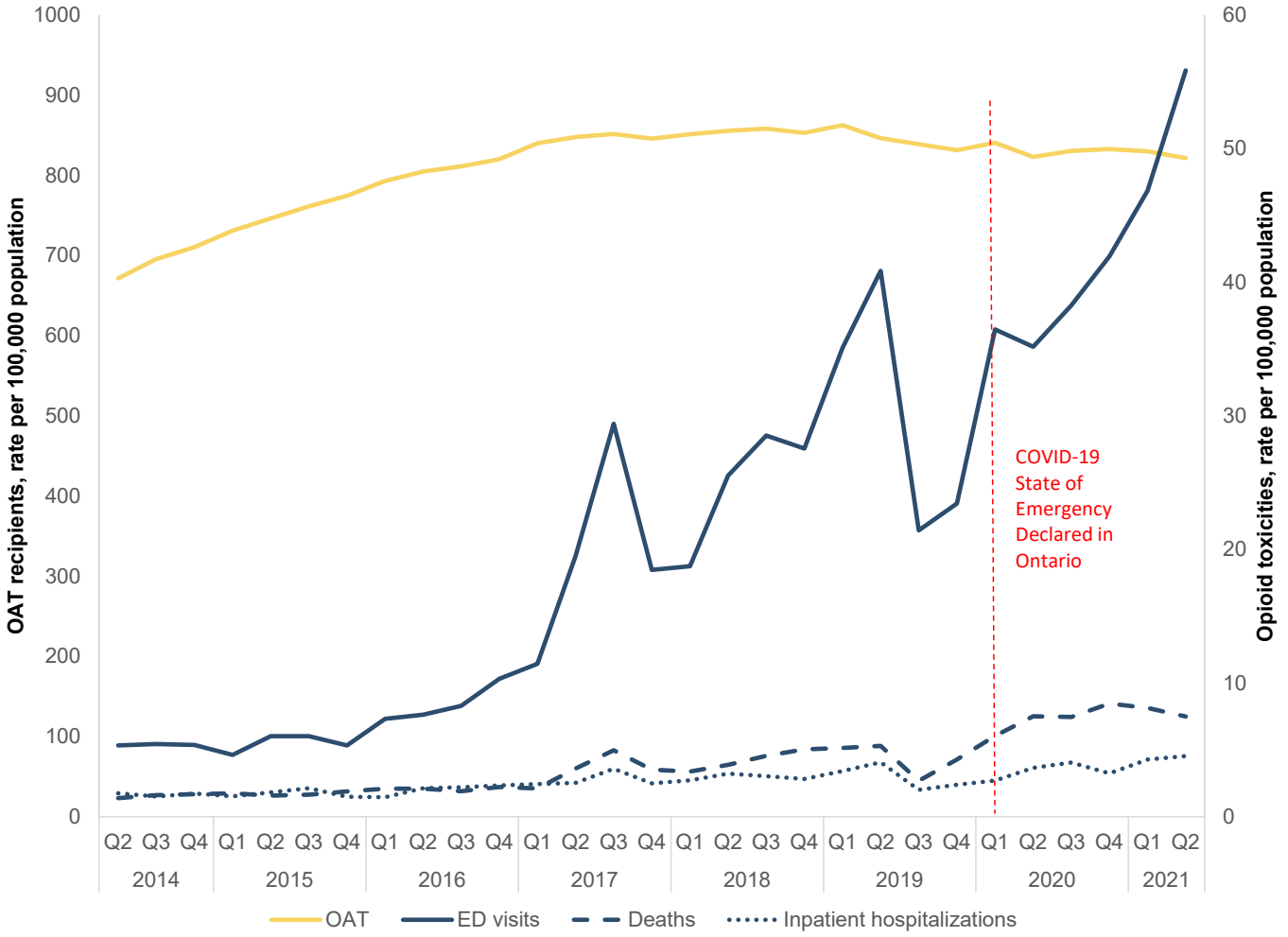




Among adolescents and young adults across the study period (Q2 2014 to Q2 2021), there was a steady decline in the quarterly rate of OAT recipients from 245.1 to 111.8 per 100,000 (4,288 to 1,879 recipients), alongside growing quarterly rates of ED visits, inpatient hospitalizations and deaths for opioid toxicity. Similar trends in decreasing OAT recipients and increasing opioid toxicity ED visits and death rates were observed after stratifying adolescents and young adults by sex and location of residence (urban vs. rural areas) (data not shown). Notably, providing universal access to medications for those aged 0 to 24 years through the implementation of the publicly-funded Ontario Pharmacare program (OHIP+) beginning in Q1 2018 did not have a measurable impact on the rates of individuals receiving OAT.

Increases were largest for ED visits, which more than quadrupled from 3.9 to 17.7 per 100,000 (69 to 297 visits, quarterly) across the study period, followed by death rates which nearly tripled from 1.2 to 3.4 per 100,000 between Q2 2014 and Q1 2021 (21 to 58 deaths, quarterly), before declining in Q2 2021 (1.7 per 100,000; 29 deaths).

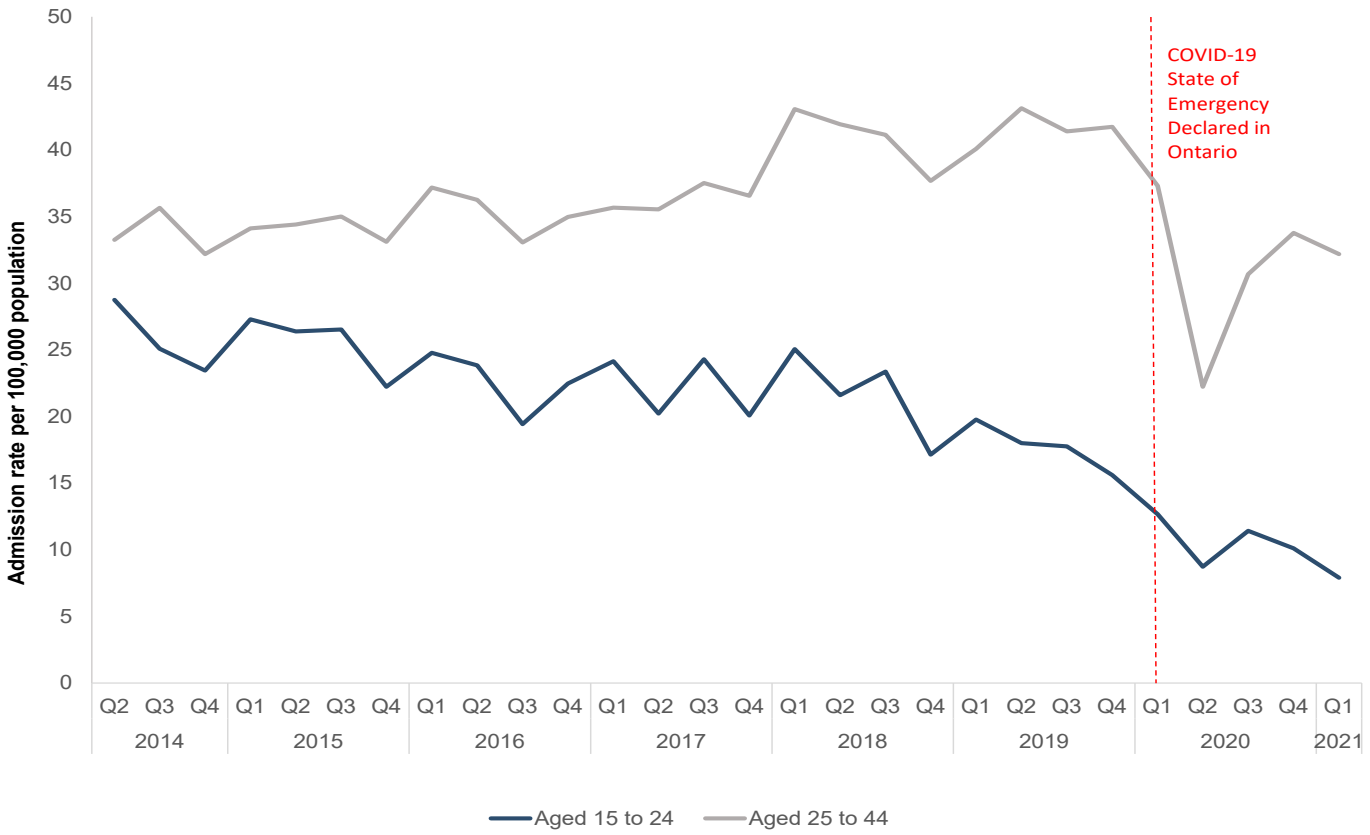
Figure 2. Quarterly OAT recipients and opioid toxicity outcomes among individuals aged 25 to 44, Q2 2014 to Q2 2021



In general, population-adjusted rates of OAT recipients and opioid toxicities were much higher among adults aged 25 to 44 compared to adolescents and young adults. Patterns over time also differed considerably. Specifically, unlike adolescents and young adults, there was a steady increase in the rate of OAT recipients among adults aged 25 to 44 years, reaching a high of 862.5 individuals per 100,000 in Q1 2019, after which rates did not change considerably. By the end of the study period (Q2 2021), the rate of OAT recipients among those aged 25 to 44 was 821.7 individuals per 100,000, 7.3 times higher than what was observed among those aged 15 to 24 (111.8 individuals per 100,000).

General patterns in rising rates of ED visits, hospitalization and deaths for opioid toxicity were similar in adults aged 25 to 44 compared to those aged 15 to 24; however, the rates were much higher among those aged 25 to 44. For example, in Q2 2021, the rate of ED visits for opioid toxicities was 55.9 per 100,000, compared to 17.7 per 100,000 among adolescents and youth.

Figure 3. Quarterly admissions to residential treatment for any opioid use, by age, Q2 2014 to Q1 2021



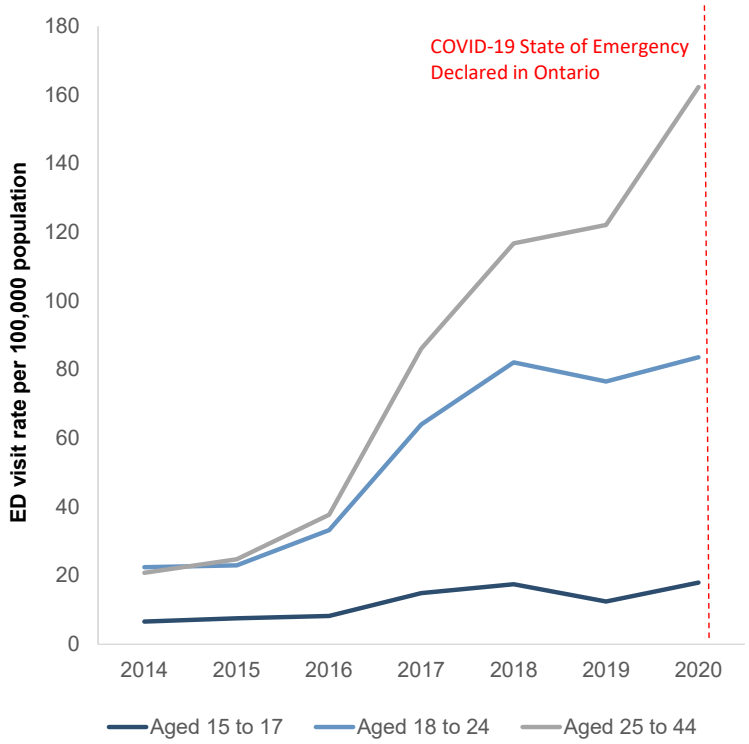
NOTE

The figure above reports number of admissions (not unique individuals). Residential treatment captures both new admissions to substance use treatment services and withdrawal management centre visits, which can vary in duration from several days to several weeks.

