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Healthcare Utilization and Clinical Comorbidities among People Who Died of a Substance-Related Toxicity Death in Ontario

Stimulant, Opioid, Benzodiazepine, and Alcohol-Related Deaths

A report prepared by:

The Ontario Drug Policy Research Network (ODPRN)

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Acknowledgments

We acknowledge all families, friends, and loved ones of those who died from a substance or alcohol-related toxicity in Ontario, recognizing that this report does not sufficiently reflect the pain, grief, and trauma experienced by those who lost their loved ones. We hope that our findings will inform programs and policies to prevent deaths in the future. We also acknowledge all those who use substances, harm reduction workers, peer support workers, first responders and health care professionals who are working tirelessly to support affected individuals and families, including their enormous role in overdose response and resuscitation efforts. Finally, it is imperative that we remember that the statistics in this report reflect lives lost of countless people who are loved and continue to be remembered, honoured, and grieved by their communities. We commit to working with our communities to find ways to use these findings to elevate the voices and experiences of those we have lost, with the goal of supporting responses that improve the lives and safety of people who use substances across the country.

Background

Substance-related mortality remains a public health concern in Canada and there has been a rapid escalation of deaths observed over the past decade, with over 40,000 apparent opioid-related toxicity deaths reported across the country between January 2016 and March 2024.[1] These trends have been tied to multiple factors including the increasing volatility of the toxic unregulated drug supply, ongoing criminalization of substance use as well as barriers to harm reduction, treatment and supports for people who use substances.[2-5] In our previous series of analyses,[2,6] we leveraged data on accidental substance-related toxicity deaths (involving alcohol, stimulants, benzodiazepines and/or opioids) in Ontario to explore trends over time, demographic characteristics as well as prescription medication use, non-fatal substance-related toxicities, and substance use disorder (SUD) diagnoses prior to death. Our first report of this series demonstrated that substance-related toxicity deaths almost doubled between 2018 and 2021, reaching 2,886 accidental deaths annually, with opioids directly contributing to majority of the deaths.[2] Moreover, we described the landscape of substance-related toxicity deaths in Ontario, with substances from the unregulated drug supply contributing to most deaths, and identified growth in the involvement of multiple substances in deaths over time (primarily a combination of opioids and stimulants).[2] In our second report of this series, we found a high prevalence of healthcare interactions for SUD diagnoses and non-fatal substance-related toxicities prior to a substance-related death, representing potential missed opportunities to support people at risk of substance-related harms.[6] Moreover, low engagement with treatment for SUD prior to death—including OAT and other pharmacotherapies—further highlighted barriers to access and need for improved transition of care and connection to treatment.[6] Previous research[3] that has described patterns of recent healthcare use prior to substance-related harms in Ontario have largely been restricted to toxicity deaths involving opioids, with 1 in 4 (24.2%) people interacting with the healthcare system in the week prior to a fatal opioid-related toxicity.[3] With growing signals of increasing use of multiple substances and related harms, there is need to expand this scope using enhanced data on substance-related toxicity deaths.

In this final report in the series, we build on earlier analyses with a broader focus on people who died of any substance-related toxicity in Ontario, to understand patterns of health service utilization, healthcare needs, and clinical comorbidities in this population. This will help provide insight into where and why individuals present to healthcare settings prior to death, with the goal of identifying gaps in access to care and supportive services for people who use substances. We used updated linked data on alcohol, stimulant, benzodiazepine, and opioid-related toxicity deaths in Ontario between January 2018 and December 2022 to describe: all-cause healthcare encounters (including emergency department [ED] visits, hospitalizations, and outpatient visits), mental health diagnoses, and health conditions preceding substance-related toxicity deaths. We also reported updated trends and characteristics of people who died of a substance-related toxicity death from our first report up to the end of December 2022.

Methods

Setting

We conducted a descriptive cross-sectional study to describe trends, characteristics, and patterns of health service utilization among people who died from an accidental alcohol, stimulant, benzodiazepine, and/or opioid-related toxicity between January 1, 2018, and December 31, 2022. We included acute substance toxicity deaths that were confirmed to be accidental (excluding intentional or undetermined) and resulted from the direct contribution of a consumed substance (i.e., alcohol, stimulant, benzodiazepine, and/or opioid), regardless of how the substance was obtained.

Data Sources

We obtained all data from ICES, 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. We captured substance-related toxicity deaths using a combination of the Alcohol, Stimulant, and Benzodiazepine-Related Mortality Database and the Drug and Drug/Alcohol Related Death Database (DDARD) which contains records from investigations of opioid-related toxicity deaths completed by the Office of the Chief Coroner/Ontario Forensic Pathology Service. Both datasets allowed for the broad assessment of all alcohol, stimulant, benzodiazepine, and/or opioid-related toxicity deaths in Ontario, Canada. Details on methods used to combine these databases have been summarized in our previous report.[2] Substance-related toxicity deaths reflect those where any of the 4 substances were determined to be direct contributors to death.

To capture socio-demographic characteristics and population denominators, we used the Registered Persons Database, a registry of all Ontario residents registered under the publicly funded Ontario Health Insurance Plan (OHIP). We obtained information on neighborhood income quintile and location of residence (urban, rural) using Statistics Canada's geographical areas and the Postal Code Conversion file.

For information on outpatient visits, we used the OHIP Claims Database and the Community Health Centre (CHC). To ascertain ED visits, acute hospital admissions, and mental health-related hospital admissions, we used the Canadian Institute for Health Information's National Ambulatory Care Reporting System (NACRS), Discharge Abstract Database (DAD), and Ontario Mental Health Reporting System (OMHRS), respectively. We used the Ontario Drug Benefit (ODB) claims database to examine history of publicly-funded direct-acting antiviral (DAA) dispensing for treatment of hepatitis C. Finally, to capture prior diagnosis of HIV, we used the Ontario HIV Database.

These datasets were linked using unique encoded identifiers and analyzed at ICES. We included all deaths when reporting overall numbers and trends (i.e., for analyses relying only on the combined Alcohol, Stimulant, and Benzodiazepine-Related Mortality Database and DDARD), but excluded individuals without valid patient identifiers for subsequent analyses where linkage to the ICES data repository was necessary. In accordance with ICES' privacy and confidentiality policy, we suppressed small cells (N<6) and provided ranges as needed to prevent residual disclosure of small cells. 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

We reported monthly trends in substance-related toxicity deaths stratified by the number of substance classes (1, 2, ≥3) that directly contributed to death (i.e., based on the 4 broad substance groupings). We described the number and percentage of overall substance-related toxicity deaths directly attributable to alcohol, stimulants, benzodiazepines, and opioids separately (i.e., classes are not mutually exclusive) over the study period. Moreover, we identified all substance(s) reported as direct contributors to death in post-mortem toxicology, created mutually exclusive groups representing whether death was caused by a single substance class or more than one substance class, and reported the number and percentage of overall substance-related toxicity deaths in each of these categories.

We described demographic characteristics for people who died of a substance-related toxicity including: age (median and interquartile range [IQR]), age group (<24, 25-44, 45-64, ≥65 years), sex (female, male), neighborhood income quintile, location of residence (urban/rural, Northern/Southern).

To examine healthcare interactions prior to death, we identified outpatient visits (all-cause and primary care), ED visits, acute inpatient hospitalizations, and mental health-related hospitalizations in the 7 and 30 days prior to, and including, the date of death (Appendix, Table A1). We also identified hospital visits for a non-fatal substance-related toxicity over the same periods. Among individuals with a hospital encounter, we reported the prevalence of people leaving the hospital before medically advised (BMA) (i.e., referring to instances where patients left the hospital before discharge was recommended by a healthcare professional). To ascertain discharges BMA from inpatient hospital settings, we captured records with discharge disposition codes from DAD indicating where patients left BMA, were absent without leave, or did not return from pass or leave. Whereas within ED settings, we captured records with discharge disposition codes from NACRS indicating where patients left BMA, or departed from an ED following registration (regardless of whether they were seen, evaluated, or treated by a health service provider). We also reported the prevalence of healthcare encounters with mental health-related diagnosis in the 5 years before death, including hospital visits, CHC visits, and other outpatient visits. For outpatient visits captured by OHIP, we examined types of mental health disorder diagnoses categorized as: psychotic, mood and anxiety, substance use, behavioral and neuro-developmental, and other mental health-related disorders (Appendix, Table A2). Finally, we examined prior health conditions, including hospital admissions for infective endocarditis and any invasive infections in the past 180 days, hepatitis C diagnosis in the past 5 years, and any prior HIV diagnosis (Appendix, Table A3). Note that hospitalizations or ED visits that ended in death were not captured in these analyses to avoid reporting on events that were associated with substance-related toxicity death.

Analysis

We reported monthly population-adjusted rates (per 100,000 population) of substance-related toxicity deaths in Ontario from January 1, 2018 to December 31, 2022. We reported demographic characteristics of people who died of substance-related toxicity over the entire study and also compared the first 12 months (January 1, 2018 to December 31, 2018) and the last 12 months of the study (January 1, 2022 to December 31, 2022). We compared patterns of health service utilization by sex (female vs. male), contributing substance(s) and across the first and last year of the study period. We used descriptive statistics to summarize trends, demographic characteristics and prior health service utilization. We used the Kruskal-Wallis test to compare medians and chi-square test to examine whether differences in proportions between groups were meaningful (using a significance level of $p \leq 0.05$).