Consistent with decreases in the rates of individuals receiving OAT among adolescents and young adults, there was also a 72.5% decrease in the quarterly admission rate to residential treatment for opioid use in this demographic throughout the study period, falling from 28.7 to 7.9 admissions per 100,000 (503 to 133 admissions), quarterly. Similar decreasing trends in admission rates were noted among adolescents and young adults when stratified by gender (men vs. women) and location of residence (urban vs. rural; data not shown).

In contrast, admissions to residential treatment among adults aged 25 to 44 years gradually increased until the COVID-19 pandemic in 2020 (from 33.2 to 37.3 between Q2 2014 and Q1 2020), which resulted in an immediate drop in residential treatment, after which rates again began to climb.

Figure 4. Annual opioid toxicity ED visits by age, 2014 to 2020



The annual rate of ED visits for opioid toxicity increased among both adolescents (aged 15 to 17) and young adults (aged 18 to 24), but to varying degrees. Specifically, among adolescents, the annual rate nearly tripled, rising from 6.6 to 18.0 per 100,000 (32 to 86 visits) over the study period. Among young adults, the rate of ED visits for opioid toxicities (22.4 per 100,000) was similar to the rate observed among those aged 25 to 44 in 2014 (20.8 per 100,000), but in 2017 began to rise more slowly than trajectories observed among those aged 25 to 44. By 2020, the rate of ED visits for opioid toxicity among young adults had nearly quadrupled, reached 83.6 per 100,000 (1,008 visits), compared to a high of 162.3 among those aged 25 to 44.

Figure 5. Opioid toxicities in 2020 by age

In 2020, young adults aged 18 to 24 years had higher rates of ED visits for opioid toxicity (83.6 [N=1,008] vs. 18.0 [N=86] per 100,000), inpatient hospitalizations (8.5 [N=102] vs. 3.6 [N=17] per 100,000) and deaths (14.4 [N=174] vs. 3.1 [N=15] per 100,000; p<0.001) compared to adolescents aged 15 to 17 years. In contrast, rates of each of these indicators was significantly higher among adults aged 25 to 44 compared to young adults (p<0.001 for death comparisons).

NOTE

Statistical comparisons of population-adjusted rates were not calculated for inpatient hospitalizations or ED visits because they are based on events and not unique individuals.

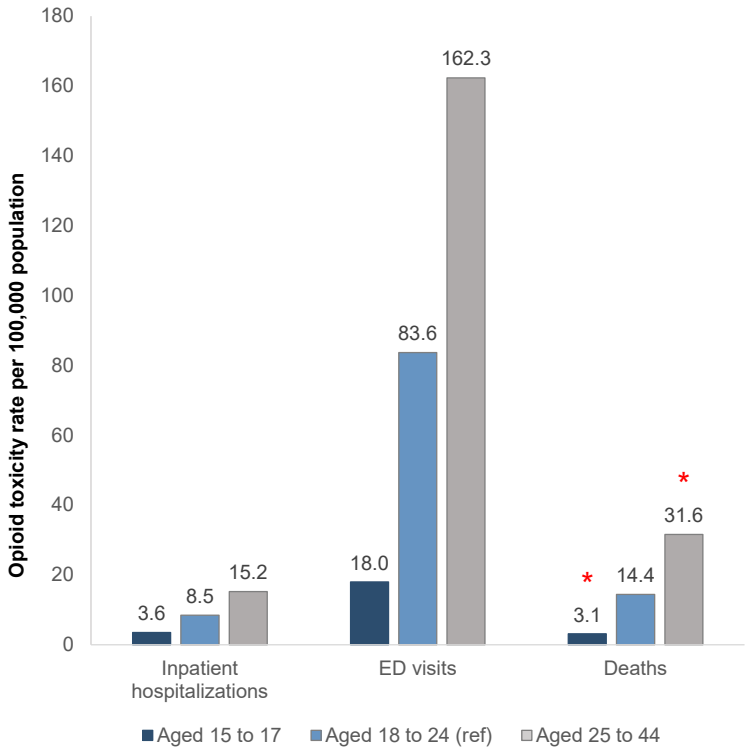
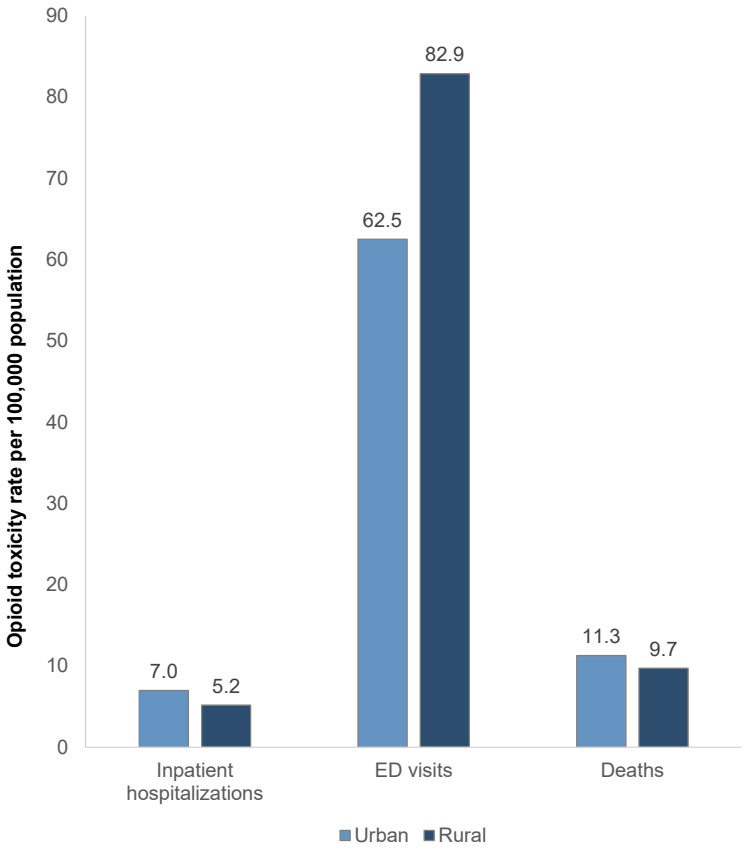


Figure 6. Opioid toxicities in 2020 among individuals aged 15 to 24 by location of residence



Adolescents and young adults residing in rural (vs. urban) areas had higher rates of opioid toxicity ED visits (82.9 [N=128] vs. 62.5 [N=948] per 100,000) and similar rates of inpatient hospitalizations (5.2 [N=8] vs. 7.0 [N=106]) and deaths (9.7 [N=15] vs. 11.3 [N=171]; p=0.58) in 2020. This may reflect lower access to community-based harm reduction or mental health services in rural areas leading to more toxicity events managed in the ED. There were no significant changes in the urban vs. rural residence location of individuals who died of an opioid toxicity prior to the pandemic compared to during the pandemic, nor when comparing adolescents and young adults with adults aged 25 to 44 during the pandemic (data not shown).

NOTE

Statistical comparisons of population-adjusted rates were not calculated for inpatient hospitalizations or ED visits because they are based on events and not unique individuals

Figure 7. Annual rate of OAT recipients by age, 2014 to 2020

The previously noted decrease in OAT recipients among adolescents and young adults is driven by the young adult age group (aged 18 to 24 years), where annual rates declined from 469.7 per 100,000 in 2014 to 248.3 per 100,000 in 2020 (from 5,923 to 2,992 recipients).

In contrast, rates of OAT among adolescents (aged 15 to 17 years) were lower and remained stable throughout the study period (range 15.5 [N=75] to 15.7 [N=75] per 100,000). The rate of individuals receiving OAT among adults aged 25 to 44 (998.9 per 100,000) remained significantly higher compared to young adults in 2020 (248.3 per 100,000; p<0.001; data not shown). These differences may reflect differences in accessibility of treatment or in prevalence of OUD diagnoses among people who use opioids in different age groups.

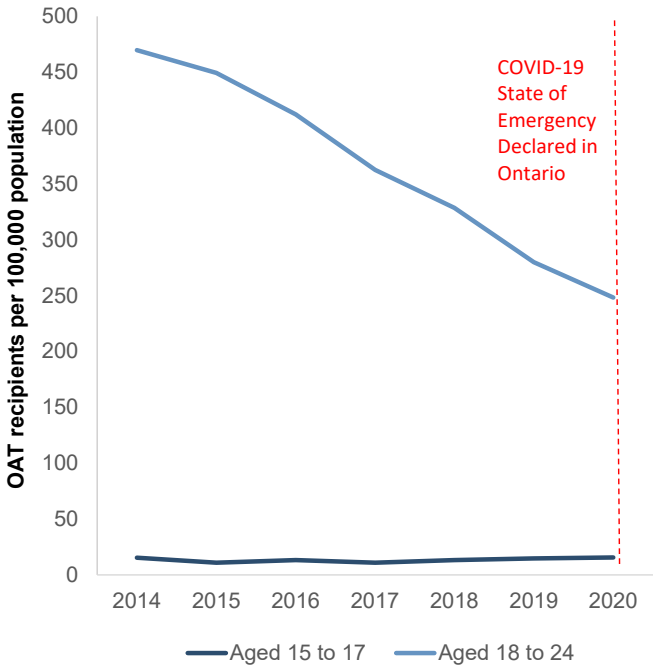
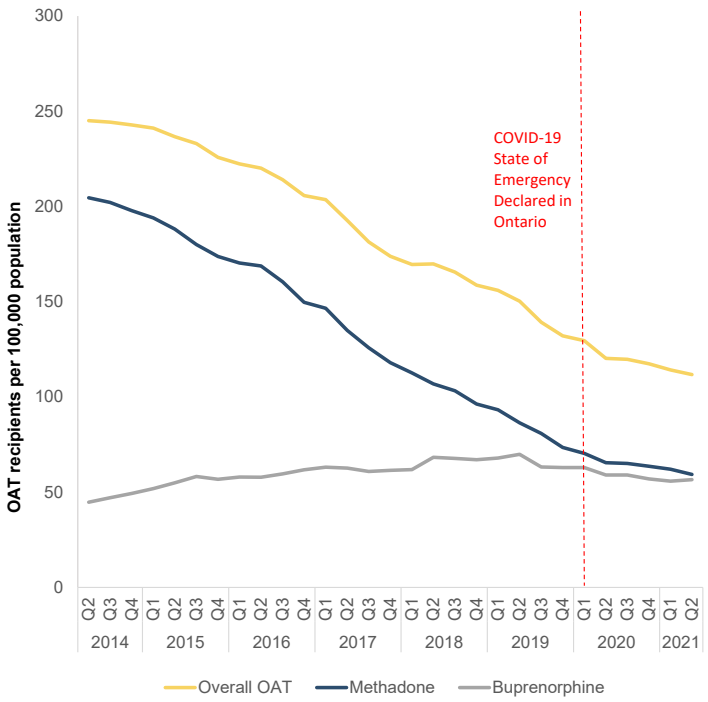
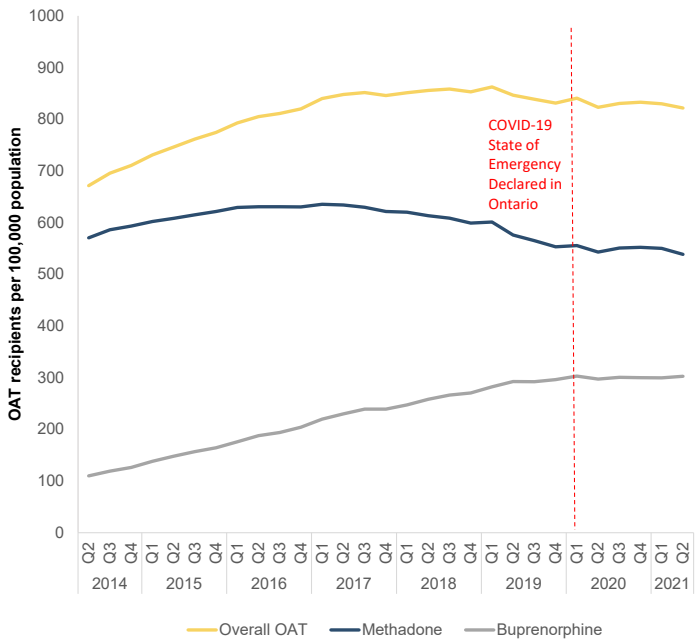


Figure 8. Quarterly rate of OAT recipients aged 15 to 24, by OAT type, Q2 2014 to Q2 2021



Decreases in the quarterly rate of individuals receiving OAT among adolescents and young adults is driven by a rapid decline (-71.0%) in methadone dispensing from 204.6 to 59.3 per 100,000 across the study period (3,579 to 997 methadone recipients). Importantly, these patterns were not compensated by changes in buprenorphine dispensing, which only rose 26.3% from 44.8 to 56.6 per 100,000 over this same period (784 to 951 buprenorphine recipients). By Q2 2021, the rate of methadone recipients among adolescents and young adults (59.3 per 100,000) was similar to the rate of buprenorphine recipients (56.6 per 100,000).