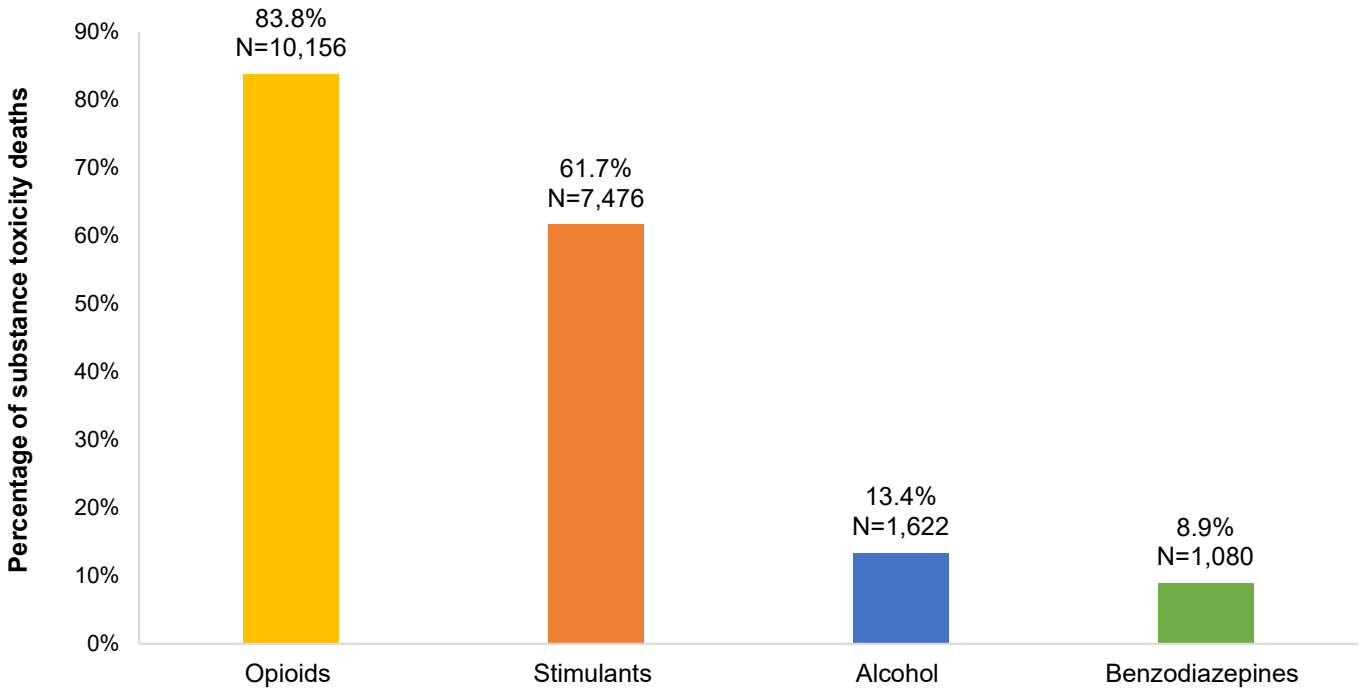
Key Findings

NOTES FOR ALL ANALYSES

- All analyses were restricted to accidental deaths.
- All analyses include substance-related toxicity deaths where any of alcohol, stimulants, benzodiazepines, and/or opioid were direct contributors to death; however, other substances detected in post-mortem (but not direct contributors) may be present.
- Number of substances (i.e., 1, 2, ≥3) directly contributing to death are based on the 4 broad substance classes (i.e., alcohol, stimulant, benzodiazepine, or opioid).
- Red asterisk (*) indicates statistically significant (stat. sig) difference between strata (2018 vs. 2022 or males vs. females, as relevant) ($p \leq 0.05$).

Substance-Related Toxicity Deaths

Figure 1. Proportion of substance-related toxicity deaths directly attributable to specific substance classes† (2018 to 2022)

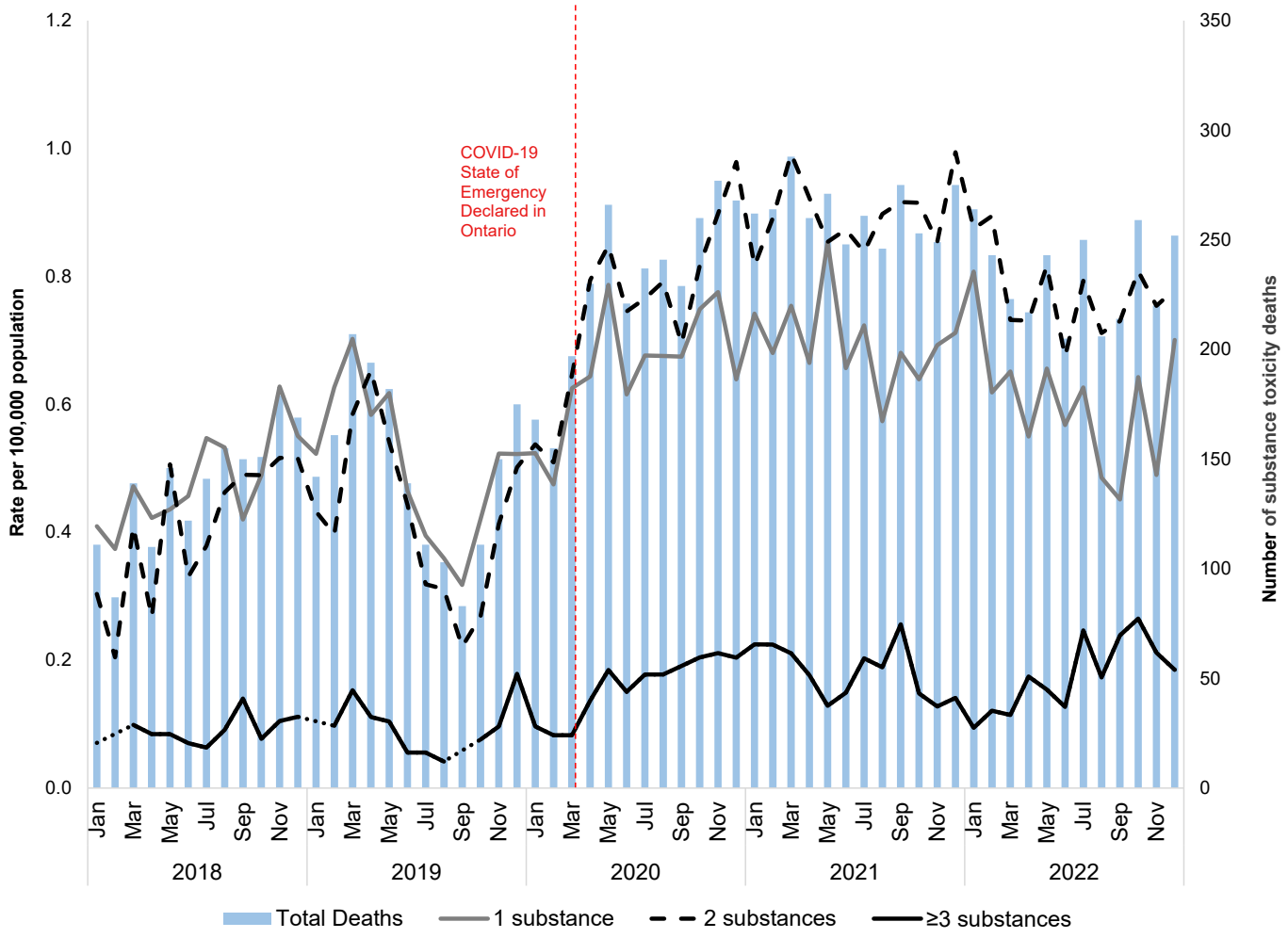


NOTE

†Substance toxicity deaths may overlap (i.e., belong to more than one substance grouping).

Between 2018 and 2022, 12,115 accidental substance-related toxicity deaths were directly attributed to alcohol, stimulants, benzodiazepines, and/or opioids across Ontario. Among these deaths, 83.8% involved opioids (N=10,156), 61.7% involved stimulants (N=7,476), 13.4% involved alcohol (N=1,622) and 8.9% involved benzodiazepines (N=1,080). These findings were consistent with our previous analysis of this data.[2]

Figure 2. Toxicity death rates stratified by number of substance classes directly involved (2018 to 2022)



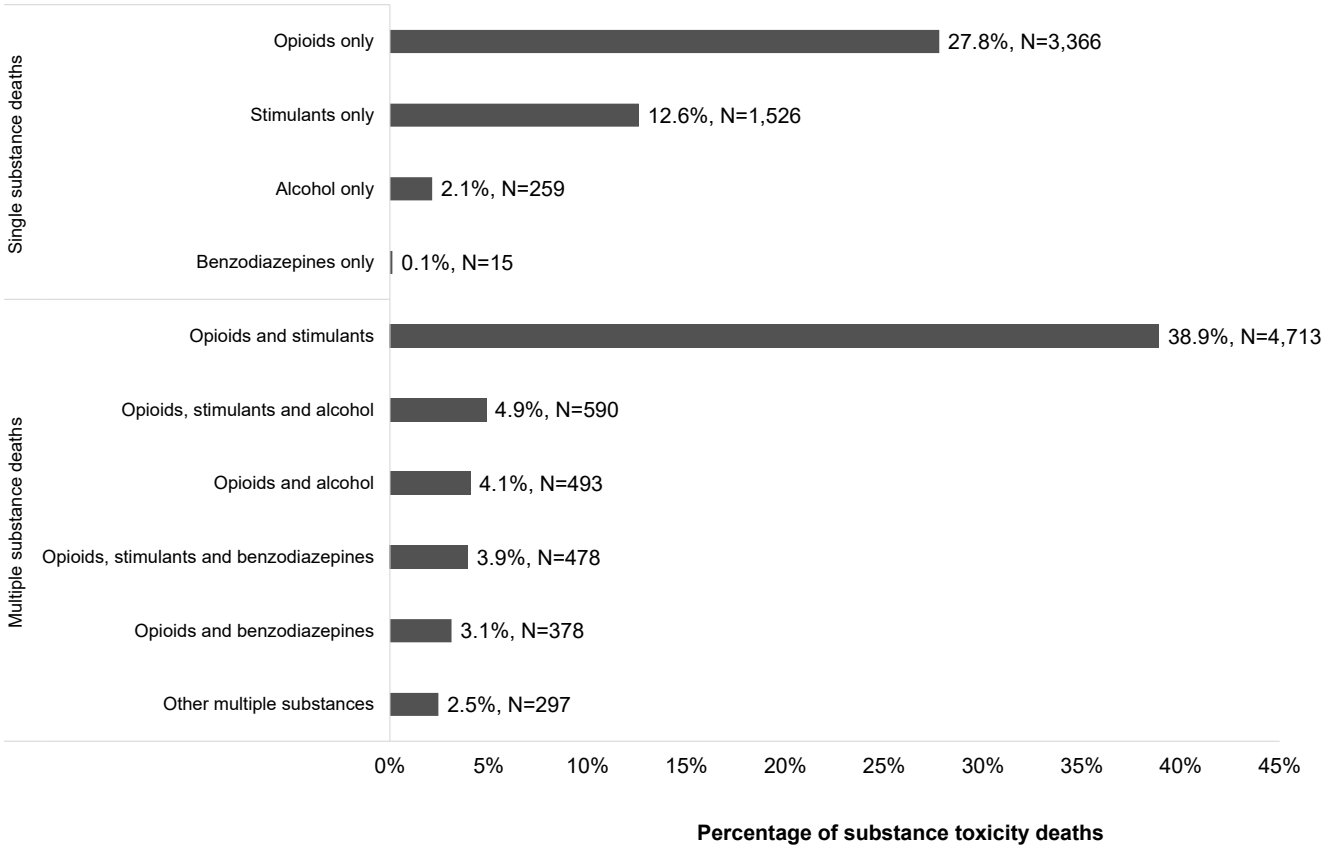
NOTE

Dotted lines for 3 or more substances indicate cell suppression to preserve anonymity (i.e., counts <6).

Over the study period, the monthly rate of accidental substance-related toxicity deaths rose from 0.78 per 100,000 population (N=111) in January 2018 to 1.67 per 100,000 (N=252) in December 2022. The monthly rate of deaths increased across all strata, with deaths involving one substance increasing by 75% (N=58 to 106, 0.4 to 0.7 per 100,000 population), two substances by 167% (N=43 to 118, 0.3 to 0.8 per 100,000 population) and three or more substances by 186% (N=10 to 28, 0.07 to 0.2 per 100,000 population).

Overall, there was a similar trend in deaths involving both one and two substances, with death rates beginning to plateau in late 2020 and then declining throughout 2022. In contrast, the rate of deaths involving at least three substances began to rise in early 2022 (coinciding with downward trend in deaths involving one and two substances) and continued to grow throughout 2022.

Figure 3. Proportion of substance-related toxicity deaths by contributing substance(s) (2018 to 2022)



NOTE

All categories are mutually exclusive.