Figure 9. Quarterly rate of OAT recipients aged 25 to 44, by OAT type, Q2 2014 to Q2 2021



Although there has been a gradual decrease in methadone recipients among those aged 25 to 44 in Ontario, this decline was much smaller compared to adolescents and young adults, falling from 570.4 to 538.7 per 100,000 quarterly from Q2 2014 to Q2 2021. This has been met by a considerable increase in buprenorphine dispensing over this time, which tripled from 109.9 to 302.8 per 100,000. In contrast to the findings among adolescents and youth, by Q2 2021, methadone remained by far the most commonly used form of OAT among those aged 25 to 44.

Figure 10. Overall OAT recipients in 2020 aged 15 to 24 by sex and location of residence

Among adolescents and young adults, the rate of receipt of OAT was significantly higher among males (194.3 per 100,000; 1,678 males) compared to females (169.5 per 100,000; 1,389 females; p<0.001) in 2020. The rate of individuals receiving OAT among rural residents (429.9 per 100,000; 664 individuals) was nearly three-fold the rate among urban residents (156.8 per 100,000; 2,377 individuals; p<0.001) in 2020.

2. Demographic Characteristics and Circumstances Surrounding Opioid Toxicity Deaths

For the remainder of the report, the following cohorts were compared:

- **Pre-Pandemic Period**: March 17th, 2019 to March 16th, 2020
  - Adolescents and young adults (aged 15 to 24 years): **115 deaths**
- **Pandemic Period**: March 17th, 2020 to March 16th, 2021
  - Adolescents and young adults (aged 15 to 24 years): **169 deaths**
  - Adults aged 25 to 44: **1,290 deaths**

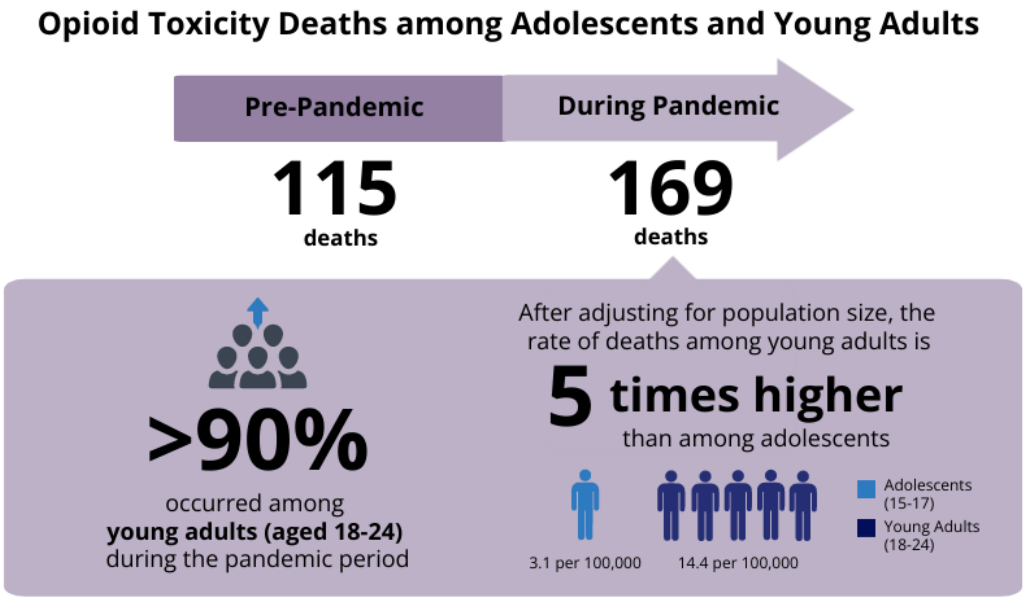
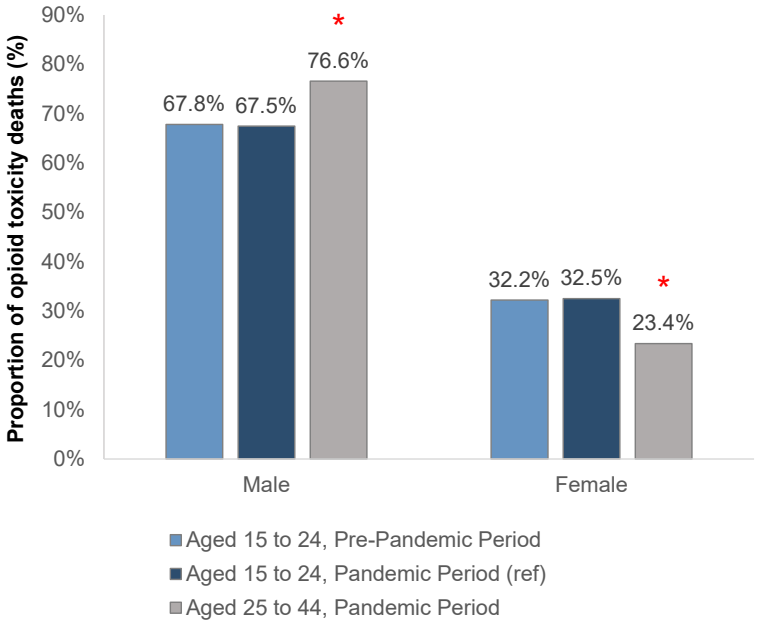
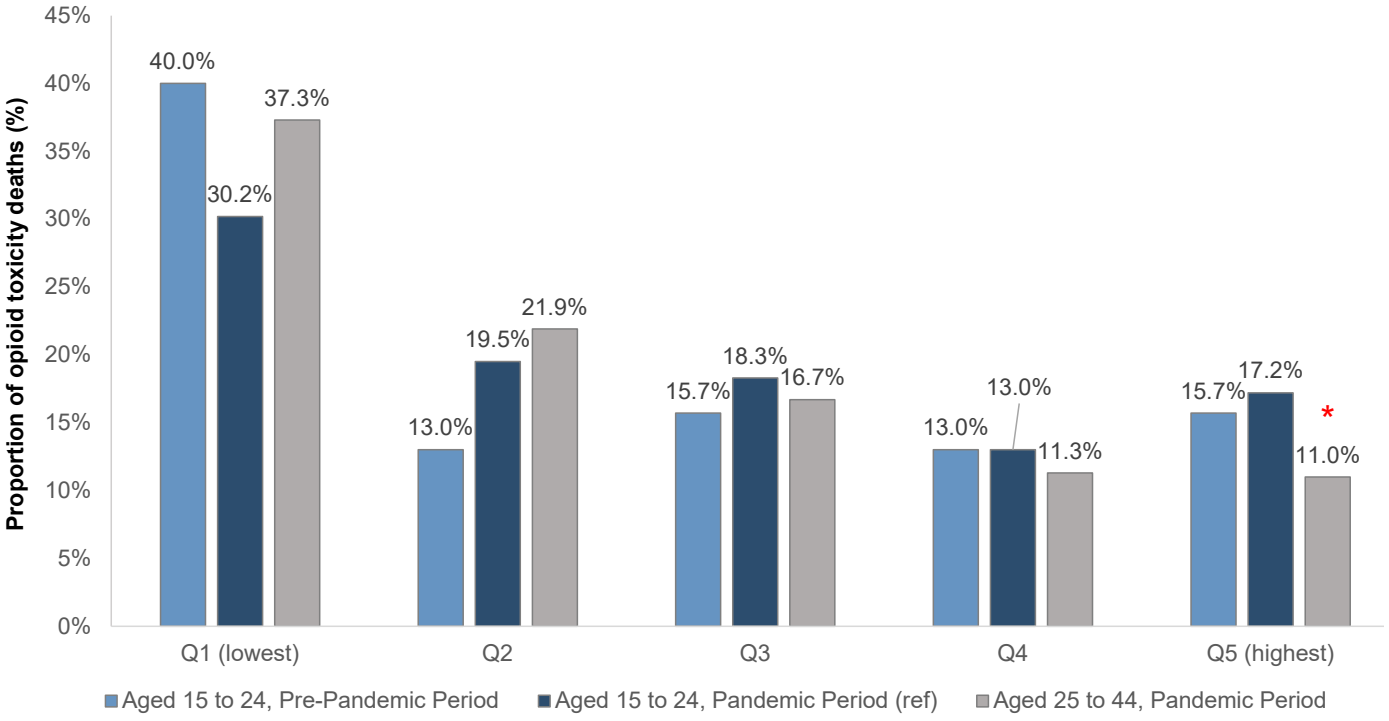


Figure 11. Distribution of opioid toxicity deaths by sex



Approximately 2 in 3 opioid toxicity deaths among adolescents and young adults were among males, and this did not change significantly during the pandemic (114 of 169 deaths were among males during the pandemic; p=0.95). However, this was lower than the percentage among people aged 25 to 44, for whom over 3 in 4 deaths during the pandemic (988 of 1,290 deaths) occurred among males (p=0.009).