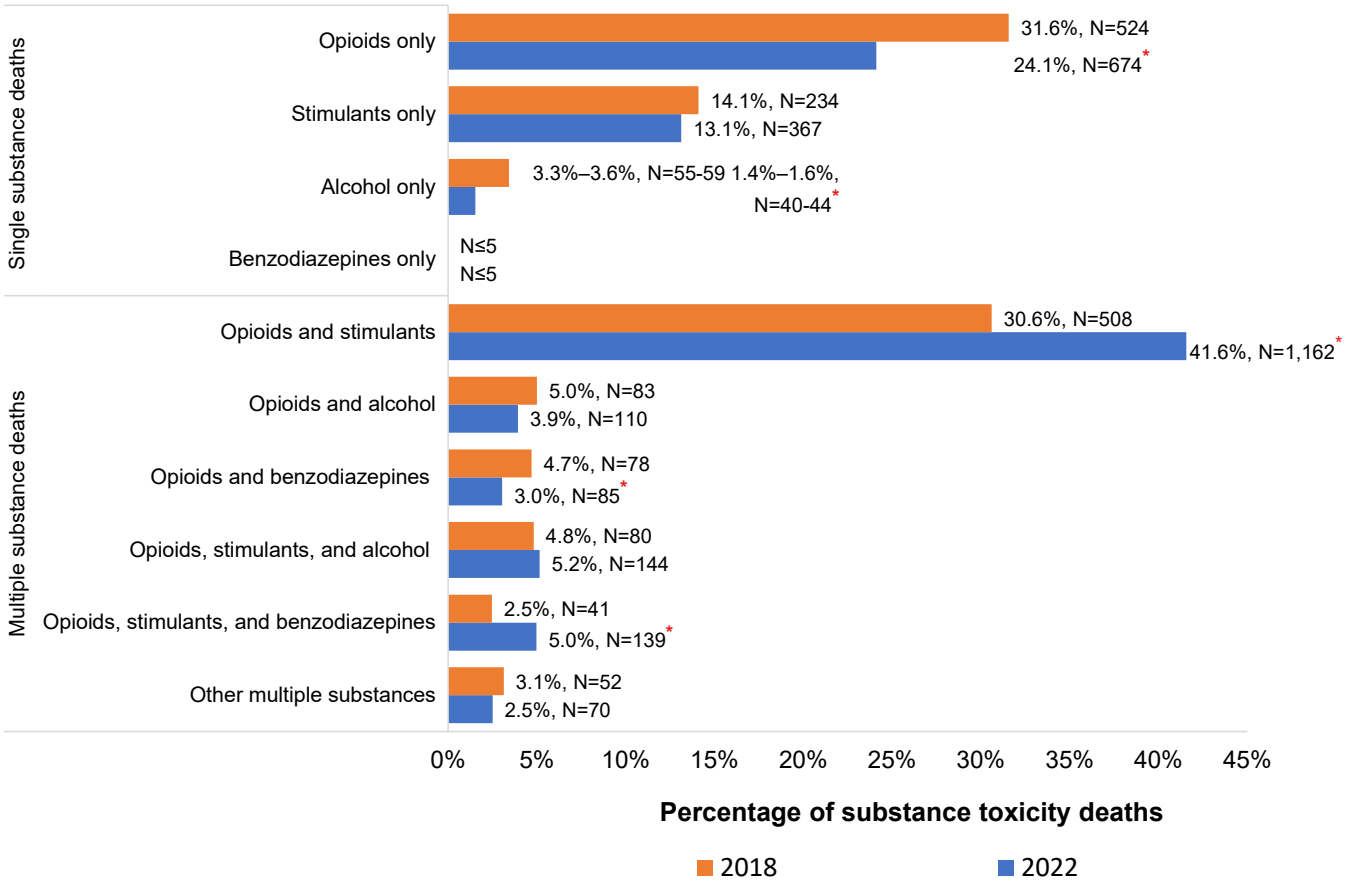
When stratifying across contributing substance(s) in toxicity deaths, the most common occurrence was deaths attributed to opioids and stimulants in combination, which accounted for almost 40% of all substance-related toxicity deaths (N=4,713; 38.9%). This was followed by deaths involving only opioids (N=3,366; 27.8%) and deaths involving only stimulants (N=1,526; 12.6%). Few deaths involved alcohol (N=259; 2.1%) or benzodiazepines (N=15; 0.1%) in the absence of other substances, with these substances more commonly contributing to death in combination with opioids and/or stimulants. Compared to our initial analysis of this data, opioids and stimulants in combination remained the most prevalent substance combination leading to death.[2]

Comparison of the first and last 12 months of study

First 12 Months
January 1, 2018 – December 31, 2018
N=1,660

Last 12 Months
January 1, 2022- December 31, 2022
N=2,796

Figure 4. Proportion of substance-related toxicity deaths by contributing substance(s) (2018 vs. 2022)



NOTE

All categories are mutually exclusive.

Overall, the proportion of deaths attributable to a single substance class declined across all four substance categories; with the absolute number of deaths directly attributed to alcohol alone declining significantly ($p<0.001$), and the number of deaths attributed to benzodiazepines alone being rare throughout the study period (N≤5 in both 2018 and 2022). Opioids and stimulants, either alone or in combination, directly contributed to majority of substance-related toxicity deaths both in 2018 (76.3%) and 2022 (78.8%). Importantly, the absolute number of toxicity deaths attributed to the combination of opioids and stimulants more than doubled in 2022 (N=1,162) vs. 2018 (N=508). Furthermore, the absolute number of substance-related toxicity deaths attributed to a combination substance class increased across all combinations. The proportion of deaths involving a combination of opioids, stimulants, and benzodiazepines, doubled between 2018 and 2022 (from 2.5% to 5.0%; $p<0.01$), whereas the proportion of substance-related toxicity deaths attributed to benzodiazepines in combination with opioids significantly declined over the same time period (from 4.7% to 3.0%; $p<0.01$).

Demographic Characteristics

All remaining analyses restricted to 11,496 individuals (94.9% of all accidental substance toxicity deaths) who were linked to healthcare data.