Figure 12. Distribution of opioid toxicity deaths across neighbourhood-level income quintiles

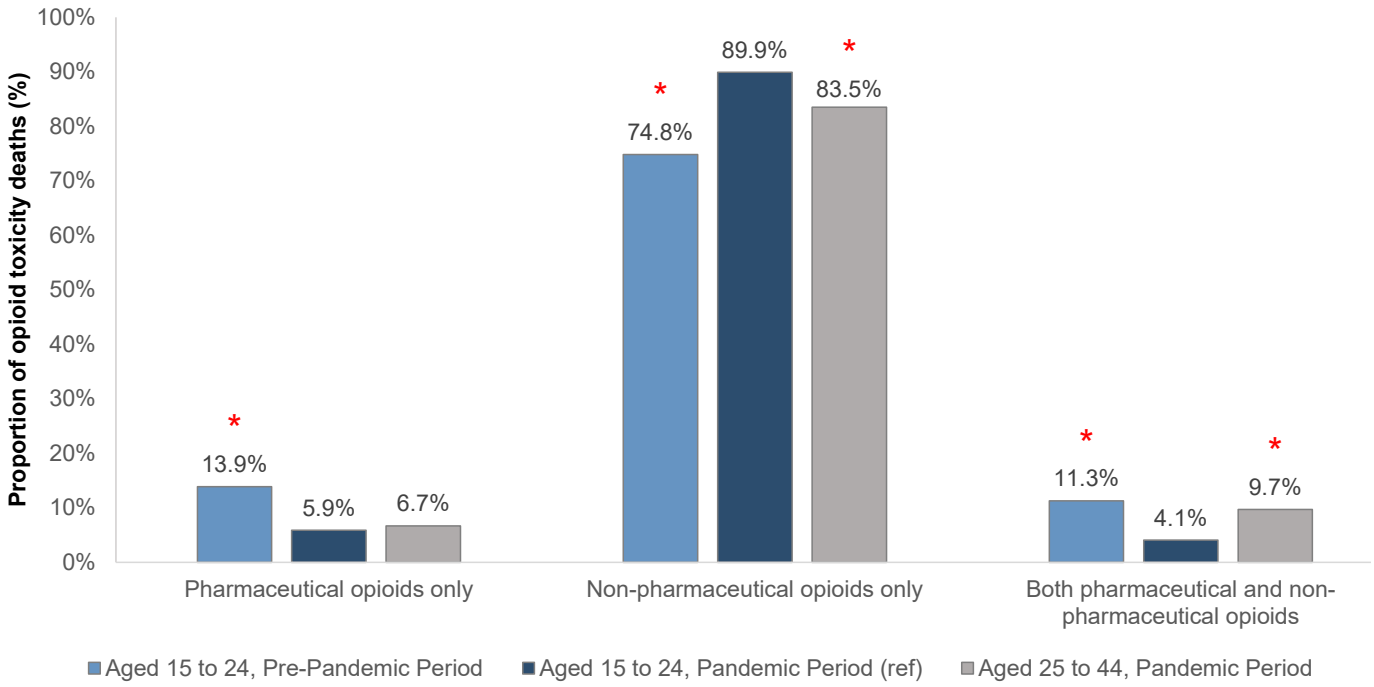


NOTE

Missing/unknown data ranged from 1.8 to 2.6% among the cohorts above.

Opioid toxicity deaths were clustered among individuals residing in lower income neighbourhoods among all age groups studied both before and during the pandemic. During the pandemic, a higher proportion of adolescents and young adults who died from an opioid toxicity were in the highest income quintile (17.2%; N=29) compared to adults aged 25 to 44 (11.0%; p=0.02).

Figure 13. Distribution of the origin of opioids directly contributing to opioid toxicity deaths



NOTE

- See **Appendix A** for definitions.
- Categories (i.e., pharmaceutical opioids only, non-pharmaceutical opioids only, and both pharmaceutical and non-pharmaceutical opioids only) are mutually exclusive.
- A recent **report** among the entire Ontario population found that fentanyl and fentanyl analogues accounted for over 99% of deaths where non-pharmaceutical opioids were a direct contributor to death.

The proportion of deaths involving only non-pharmaceutical opioids increased significantly among adolescents and young adults during the pandemic, rising from 74.8% to 89.9% (86 to 152 deaths; p=0.001). Importantly, during the pandemic, non-pharmaceutical opioid involvement in death (without combined involvement of pharmaceutical opioids) was more common among adolescents and young adults than among adults aged 25 to 44 (89.9% vs 83.5%; p=0.03). Only 5.9% (N=10) of deaths among adolescents and young adults involved only pharmaceutical opioids during the pandemic.

Table 1. Specific types of opioids directly contributing to opioid toxicity death

	Aged 15 to 24		Aged 25 to 44
	Pre-Pandemic Period N=115	Pandemic Period (ref) N=169	Pandemic Period N=1,290
Non-Pharmaceutical opioids			
Any	**99 (86.1%)***	159 (94.1%)	1,202 (93.2%)
Fentanyl	**97 (84.3%)***	158 (93.5%)	1,199 (92.9%)
Heroin	**10 (8.7%)***	N≤5	20 (1.6%)
Opioids indicated for pain			
Any	**23 (20.0%)***	12 (7.1%)	115 (8.9%)
Hydromorphone	**11 (9.6%)***	N≤5	41 (3.2%)
Oxycodone	6 (5.2%)	N≤5	33 (2.6%)
Codeine	0	N≤5	9 (0.7%)
Morphine	**9 (7.8%)***	N≤5	46 (3.6%)
Opioid agonist therapy			
Methadone	6 (5.2%)	7 (4.1%)	106 (8.2%)
Buprenorphine	0	0	N≤5

NOTE

- Reference group (ref) for statistical comparisons: adolescents and young adults in the pandemic period.
- An asterisk and bolded font indicated statistical significance between the reference group and (i) adolescents and young adults in the pre-pandemic period and (ii) adults aged 25 to 44 in the pandemic period.
- Categories are not mutually exclusive. Some deaths were attributed to multi-drug toxicity where more than one substance can contribute to an individual death.

During the pandemic period, fentanyl (and its analogues; either alone or in combination with other opioids) directly contributed to 93.5% of opioid toxicity deaths among adolescents and young adults, a significant increase compared to the prevalence prior to the pandemic (84.3%; p=0.01).

Considering pharmaceutical opioids, there was a significant decrease in the involvement of opioids indicated for pain as direct contributors to death (20.0% to 7.1%; p=0.001) among adolescents and young adults during the pandemic, largely influenced by less hydromorphone and oxycodone involvement in deaths. Methadone rarely contributed to opioid toxicity deaths among adolescents and young adults during the pandemic period (4.1%, N=7).

Table 2. Other non-opioid substances directly contributing to opioid toxicity deaths

	Aged 15 to 24		Aged 25 to 44
	Pre-Pandemic Period N=115	Pandemic Period (ref) N=169	Pandemic Period N=1,290
Non-opioid substances directly contributing to opioid toxicity death			
Alcohol	12 (10.4%)	11 (6.5%)	**171 (13.3%)***
Stimulants			
Non-pharmaceutical	48 (41.7%)	81 (47.9%)	**762 (59.1%)***
Cocaine	36 (31.3%)	61 (36.1%)	532 (41.2%)
Methamphetamine	19 (16.5%)	36 (21.3%)	**375 (29.1%)***
Pharmaceutical only	0 (0.0%)	N≤5	N≤5
Any benzodiazepine	12 (10.4%)	18 (10.7%)	130 (10.1%)
Non-pharmaceutical	**N≤5***	13-17 (7.7%-10.1%)	100 (7.8%)
Pharmaceutical only	**7-11 (6.1%-9.6%)***	N≤5	30 (2.3%)

NOTE

- Reference group (ref): adolescents and young adults in the pandemic period.
- An asterisk and bolded font indicated statistical significance between the reference group and (i) adolescents and young adults in the pre-pandemic period and (ii) adults aged 25 to 44 in the pandemic period.
- **Some deaths were attributed to more than one substance. Deaths due to non-pharmaceutical stimulants and benzodiazepines may include pharmaceutical stimulants and benzodiazepines, respectively. However, deaths attributed to pharmaceutical benzodiazepines do not include any non-pharmaceutical benzodiazepines.**
- Non-pharmaceutical stimulants include Methamphetamines, Cocaine, Methylenedioxyamphetamine (MDA) and Methylenedioxymethamphetamine (MDMA).
- Cell counts ≤5 were suppressed according to ICES privacy policies. Ranges were provided where necessary to prevent calculation of suppressed counts.

Half of all opioid toxicity deaths among adolescents and young adults during the pandemic involved non-pharmaceutical stimulants (47.9%), approximately 1 in 10 involved non-pharmaceutical benzodiazepines (7.7%-10.1%), and 6.5% involved alcohol as direct contributors to death. In general, there were few changes in non-opioid substance involvement in opioid toxicity deaths among adolescents and young adults during the pandemic, with the exception of rising detection of non-pharmaceutical benzodiazepines ($p<0.05$).

When compared to adults aged 25 to 44 during the pandemic, opioid toxicity deaths among adolescents and young adults were less likely to involve alcohol (6.5% vs. 13.3%; $p=0.01$) and non-pharmaceutical stimulants (47.9% vs. 59.1%; $p=0.006$).

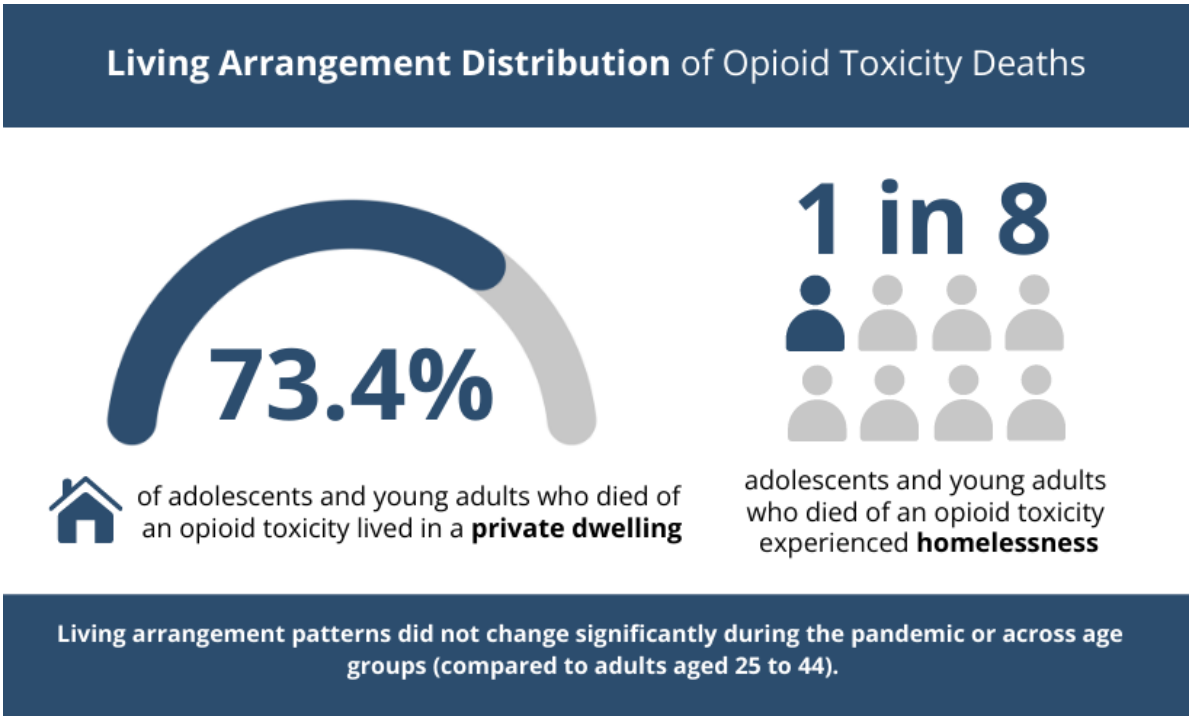
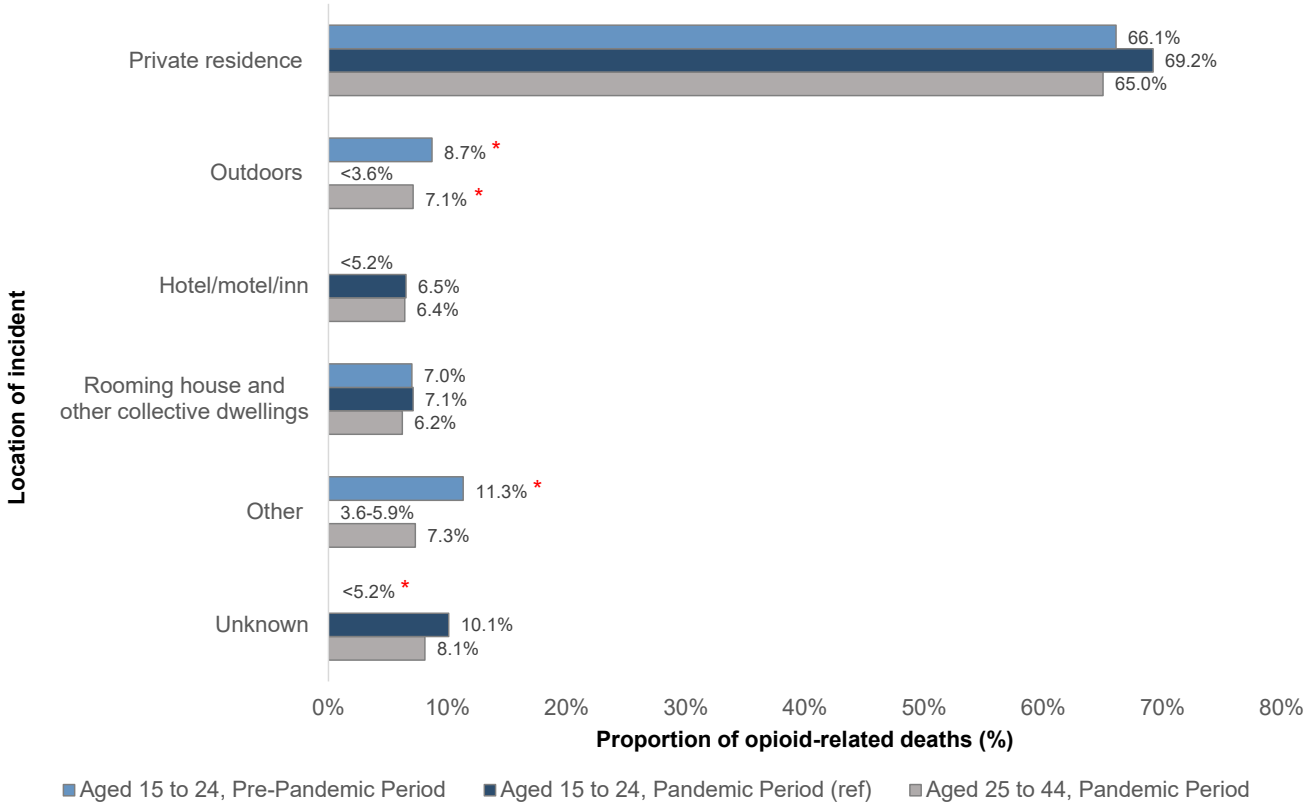