Table 1. Descriptive characteristics of substance-related toxicity deaths, overall (2018 to 2022) and during the first and last year of the study period

	Overall (N=11,496)	First vs. last year of the study period		
		2018 (N=1,581)	2022 (N=2,672)	Stat. sig.
Age, median (IQR)	41 (32-52)	41 (31-52)	42 (33-53)	*
Age category (N, %)				
0 to 24	813 (7.1%)	119 (7.5%)	167 (6.3%)	
25 to 44	5,907 (51.4%)	794 (50.2%)	1,332 (49.9%)	
45 to 64	4,379 (38.1%)	609 (38.5%)	1,065 (39.9%)	
65+	397 (3.5%)	59 (3.7%)	108 (4.0%)	
Sex (N, %)				
Female	2,879 (25.0%)	429 (27.1%)	637 (23.8%)	*
Male	8,617 (75.0%)	1,152 (72.9%)	2,035 (76.2%)	
Location of residence (N, %)				
Urban	10,256 (89.2%)	1,417 (89.6%)	2,364 (88.5%)	
Rural	1,064 (9.3%)	139 (8.8%)	263 (9.8%)	
Unknown	176 (1.5%)	25 (1.6%)	45 (1.7%)	
Northern/Southern Ontario (N, %)				
Southern Ontario	9,973 (86.8%)	1,411 (89.2%)	2,303 (86.2%)	*
Northern Ontario	1,523 (13.2%)	170 (10.8%)	369 (13.8%)	
Neighbourhood income quintile (N, %)				
1 (lowest)	4,793 (41.7%)	610 (38.6%)	1,149 (43.0%)	
2	2,468 (21.5%)	340 (21.5%)	541 (20.2%)	
3	1,757 (15.3%)	270 (17.1%)	400 (15.0%)	
4	1,260 (11.0%)	187 (11.8%)	293 (11.0%)	
5 (highest)	1,040 (9.0%)	148 (9.4%)	244 (9.1%)	
Unknown	178 (1.5%)	26 (1.6%)	45 (1.7%)	
Number of substance classes involved in death (N, %)				
1	4,890 (42.5%)	767 (48.5%)	1,049 (39.3%)	*
2	5,459 (47.5%)	673 (42.6%)	1,323 (49.5%)	
≥3	1,147 (10.0%)	141 (8.9%)	300 (11.2%)	

Overall, the majority of substance-related toxicity deaths occurred among people aged 25 to 44 years (51.4%), and men (75.0%), with the majority of people residing in urban locations (89.2%), Southern Ontario (86.8%), and neighbourhoods in the lowest two income quintiles (63.2%). Between 2018 and 2022, the median age at the time of death increased slightly from 41 to 42 years (p=0.01), the burden of substance-related toxicity deaths among males increased significantly (72.9% vs. 76.2%; p=0.02), and the proportion of deaths occurring among people residing in Northern Ontario increased (10.8% vs. 13.8%; p=0.004). There were also considerable changes in the number of substance classes contributing to substance-related toxicity deaths over time (p<0.001). In 2018, 48.5% of deaths were attributed to a single substance, which declined to 39.3% in 2022. At the same time, the proportion of deaths attributed to two substances increased from 42.6% in 2018 to 49.5% in 2022, with the absolute number of deaths nearly doubling (from N=673 to N=1,323). Similarly, the proportion of deaths attributed to three or more substances increased between 2018 and 2022 (from 8.9% to 11.2%) and absolute number of deaths doubled (from N=141 to N=300).

Healthcare Interactions Prior to Death

Before Medically Advised (BMA) discharges reflect instances where patients left the hospital before discharge was recommended by a healthcare professional. It is important to note that systemic factors within the healthcare system—such as long wait times, experiences of stigma, absence of embedded safe spaces for substance use, and inadequate management of health needs (including pain/withdrawal symptoms)—contribute to people who use substances leaving the hospital before receiving or completing care.

Table 2. Recent healthcare encounters in the 7 and 30 days prior to substance-related toxicity death (2018 to 2022)

	Substance-related toxicity deaths (N=11,496)	
	Past 7 days	Past 30 days
Any healthcare encounter†	3,417 (29.7%)	6,402 (55.7%)
Outpatient visits§	2,318 (20.2%)	5,020 (43.7%)
Primary care outpatient visit	998 (8.7%)	3,028 (26.3%)
Hospital encounters‡	1,624 (14.1%)	3,097 (26.9%)
ED visit	1,580 (13.7%)	3,055 (26.6%)
Left ED before medically advised*	169 (10.7%)	520 (17.0%)
Inpatient hospitalization (acute)	210 (1.8%)	586 (5.1%)
Left hospital before medically advised*	47 (22.4%)	142 (24.2%)
Mental health hospitalization	71 (0.6%)	192 (1.7%)
Hospital visits for non-fatal substance toxicity	451 (3.9%)	799 (7.0%)

NOTE

- †Includes outpatient visits (including primary care), ED visits, or hospital admissions. Excludes any inpatient hospitalization or ED visit that resulted in death.
- §Includes visits with any provider type (including physicians and nurse practitioners) in an outpatient setting.
- ‡Includes ED visits, inpatient hospitalizations (acute), mental health hospitalizations.
- *Reported as percentage of hospital visits with self-directed discharges.

Among people who died of a substance-related toxicity between 2018 and 2022, nearly one-third (29.7%) had a healthcare encounter in the 7 days prior to death, and over half (55.7%) interacted with the healthcare system in the 30 days before death. Approximately 1 in 5 people (20.2%; N=2,318) received healthcare in an outpatient setting in the prior week, with 8.7% of people specifically visiting a primary care provider in this time (N=998). Hospital encounters in the week prior to substance-related toxicity death mostly occurred within ED settings (13.7%) with the prevalence of inpatient hospitalization for either an acute stay (1.8%) or mental health related visit (0.6%) remaining lower in comparison. Approximately 1 in 10 (11%) ED visits and one-fourth (22.4%) of inpatient hospitalizations in the week prior to death resulted in the individual leaving BMA. Moreover, when looking back 30 days before death, the prevalence of people leaving BMA increased to 17.0% within ED settings, whereas this prevalence remained relatively unchanged within inpatient hospital settings (24.2%).