Figure 14. Location of incident among opioid toxicity deaths prior to, and during the pandemic



Almost 70% (N=117) of opioid toxicity deaths among adolescents and young adults occurred in private residences, with 62.7% (N=106) occurring in decedent's home address during the pandemic. This was not significantly different from trends observed prior to the pandemic (p=0.58), and those observed among adults aged 25 to 44 during the pandemic (p=0.26). Very few opioid toxicity deaths among adolescents and young adults occurred outdoors during the pandemic (≤3.6%), which differed from prior to the pandemic (8.7%; p<0.05) and among adults aged 25 to 44 during the pandemic (7.1%; p=0.02).

During the Pandemic Period | Mar 17, 2020 - Mar 16, 2021

There was an **individual present who could intervene** in only

23.1%

of deaths among adolescents and young adults

Among deaths where an individual was present to intervene,

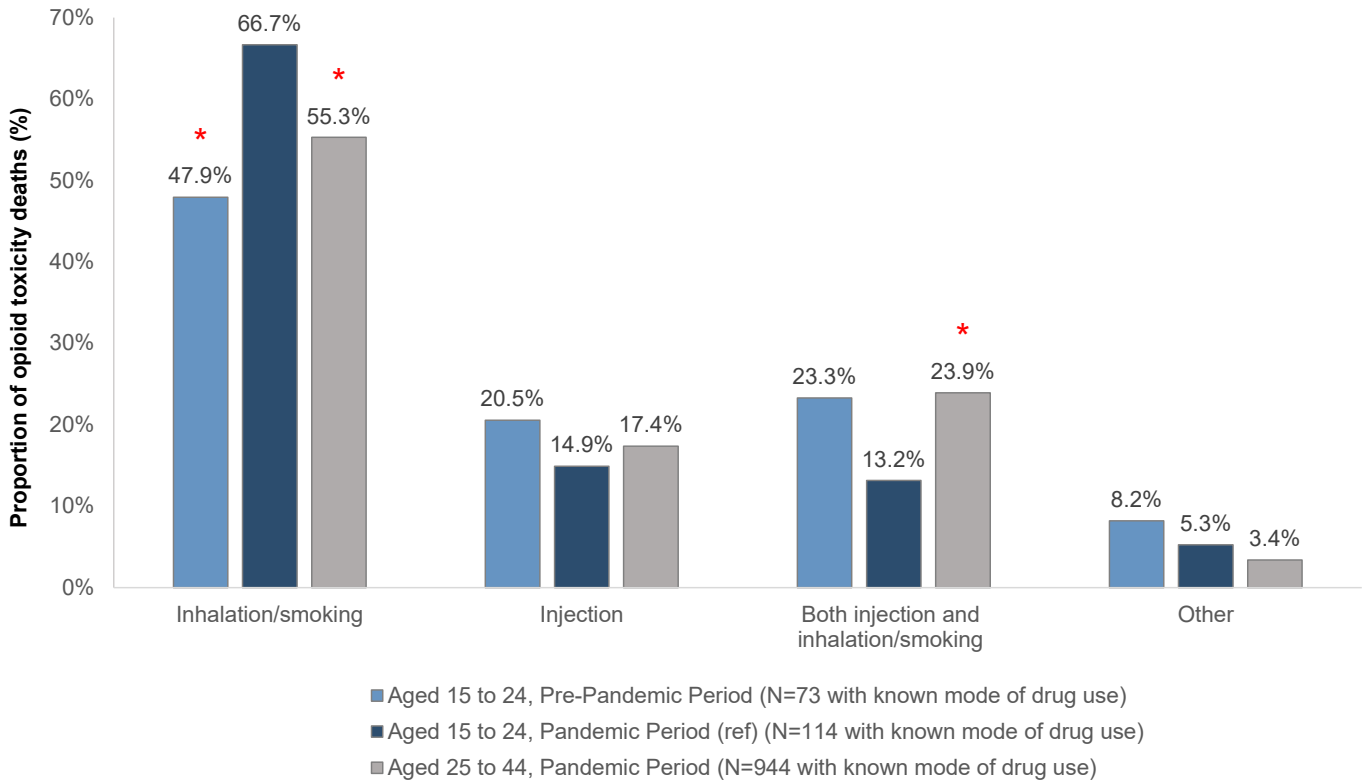
naloxone was administered only

1/2

of the time

No significant differences were observed across the pre-pandemic and pandemic periods among adolescents and young adults, nor when compared to adults aged 25 to 44 during the pandemic.

Figure 15. Likely mode of drug use in opioid toxicity death based on coroner's investigation



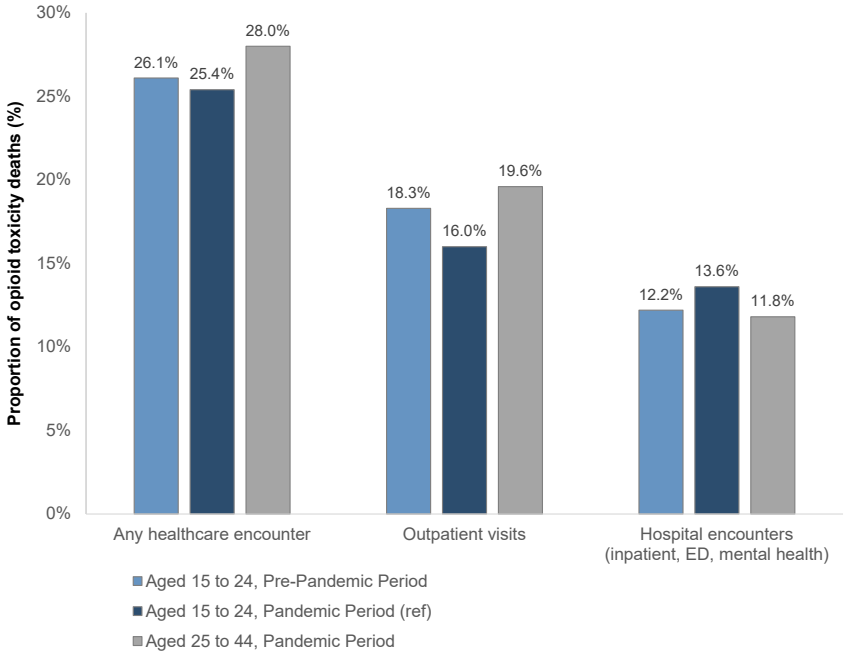
NOTE

- Categories are mutually exclusive.
- Percentages are among those with known mode of drug use. These data should be interpreted within the context of a high degree of missing data (36.5% and 32.5% among adolescents and young adults during the pre- pandemic and pandemic periods, respectively; 26.8% among adults aged 25 to 44), where the likely mode of substance use could not be determined by the investigating coroner.

Among adolescents and young adults, the majority of opioid toxicity deaths where mode of drug use was known involved inhalation or smoking during the pandemic period (66.7%; N=76 of 114), while 14.9% involved injection (N=17 of 114) and 13.2% involved both injection and inhalation (N=15 of 114). Inhalation or smoking increased during the pandemic among adolescents and young adults (47.9% to 66.7%; N=35 to 76; p=0.01), and was higher among adolescents and young adults (66.7%) compared to adults aged 25 to 44 during the pandemic (55.3%; p=0.02). Indication of both injection and inhalation/smoking at time of death was less prevalent among adolescents and young adults (13.2%; N=15 of 114) compared to adults aged 25 to 44 (23.9%) during the pandemic (p=0.01).

3. Recent Interactions with the Healthcare System Prior to Opioid Toxicity Death

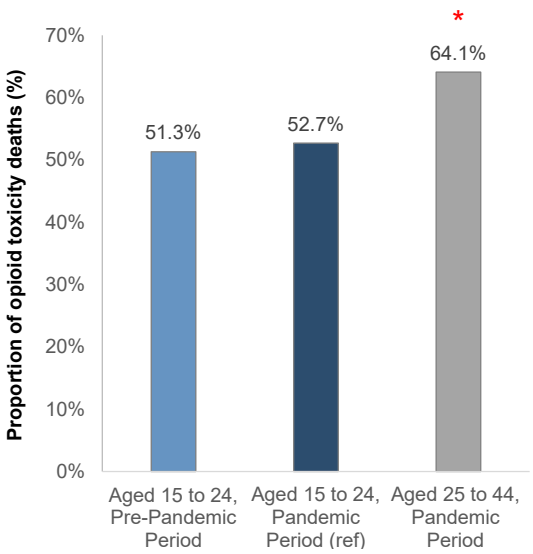
Figure 16. Recent healthcare encounters in the seven days prior to opioid toxicity death



Overall, patterns of healthcare utilization before death did not change significantly during the pandemic among adolescents and young adults, or when compared to adults aged 25 to 44 during the pandemic. One in four adolescents and young adults who died of an opioid toxicity had a healthcare encounter in the week prior to death (25.4%; N=43), with 16.0% (N=27) having an outpatient visit and 13.6% (N=23) having a hospital encounter.