Approximately 4% (N=451) of people visited a hospital for a non-fatal toxicity in the 7 days prior to death. This proportion slightly increased when looking at the 30 days before death, with just under 1 in 14 people (7.0%; N=799) having a hospital visit for a non-fatal substance-related toxicity in the prior month.

Table 3. Recent healthcare encounters in the 7 days prior to substance-related toxicity death, by sex (2018 to 2022)

	Overall		
	Females (N=2,879)	Males (N=8,617)	Stat. sig.
Any healthcare encounter[†] (past 7 days) (N, %)	998 (34.7%)	2,419 (28.1%)	*
Outpatient visits[§]	686 (23.8%)	1,632 (18.9%)	*
Primary care outpatient visit	311 (10.8%)	687 (8.0%)	*
Hospital encounters[‡]	468 (16.3%)	1,156 (13.4%)	*
ED visit	456 (15.8%)	1,124 (13.0%)	*
Left ED before medically advised*	29 (6.4%)	140 (12.5%)	*
Inpatient hospitalization (acute)	69 (2.4%)	141 (1.6%)	*
Left hospital before medically advised*	13 (18.8%)	34 (24.1%)	
Mental health hospitalization	23 (0.8%)	48 (0.6%)	
Hospital visits for non-fatal substance toxicity (past 7 days) (N, %)	120 (4.2%)	331 (3.8%)	

NOTE

- [†]Includes outpatient visits (including primary care), ED visits, or hospital admissions. Excludes any inpatient hospitalization or ED visit that resulted in death.
- [§]Includes visits with any provider type (including physicians and nurse practitioners) in an outpatient setting.
- [‡]Includes ED visits, inpatient hospitalizations (acute), mental health hospitalizations.
- *Reported as percentage of hospital visits with self-directed discharges.

The prevalence of healthcare encounters in the week prior to substance-related toxicity deaths varied across sex, with a higher overall prevalence of any healthcare encounter among women compared to men (34.7% vs. 28.1%; p<0.001). Specifically, women more commonly engaged with the healthcare system in both outpatient (23.8% vs. 18.9%; p<0.001) and hospital (16.3% vs. 13.4%; p<0.001) settings in the week before death. Despite more frequent engagement in hospital settings among women relative to men, leaving BMA from ED settings were more prevalent among men compared to women (12.5% vs. 6.4%; p<0.001). While not statistically different from one another, there was a high degree of leaving BMA from inpatient hospital stays among both men (24.1%) and women (18.8%). There were no significant differences in the proportions of mental health-related hospitalizations and hospital-treated non-fatal substance toxicities in the week before a substance-related toxicity death between men and women.

Among people who died of a substance-related toxicity between 2018 and 2022, nearly one-third (29.7%) had a healthcare encounter in the 7 days prior to death, and over half (55.7%) interacted with the healthcare system in the 30 days before death. Approximately 1 in 5 people (20.2%; N=2,318) received healthcare in an outpatient setting in the prior week, with 8.7% of people specifically visiting a primary care provider in this time (N=998). Hospital encounters in the week prior to substance-related toxicity death mostly occurred within ED settings (13.7%) with the prevalence of inpatient hospitalization for either an acute stay (1.8%) or mental health related visit (0.6%) remaining lower in comparison. Approximately 1 in 10 (11%) ED visits and one-fourth (22.4%) of inpatient hospitalizations in the week prior to death resulted in the individual leaving BMA. Moreover, when looking back 30 days before death, the prevalence of people leaving BMA increased to 17.0% within ED settings, whereas this prevalence remained relatively unchanged within inpatient hospital settings (24.2%).

Table 4. Recent healthcare encounters in the 7 days prior to substance-related toxicity death, during the first and last year of the study period

	First vs. last year of the study period		
	2018 (N=1,581)	2022 (N=2,672)	Stat. sig.
Any healthcare encounter† (past 7 days) (N, %)	514 (32.5%)	778 (29.1%)	*
Outpatient visits§	369 (23.3%)	520 (19.5%)	*
Primary care outpatient visit	164 (10.4%)	228 (8.5%)	*
Hospital encounters‡	238 (15.1%)	384 (14.4%)	
ED visit	230 (14.5%)	369 (13.8%)	
Left ED before medically advised*	15 (6.5%)	53 (14.4%)	*
Inpatient hospitalization (acute)	26 (1.6%)	46 (1.7%)	
Left hospital before medically advised*	7 (26.9%)	13 (28.3%)	
Mental health hospitalization	13 (0.8%)	23 (0.9%)	
Hospital visits for non-fatal substance toxicity (past 7 days) (N, %)	64 (4.0%)	105 (3.9%)	

NOTE

- †Includes outpatient visits (including primary care), ED visits, or hospital admissions. Excludes any inpatient hospitalization or ED visit that resulted in death.
- §Includes visits with any provider type (including physicians and nurse practitioners) in an outpatient setting.
- ‡Includes ED visits, inpatient hospitalizations (acute), mental health hospitalizations.
- *Reported as percentage of hospital visits with self-directed discharges.

Overall, the prevalence of any healthcare encounter in the week prior to death decreased over time from 32.5% in 2018 to 29.1% in 2022 (p=0.02). This was driven by significant decreases in interactions in outpatient settings (from 23.3% to 19.5%; p=0.003), including primary care outpatient settings (from 10.4% to 8.5%; p=0.05). While there was no significant change in the prevalence of ED visits, inpatient hospitalizations, or mental health hospitalizations in the week before death over time, the proportion of people who left BMA from an ED setting rose from 6.5% to 14.4% (p=0.003), with absolute numbers more than tripling (from N=15 to N=53).