Figure 17. Diagnosis or treatment of opioid use disorder in prior 5 years

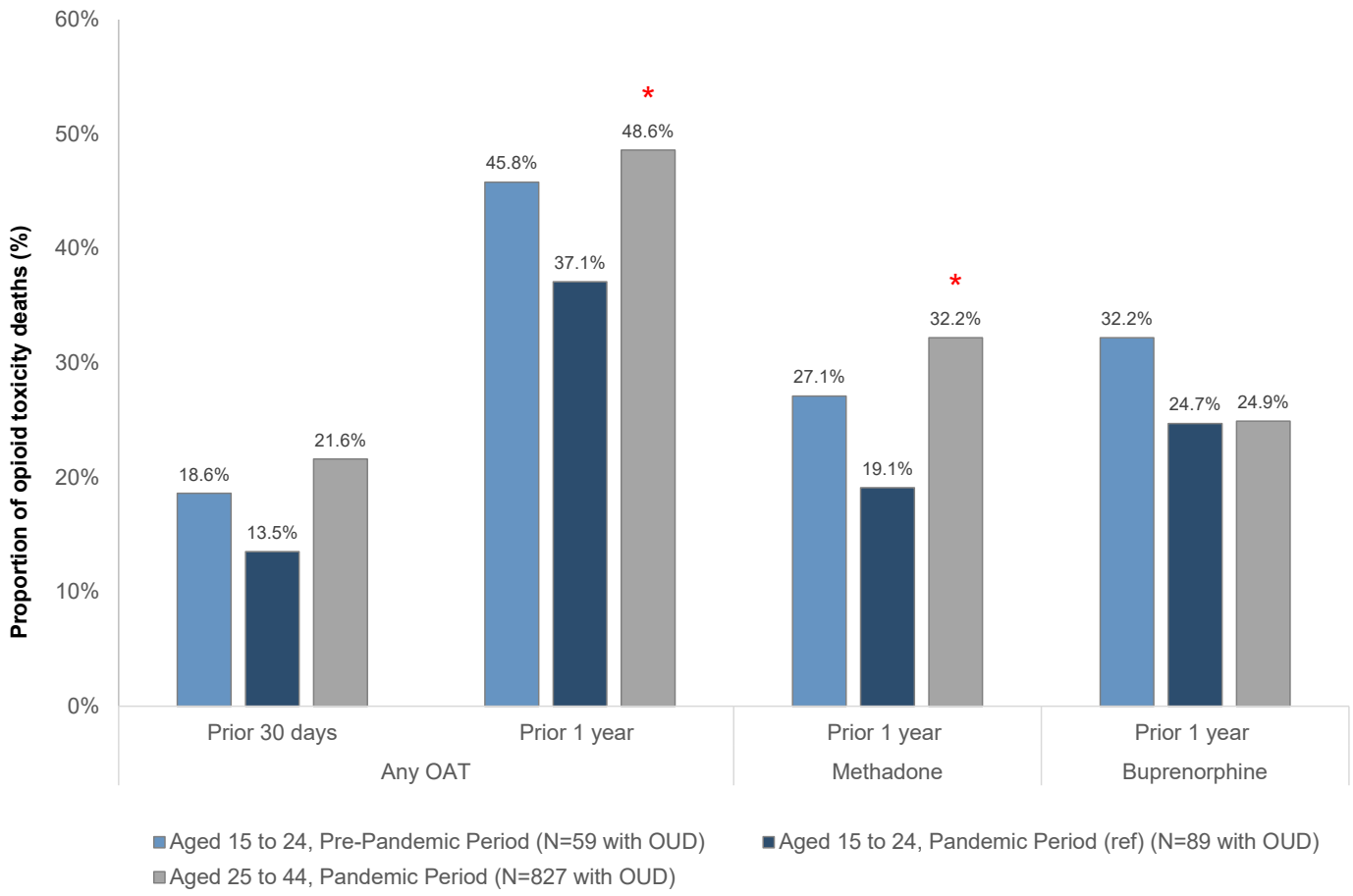
Approximately half of adolescents and young adults who died of an opioid toxicity during the pandemic period had a healthcare encounter related to an OUD diagnosis within the five years prior to death (52.7%; N=89). This was similar to the prevalence observed prior to the pandemic (51.3%; p=0.82), but significantly lower than the prevalence of OUD encounters among adults aged 25 to 44 (64.1%; p=0.004).



NOTE

OUD is defined as either a healthcare encounter for an OUD or a dispense for OAT in the 5 years prior to death (see Appendix B, Table B2).

Figure 18. Recent receipt of a prescription for opioid agonist treatment (OAT) among those with an opioid use disorder (OUD) who died of an opioid toxicity



NOTE

All buprenorphine is buprenorphine/naloxone among adolescents and young adults. There were no claims for the buprenorphine extended-release injection (Sublocade®) or the buprenorphine subdermal implant (Probuphine®) among adolescents and young adults in the five years prior to death.

Among adolescents and young adults with a healthcare encounter related to OUD in the previous 5 years, only 13.5% (N=12 of 89) were dispensed OAT in the month prior to death, and 37.1% (N=33 of 89) were dispensed OAT in the prior year. Receipt of OAT in the past year lowered slightly (from 45.8% to 37.1%; p=0.29) during the pandemic among adolescents and young adults, and was significantly lower than the prevalence observed among adults aged 25 to 44 during the pandemic (37.1% vs. 48.6%; p=0.04). Methadone (19.1%; N=17 of 89) and buprenorphine (24.7%, N=22 of 89) dispensing in the past year was similar among adolescents and young adults during the pandemic.

Table 3. Healthcare encounters for mental health-related diagnosis in the past 5 years among those who died of an opioid toxicity

	Aged 15 to 24		Aged 25 to 44
	Pre-Pandemic Period N=115	Pandemic Period (ref) N=169	Pandemic Period N=1,290
Any healthcare encounter for mental health-related diagnosis in prior 5 years	101 (87.8%)	150 (88.8%)	1155 (89.5%)
ED visit or hospitalization	79 (68.7%)	121 (71.6%)	**790 (61.2%)***
Outpatient Visit at Community Health Centre	10 (8.7%)	15 (8.9%)	124 (9.6%)
Other outpatient visit	97 (84.3%)	145 (85.8%)	1,116 (86.5%)
Psychotic disorders	12 (10.4%)	29 (17.2%)	240 (18.6%)
Mood and anxiety disorders	87 (75.7%)	127 (75.1%)	879 (68.1%)
Substance use disorders	60 (52.2%)	90 (53.3%)	**864 (67.0%)***
Behavioural and neuro-developmental disorders	22 (19.1%)	42 (24.9%)	**111 (8.6%)***
Other mental health-related disorders	34 (29.6%)	52 (30.8%)	366 (28.4%)

NOTE

- Reference group (ref): adolescents and young adults in the pandemic period.
- An asterisk and bolded font indicated statistical significance between the reference group and (i) adolescents and young adults in the pre-pandemic period and (ii) adults aged 25 to 44 in the pandemic period.

Almost 90% of adolescents and young adults who died from an opioid toxicity during the pandemic had a healthcare encounter for a mental health diagnosis in the five years prior to death, with diagnostic claims indicating a high prevalence of mood and anxiety disorders (75.1%), substance-use disorders (53.3%), and behavioural and neuro-developmental disorders (24.9%).

While patterns of mental health-related diagnoses did not change significantly among adolescents and young adults during the pandemic, in general, ED visits or hospitalizations for mental health diagnoses were more prevalent in this demographic during the pandemic (71.6%) compared to adults aged 25 to 44 (61.2%; p=0.009). Similarly, behavioural or neuro-developmental disorders were more prevalent among adolescents and young adults (24.9% vs. 8.6%; p<0.001), and diagnoses of substance use disorders were less prevalent (53.3% to 67.0%; p<0.001) than among adults aged 25 to 44. Note that more behavioural and neuro-developmental disorders may reflect a higher likelihood for these disorders to be diagnosed and treated in childhood.

Limitations

1. In our analyses of coronial records, we only included *confirmed* opioid toxicity deaths. This means that some deaths that may later be determined to be opioid-related are not included in our study, although we anticipate that this difference is small.
2. Diagnoses of OUD may be underestimated in our analyses as we relied on healthcare encounters related to OUD and prior receipt of OAT to define this measure (using ICES data). Therefore, we do not capture individuals with OUD who have not been engaged in the healthcare system related to this diagnosis and those who may have accessed residential treatment for an OUD but had no related diagnosis identified in other healthcare records.
3. We are unable to determine whether treatment was offered to individuals and declined; therefore, gaps in access to treatment reported here may reflect a combination of lower access to treatment and lower acceptability of/preference for treatment among adolescents and young adults.
4. Our definition of OAT was limited to methadone and buprenorphine, excluding slow-release oral morphine (SROM), which in Ontario is primarily prescribed for pain. SROM is less commonly used among adolescents and young adults in Ontario, with 56 and 189 individuals aged 15 to 24 years receiving SROM in 2020 and 2021, respectively.[18] No evidence currently supports the use of SROM for youth, and SROM is only recommended for youth where methadone and buprenorphine/naloxone were unsuccessful or contraindicated.[11]
5. We expect some misclassification regarding the origin of the opioid involved in death, despite the steps taken to exclude potential metabolites (see **Methods**).
    a. We anticipate underreporting of heroin-attributable deaths. To demonstrate, some deaths that were classified as morphine in our analysis may be caused by heroin, which metabolizes into morphine. 6-MAM (a metabolite of heroin) is quickly eliminated from the body, and thus may not be detected in post-mortem toxicology analysis.
    b. It is possible that some non-pharmaceutical opioid toxicity deaths involve the use of prescription fentanyl; however, we expect this to be very rare as previous research using the same dataset found that fentanyl patches at the scene of the incident or evidence of prior fentanyl prescriptions were only found in about 1% of fentanyl-related deaths.[22]
6. A high proportion of missing values may result in underestimated proportions for mode of drug use (32.5% of values are missing among adolescents and young adults during the pandemic).

Discussion

We found that treatment for OUD is decreasing amid increasing rates of fatal and non-fatal opioid toxicities among adolescents and young adults in Ontario. Importantly, rates of treatment are declining both for first line treatment with OAT, as well as residential treatment for OUD in this demographic. From Q2, 2014 to Q2, 2021, the rate of individuals receiving OAT decreased by more than half, while opioid toxicity ED visit rates more than quadrupled and deaths tripled among adolescents and young adults. In the first year of the pandemic, there were 169 adolescents and young adults who lost their lives to an accidental opioid toxicity, and a total of 752 deaths in this demographic from Q2, 2014 to Q2, 2021. Our findings are consistent with rising opioid toxicities in Canada and the United States[4,7] and reports of declining OUD treatment in the United States among adolescents and young adults.[20] The decrease in the rate of individuals receiving OAT is driven by declining rates of methadone dispensing, which historically has been the primary type of OAT prescribed in this population. In contrast, rates of buprenorphine dispensing among adolescents and young adults has remained consistently low with minimal increases over this timeframe, which was not the case for adults aged 25 to 44 where buprenorphine rates increased three-fold. Importantly, the observed declines in OAT appear to be unique to young adults aged 18 to 24, as the rate of individuals receiving OAT remained low and generally stable in the adolescent (15 to 17 year) and 25 to 44-year age groups. Reasons for these trends may include increasing rates of unregulated drug use, lower access to (or reduced preference for) OAT over time, differential rates of OUD diagnoses across age groups, and an increasingly volatile unregulated drug supply composed primarily of fentanyl, fentanyl analogues and unregulated benzodiazepines among young people.

Declining OAT despite rising opioid-related harms may be a result of changes to accessibility of treatment or perceptions around pharmaceutical treatment for OUD among adolescents and young adults. Although only half of adolescents and young adults who lost their lives to an opioid toxicity had a prior diagnosis of OUD, there is evidence of considerable under-treatment within this population. Specifically, only 13.5% of adolescents and young adults with an OUD were prescribed OAT in the month prior to death, and 37.1% in the year prior to death, which was significantly lower than rates observed among adults aged 25 to 44 (48.6% in the year prior to death; p=0.04). Further, we observed that adolescents and young adults were increasingly less connected to OUD treatment, including OAT and residential treatment.These findings align with other research suggesting a high prevalence of OUD under-treatment in this younger demographic, with some studies from the United States showing alarmingly low rates of OAT prescribing among youth surviving an opioid toxicity (~2%).[23] Low OAT use among those with an OUD may reflect barriers in access to services or different perceptions of, and preferences for, services in younger populations. For example, pressure to use buprenorphine despite preference for methadone, medication side-effects, fear of stigma when accessing OAT, aging out of youth services, pressure to engage in abstinence-based treatment, not wanting to experience buprenorphine-precipitated withdrawal and fears around long-term OAT use and its implications on quality of life have been identified as potential barriers to OAT use among young people.[15-17] Further, the difficulties adhering to OAT over a long period are likely exacerbated by reduced effectiveness of OAT among fentanyl users[3] in addition to a higher degree of financial challenges, mental health concerns and insecure housing,[15] as our findings demonstrate. Overall, these findings suggest that while about half of adolescents and young adults who died of an opioid toxicity had an OUD, the majority are not receiving OAT, suggesting that traditional approaches to treatment may be increasingly undesirable and inaccessible. The risk of opioid-related harm and death associated with lack of access to treatment are heightened by the increasingly volatile and toxic unregulated opioid supply, signifying an urgent need to tailor treatment, health, and community services to adolescents and young adults with an OUD, according to their unique needs, preferences and goals.

Rising rates of opioid-related toxicity may be influenced by the harms of an increasingly unpredictable and potent unregulated drug supply encountered by people who use drugs occasionally. Almost half of opioid toxicity deaths among adolescents and young adults occurred among those without an OUD diagnosis. Although this could, in part, reflect under-diagnosis of OUD in this population, it also suggests that risks encountered by people who use drugs occasionally may be particularly important factors to consider within this demographic. With the increasingly unpredictable unregulated drug supply that is dominated by fentanyl, people who use substances intermittently are at particularly high risk of toxicity due to a lower physiologic tolerance to the potent opioid supply.[12] Further, high levels of inhalation or smoking at time of death (66.7%) suggests the need for harm reduction responses specific to those who smoke or inhale drugs. Although harm reduction services including naloxone programs, supervised consumption sites (largely excluding smoking/inhalation use), and public health programs providing sterile supplies for injection and inhalation are available across the province, younger demographics may have fewer connections with these services, and may experience difficulties navigating access to spaces that serve their needs.[16] Therefore, responses to the drug toxicity crisis among adolescents and young adults must include harm reduction services tailored to the needs of this population, and provided within accessible spaces. Examples of this include widespread naloxone provision and associated training within school settings and peer-to-peer support within community-based, youth-centric programs.

Similar to trends identified at the population level in Ontario, drug toxicity harms among adolescents and young adults are being driven by fentanyl from the unregulated drug supply, with non-pharmaceutical stimulants (i.e., cocaine and methamphetamine) also commonly directly contributing to opioid toxicity deaths. Importantly, there was a shift towards more harm from the unregulated drug supply during the pandemic among adolescents and young adults, consistent with rapid rises in deaths attributed to fentanyl in the general Ontario population.[24] During the pandemic, non-pharmaceutical opioids (e.g. fentanyl) alone directly contributed to a higher proportion of opioid toxicity deaths among adolescents and young adults (89.9%) than among adults aged 25 to 44 years (83.5%; p=0.03), and there were large, decreasing shifts in the role of pharmaceutical opioids in opioid toxicity deaths. In particular, prior to the pandemic, 1 in 7 (13.9%) opioid toxicity deaths among adolescents and young adults were solely attributed to pharmaceutical opioids, which was reduced by more than half during the pandemic (5.9%; p=0.02). These dynamics emphasize the pivotal role that the unregulated drug supply plays in harms experienced among adolescents and young adults, and the need for responses to address these risks. In addition, fentanyl contamination in Ontario is not consistently identified or commonly observed in stimulant samples,[25] suggesting a need for approaches that address concurrent use of multiple substances among adolescents and young adults. These may include harm reduction strategies such as expanded access to supervised inhalation and safer smoking spaces.

This report also shows the high degree of polysubstance use that is contributing to drug toxicity harms in Ontario's adolescents and young adults, with nearly half of opioid-related deaths involving non-pharmaceutical stimulants (47.9%), and an increasing involvement of non-pharmaceutical benzodiazepines during the pandemic. The increasing exposure to non-pharmaceutical benzodiazepines (e.g., etizolam, flualprazolam) through the unregulated drug supply during the pandemic is likely influencing these patterns. This has important complications for people who use drugs in this demographic, including identifying a need for treatment for benzodiazepine withdrawal, more complex overdose response requirements, and the potential long-term negative health impacts of continued exposure to high potency benzodiazepines.[26-28] Therefore, specific services that meet the needs of people using other substances with opioids and those who have developed a physiologic dependency on multiple substances are warranted. Risk mitigation may also be achieved through a predictable alternative to the unregulated drug supply (e.g., prescribed safer supply with hydromorphone and/or diacetylmorphine) among young people at high risk of opioid-related harm,[29] and should be explored through future research. Further, exploring other modes of OAT, such as long-acting modalities, may address some of the barriers related to stigma and inaccessibility among adolescents and young adults with an OUD. Efforts to destigmatize drug use

and facilitate networks of support for harm reduction in this younger demographic are also urgently needed, given that most opioid toxicity deaths in this younger demographic occurred at home (62.7%) and without anyone present to intervene (76.9%).

With 1 in 4 adolescents and young adults having contact with the healthcare system in the week prior to death (25.4%) and a high prevalence of mental health diagnoses (88.8%) in this population, there is a need to ensure that hospitals are creating safe, inclusive spaces for people who use drugs, that services tailored to the needs of this demographic are integrated directly into hospital and ED settings, and that continuity of care between inpatient and outpatient settings is prioritized. In addition to connecting adolescents and young adults to treatment and harm reduction programs in the community, diagnosis and management of mood and anxiety disorders is crucial for reducing the risk of self-medication and OUD in this population.[30] The importance of timely and effective treatment of mood and anxiety disorders is evident given their high prevalence among adolescents and young adults who died of an opioid toxicity (3 in 4). Further, healthcare contacts for behavioural and neuro-developmental disorders in the prior 5 years were much more common among adolescents and young adults experiencing opioid-related harm compared to adults aged 25-44 (24.9% vs. 8.6%; $p<0.001$). Although this likely reflects a higher likelihood that these disorders will be diagnosed and treated in childhood, this high prevalence is important to note given that attention deficit/hyperactivity disorder (ADHD) severity has been associated with higher rates of unregulated substance use and worse OUD-related outcomes.[31,32]

Unfortunately, there are many barriers to mental health treatment in Ontario, including delays in access to care, financial barriers to accessing counselling and psychological support (which is generally not publicly funded in Ontario), and difficulties transitioning from child to adult mental healthcare systems.[33-35] Addressing barriers such as these as well as mitigating adverse childhood experiences may promote upstream prevention of opioid-related harms through early prevention or intervention of mental health conditions. Better integration of psychosocial interventions may also lead to better OAT retention and treatment trajectories while also addressing comorbid mental health conditions among adolescents and young adults with OUD.[10]

Conclusion

Our results demonstrate a widening treatment gap for OUD among adolescents and young adults driven by decreasing methadone and plateauing buprenorphine use amid increasing rates of opioid toxicity. As opioid toxicity harms are increasingly driven by the unregulated drug supply, with risks identified both among adolescents and young adults with OUD and those who are likely using drugs only occasionally, it is clear that a multi-faceted approach is needed to address the needs of this population. Although evidence-informed responses to this crisis within younger demographics are similar to the needs identified for the population as a whole, specific consideration is needed to ensure that services provided are tailored to the preferences, needs and goals of adolescents and young adults. For example, understanding specific treatment goals, preferred forms of treatment, and integration of OAT into hospitals, primary care and other settings that are widely accessible to younger people with OUD is needed. Furthermore, ensuring adequate knowledge of, and access to, varied harm reduction programs and services is imperative, as well as the need for integration of peer-to-peer support throughout these services. Finally, strategies that address upstream risk factors for substance-related harm are warranted, including ensuring access to stable housing, addressing food insecurity, and removing barriers to mental health treatment.

Contributors

Ontario Drug Policy Research Network

The Ontario Drug Policy Research Network (ODPRN) is a province-wide network of researchers who provide timely, high quality, drug policy relevant research to decision makers. The ODPRN houses the Ontario Opioid Drug Observatory (OODO) which is funded through a grant from the Canadian Institutes of Health Research (CIHR). This observatory aims to measure, assess and evaluate the use of prescription opioids, opioid-related overdoses, and opioid-related drug policy by leveraging large, population-level data sources. For more information, visit **odprn.ca**.

Office of the Chief Coroner/Ontario Forensic Pathology Service

Together the Office of the Chief Coroner/Ontario Forensic Pathology Service (OCC/OFPS) provide death investigation services in Ontario serving the living through high quality investigations and inquests to ensure that no death will be overlooked, concealed or ignored. The findings are used to generate recommendations to help improve public safety and prevent further deaths. In Ontario, coroners are medical doctors with specialized training in the principles of death investigation. Coroners investigate approximately 17,000 deaths per year in accordance with section 10 of the Coroners Act. The OFPS provides forensic pathology services in accordance with the Coroners Act. It provides medicolegal autopsy services for public death investigations under the legal authority of a coroner. The OFPS performs approximately 7,500 autopsies per year. For more information, visit **mcscs.jus.gov.on.ca**.

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Disclaimer

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Appendix A: Definitions

Adolescents:
Individuals aged 15 to 17 years.

Young adults:
Individuals aged 18 to 24 years.

Opioids:
A family of substances that include opioids available through regulated and pharmaceutical sources for the treatment of pain and OUD (e.g., oxycodone, hydromorphone, morphine, methadone) and opioids available primarily through unregulated or non-pharmaceutical markets or sources (e.g., heroin, fentanyl, carfentanil).

Opioid toxicity 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.

Opioid use disorder:
Opioid use disorder (OUD) is a medical condition associated with cravings for opioids that may lead to chronic use of opioids and behaviours that may interfere with the activities of daily life.[36] OAT is often used as the first-line treatment of OUD.

Opioid agonist treatment:
Opioid agonist treatment (OAT) is the provision of opioid agonist medications and is the first-line, recommended treatment for people with OUD, including youth.[11, 37] These medications are opioids that help prevent opioid withdrawal and cravings. Two of the most common types of OAT are methadone and the combination product buprenorphine/naloxone (commonly known by its brand name Suboxone®). Newer longer-acting buprenorphine formulations (Sublocade® and Probuphine®) are included under buprenorphine.

Origin of opioids:
- Opioids with **primarily unregulated and non-pharmaceutical origins** include:
  - Heroin, heroin metabolites (morphine where monoacetylmorphine (6-MAM) was also detected), U-47700
  - Fentanyl, fentanyl analogues (including carfentanil)
- Opioids with **primarily regulated and pharmaceutical origins** include:
  - Buprenorphine, codeine, hydrocodone, hydromorphone, methadone, morphine where 6-MAM was not detected, 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).

Benzodiazepines:
A class of sedative and anti-anxiety drugs that are widely prescribed for the treatment of anxiety, sleep disorders (e.g., insomnia), certain forms of epilepsy, and alcohol withdrawal. Currently, 14 different benzodiazepines are approved for use in Canada. Benzodiazepines that are not approved for medical use in Canada, such as etizolam, are increasingly being found in the unregulated drug supply.

Stimulants:
A class of drugs used for the treatment of attention-deficit/hyperactivity disorder and sleeping disorders (e.g., narcolepsy). These drugs act on the central nervous system to increase alertness, attention and energy. This category also includes stimulants that are used occasionally and primarily available from the unregulated market, such as cocaine and methamphetamine.

Substance involvement in opioid toxicity deaths:
- **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.

Living arrangement:
- **Private dwelling:** Includes private dwellings.
- **Rooming house/other collective dwelling:** Includes temporary/transitional housing, lodging and rooming houses, military bases, sober living facility.
- **Experiencing homelessness:** No fixed address, unsheltered, emergency sheltered, provisionally accommodated, at immediate risk of homelessness.
- **Other:** Motel/hotel, hospital, long-term care, mental health facility, mental health unit at a hospital.
- **Unknown:** Missing, unknown.

Location of incident:
- **Private residence:** Includes private dwellings.
- **Hotel/Motel/Inn:** Includes hotels, motels or inns.
- **Outdoors:** Includes outdoor areas, such as lakes, parking lots, parks, etc.
- **Rooming house/other collective dwellings: I**ncludes sober living facilities, boarding houses, halfway houses, rooming houses, etc.
- **Other:** Includes all other locations, such as public indoor spaces, shelters, supported living/long-term care/retirement homes, corrections/in-custody, hospitals, etc.
- **Unknown:** Includes missing, unknown and other categories where there is not sufficient detail to classify (e.g., homeless).

Rural Ontario:
A community with a population of 10,000 people or less, as assigned by Statistics Canada based on the postal code associated with the individual's health card.

Northern Ontario:
North East (13) and North West (14) LHINs. For a map of the various LHINs, click here.

Southern Ontario:
LHINs 1 to 12. For a map of the various LHINs, click here.

Rate:
The frequency with which an event or circumstance occurs per unit of time, population, or other standard of comparison. Example: Based on a rate of 1.5 deaths per 10,000 people, we can expect approximately 15 deaths in a community of 100,000.

Appendix B: Diagnosis Codes Used to Identify Healthcare Encounters and Health Conditions

Table B1. Healthcare Encounters

Type of Encounter/Condition	Criteria	Data Source	Codes
General healthcare encounters			
Acute hospital admission	Any acute-care related hospital admission. Excludes admissions to adult-designated mental health beds. Includes admissions related to mental health care for children and adolescents (i.e., people less than 18 years of age).	DAD	N/A
Emergency department visit	Any visit to an emergency department. Includes visits related to mental health diagnoses.	NACRS	N/A
Mental health-related hospital admission	Any admission to a mental health bed in a hospital. Contains records for both adults and those <18 years old.	OMHRS, DAD (DADOMHRS_EPI)	N/A
Outpatient care	Any visit (with any provider type) in an office, home care, virtual, long-term care, or community health centre setting.	OHIP Claims Database, CHC	N/A

CHC: Community Health Centre; DAD: Discharge Abstract Database; DDARD: Drug and Drug/Alcohol Related Death Database; NACRS National Ambulatory Care Reporting System; NMS: Narcotics Monitoring System; OHIP: Ontario Health Insurance Plan; OMHRS: Ontario Mental Health Reporting System

Table B2. Health Conditions: History of an Opioid Use Disorder (OUD)

History of OUD was defined as meeting any one of the criteria below:

Criteria	Data Source	Codes
Any outpatient visit with a diagnosis code for drug use	OHIP Claims Database	**OHIP diagnosis code:** 304
Any outpatient visit with a diagnosis code for drug use in the 5 years prior to death	OHIP Claims Database	**OHIP feecodes:** K682, K683, K684 Note: OHIP K-codes were initially implemented in mid-2011
Any emergency department visit or acute hospital admission with a diagnosis code for opioid-related dependence in the 5 years prior to death	NACRS, DAD	**ICD-10 diagnosis code:** F11
Any mental health-related hospital admission with a diagnosis code for opioid use disorder in the 5 years prior to death	OMHRS	**DSM diagnosis codes:** 304.0, 305.5 **ICD-10 diagnosis code:** F11
Received a prescription for opioid agonist treatment (methadone, the combination product buprenorphine/naloxone, Probuphine, or Sublocade) in the 5 years prior to and including death	NMS	N/A

CHC: Community Health Centre; DAD: Discharge Abstract Database; DDARD: Drug and Drug/Alcohol Related Death Database; NACRS National Ambulatory Care Reporting System; NMS: Narcotics Monitoring System; OHIP: Ontario Health Insurance Plan; OMHRS: Ontario Mental Health Reporting System

Table B3. Health Conditions:

History of a Mental Health-Related Healthcare Encounter

History of a mental health-related healthcare encounter was defined as meeting any one of the criteria below:

Criteria	Data Source	Codes	
Outpatient visits (in settings other than community health centres) for mental health-related reasons			
Any visit with a diagnosis code for **psychotic disorders** in the 5 years prior to death	OHIP Claims Database	**OHIP diagnosis codes:** 295, 297, 298	
Any visit with a diagnosis code for **mood and anxiety disorders** in the 5 years prior to death	OHIP Claims Database	**OHIP diagnosis codes:** 296, 300, 311	
Any visit with a diagnosis code for **substance use disorders** in the 5 years prior to death	OHIP Claims Database	**OHIP diagnosis codes:** 303, 304	
Any visit with a diagnosis code for **behavioural and neuro-developmental disorders** in the 5 years prior to death	OHIP Claims Database	**OHIP diagnosis codes:** 299, 313, 314, 315	
Any visit with a diagnosis code for **other mental health-related disorders** in the 5 years prior to death	OHIP Claims Database	**OHIP diagnosis codes:** 291, 292, 299, 307, 313, 314, 315, or other OHIP diagnosis codes accompanied by billing codes indicating mental health-related services	
Outpatient visits in community health centres for mental health-related reasons			
Any visit with a diagnosis code for any mental health condition or disorder in the 5 years prior to death	Community Health Centre Database	Any ICD-10 diagnosis code between F06 and F99 in the primary diagnostic position, excluding dementia and delirium-related diagnoses	
Emergency department visit or acute hospital admission for mental health-related reasons, or admission in adult-designated mental health bed			
Any emergency department visit, acute hospital admission, or admission to an adult-designated mental health bed with a diagnosis code for the following:			
Any mental health and addictions	National Ambulatory Care Reporting System, Discharge Abstract Database, Ontario Mental Health Reporting System	**ICD-9-CM codes (OMHRS DSM-V):** DSM5CODE_DISCH1 = Any OMHRS (includes missing; excludes 290.x, 294.0x-). Exclude if DSM5CODE_DISCH 1 missing and Provisional =17	**ICD-10-CA codes (DAD/NACRS):** DX10CODE1= F06-F99 or DX10CODE2-DX10CODE10 = X60-X84, Y10-Y19, Y28 when DX10CODE1 ne F06-F99
Anxiety disorders	National Ambulatory Care Reporting System, Discharge Abstract Database, Ontario Mental Health Reporting System	**ICD-9-CM codes (OMHRS DSM-V):** DSM5CODE_DISCH1 = 293.84, 300, 300.0x, 300.2x, 309.21, 313.23. Provisional = 5	**ICD-10-CA codes (DAD/NACRS):** DX10CODE1 = F06.4, F40, F41, F93.0-2, F94.0

Criteria	Data Source	Codes	
Substance-related and addictive disorders	National Ambulatory Care Reporting System, Discharge Abstract Database, Ontario Mental Health Reporting System	**ICD-9-CM codes (OMHRS DSM-IV):** DSM5CODE_DISCH1 = 291.x (all 291 codes), 292.x (all 292 codes), 303.x (all 303 codes), 304.x (all 304 codes), 305.x. Can be split into sub-groups: 1. 291.x,303.x,3050 = Alcohol 2. 3040,3047,3055 = Opioids 3. 292.x, 304 [excl 3040,3047], 305 [excl 3050, 3055] = Other drugs Provisional =16	**ICD-10-CA codes (DAD/NACRS):** DX10CODE1 = F10-19, F55 Can be split into sub-groups: F10 = **Alcohol** F11 = **Opioids** F12, F13, F14, F15, F16, F18, F19 = **Other drugs** F17, F55 = **Other**
Schizophrenia spectrum and other psychotic disorders	National Ambulatory Care Reporting System, Discharge Abstract Database, Ontario Mental Health Reporting System	**ICD-9-CM codes (OMHRS DSM-V):** DSM5CODE_DISCH1 = 293.81, 293.82, 295.x (all 295 codes), 297.x (all 297 codes), 298.x (all 298 codes). Provisional =2	**ICD-10-CA codes (DAD/NACRS):** DX10CODE1 = F06.0-2, F20, F22-F29, F53.1
Mood disorders	National Ambulatory Care Reporting System, Discharge Abstract Database, Ontario Mental Health Reporting System	**ICD-9-CM codes (OMHRS DSM-V):** DSM5CODE_DISCH1 = 293.83, 296.x (all 296 codes), 300.4x, 301.13, 311.x, 625.4. Provisional =3, 4 Can be split as follows: **Bipolar** [296.0x, 296.4x, 296.5x, 296.6x, 296.7x, 296.8x, 301.13. provisional=3], **Depressive** [296.2x, 296.3x, 296.9x, 300.4x, 311.x, 625.4x. provisional=4], **Other mood** [293.83]	**ICD-10-CA codes (DAD/NACRS):** DX10CODE1 = F06.3, F30.x-F34.x, F38.x, F39.x, F53.0 Can be split as follows: **Bipolar** [F30.x, F31.x, F34.0], **Depressive** [F32.x, F33.x, F34.1,], **Other mood** [F06.3, F38.x, F39.x, F53.0, F34.8, F34.9]
Trauma/stressor-related disorders	National Ambulatory Care Reporting System, Discharge Abstract Database, Ontario Mental Health Reporting System	**ICD-9-CM codes (OMHRS DSM-V):** DSM5CODE_DISCH1 = 308.3x, 309, 309.0x, 309.24, 309.28, 309.3x, 309.4x, 309.81, 309.89, 309.9x, 313.89. Provisional = 7	**ICD-10-CA codes (DAD/NACRS):** DX10CODE1 = F43.x, F94.1, F94.2
OCD & related disorders	National Ambulatory Care Reporting System, Discharge Abstract Database, Ontario Mental Health Reporting System	**ICD-9-CM codes (OMHRS DSM-V):** DSM5CODE_DISCH1 = 300.3x, 300.7x, 312.39, 698.4x. Provisional = 6	**ICD-10-CA codes (DAD/NACRS):** DX10CODE1 = F42.x, F45.2, F63.3
Personality disorders	National Ambulatory Care Reporting System, Discharge Abstract Database, Ontario Mental Health Reporting System	**ICD-9-CM codes (OMHRS DSM-V):** DSM5CODE_DISCH1 = 301, 301.0x, 301.2x, 301.4x, 301.5x, 301.6x, 301.7x, 301.81-3, 301.89, 301.9x 310.1. Provisional = 18	**ICD-10-CA codes (DAD/NACRS):** DX10CODE1 = F07, F21, F60, F61, F62. F68, F69
Deliberate self-harm	National Ambulatory Care Reporting System, Discharge Abstract Database	**ICD-9-CM codes (OMHRS DSM-V):** N/A (DAD/NACRS)	**ICD-10-CA codes (DAD/NACRS):** DX10CODE2-10 (NACRS)/ DXCODE2-25(DAD) = X60-X84, Y10-Y19, Y28 when DX10CODE1 ne F06-F99