Table 5. Recent healthcare encounters in the 7 days prior to substance-related toxicity death by contributing substance(s) (2018 to 2022)

Contributing substances	N	Any recent healthcare encounter[†]
Opioid only deaths	3,156	1,069 (33.9%)
Stimulant only deaths	1,473	433 (29.4%)
Alcohol only deaths	247	66 (26.7%)
Benzodiazepine only deaths	14	6 (42.9%)
Opioids and stimulants deaths	4,479	1,229 (27.4%)
Opioids and alcohol deaths	469	125 (26.7%)
Opioids and benzodiazepines deaths	368	145 (39.4%)
Opioids, stimulants, and alcohol deaths	555	98 (17.7%)
Opioids, stimulants, and benzodiazepines deaths	453	153 (33.8%)
Other polysubstance deaths	282	93 (33.0%)

NOTE

[†]Includes outpatient visits (including primary care), ED visits, or hospital admissions. Excludes any inpatient hospitalization or ED visit that resulted in death.

Across all contributing substance(s), over 1 in 4 people who died of a substance-related toxicity death had interacted with the healthcare system in the week before death (26.7%–42.9%) with the exception of deaths involving a combination of opioids, stimulants, and alcohol, where recent healthcare interactions were slightly lower (17.7%). Deaths where benzodiazepines were involved (either alone or in combination with other substances) generally had the highest prevalence of recent healthcare encounters (33.8%– 42.9%). The prevalence of healthcare encounters in the week prior to death was also higher among deaths involving opioids alone (33.9%; N=1,069).

Table 6. Mental health-related encounters and health conditions prior to substance-related toxicity death, overall (2018 to 2022) and during the first and last year of the study period

	Overall (N=11,496)	First vs. last year of the study period		
		2018 (N=1,581)	2022 (N=2,672)	Stat. sig.
Any health encounters for mental health diagnosis (prior 5 years)	9,964 (86.7%)	1,350 (85.4%)	2,282 (85.4%)	
ED visit or hospitalization	6,539 (56.9%)	843 (53.3%)	1,550 (58.0%)	*
Any outpatient visit	9,465 (82.3%)	1,282 (81.1%)	2,166 (81.1%)	
CHC visit	236 (2.1%)	26 (1.6%)	60 (2.2%)	
Other outpatient visit†	9,445 (82.2%)	1,279 (80.9%)	2,162 (80.9%)	
Psychotic disorders	1,634 (14.2%)	175 (11.1%)	458 (17.1%)	*
Mood and anxiety disorders	7,365 (64.1%)	1,045 (66.1%)	1,674 (62.6%)	*
Substance use disorders	6,767 (58.9%)	864 (54.6%)	1,552 (58.1%)	*
Non-psychotic disorders	824 (7.2%)	104 (6.6%)	218 (8.2%)	
Other mental health-related disorders	2,940 (25.6%)	404 (25.6%)	679 (25.4%)	
Health Conditions				
Recent hospitalization for infective endocarditis (prior 180 days)	45 (0.4%)	6 (0.4%)	8 (0.3%)	
Recent hospitalization for any invasive infection (prior 180 days)	261 (2.3%)	35 (2.2%)	59 (2.2%)	
Hepatitis C (prior 5 years)	1,161 (10.1%)	161 (10.2%)	273 (10.2%)	
Diagnosed with HIV prior to death	219 (1.9%)	28 (1.8%)	39 (1.5%)	

NOTE

†Includes non-CHC visits captured in OHIP data.

Almost 9 in 10 people (86.7%) who died of a substance-related toxicity over the study period had engaged with the healthcare system for a mental-health related diagnosis in the 5 years prior to death, with diagnoses in both outpatient settings (82.3%) and hospital settings (ED or inpatient) (56.9%) being common. Outpatient mental health diagnoses for mood and anxiety disorders (64.1%) and SUD (58.9%) were relatively common. When comparing the first and last year of the study period, the prevalence of healthcare encounters for mental health diagnoses did not change (85.4% [N=1,350] vs. 85.4% [N=2,282]; p=0.99). However, there was a significant increase in the proportion of people with mental health diagnoses made in hospital (from 53.3% to 58.0%; p=0.003), and those with outpatient diagnoses of psychotic disorders (from 11.1% to 17.1%; p<0.001) and SUD (from 54.6% to 58.1%; p=0.03) in 2022 relative to 2018. Notably, in 2018, 66.1% of people who died of a substance-related toxicity had an outpatient diagnosis of a mood and anxiety disorder, which declined slightly to 62.6% by 2022 (p=0.02).

About 1 in 10 people who died of a substance-related toxicity had a hepatitis C diagnosis in the 5 years prior to death. The prevalence of infective endocarditis, invasive infections, and HIV were relatively low, with only 0.4%, 2.3%, and 1.9% of people having a prior diagnosis of these health conditions, respectively. There were no significant changes in the prevalence of the aforementioned health conditions over time.

Table 7. Mental health-related encounters prior to substance-related toxicity death by contributing substance(s) (2018 to 2022)

Contributing substances	N	Any health encounter for mental health diagnosis (prior 5 years)
Opioid only deaths	3,156	2,834 (89.8%)
Stimulant only deaths	1,473	1,139 (77.3%)
Alcohol only deaths	247	201 (81.4%)
Benzodiazepine only deaths	14	13 (92.9%)
Opioids and stimulants deaths	4,479	3,943(88.0%)
Opioids and alcohol deaths	469	388 (82.7%)
Opioids and benzodiazepines deaths	368	333(90.5%)
Opioids, stimulants, and alcohol deaths	555	457 (82.3%)
Opioids, stimulants, and benzodiazepines deaths	453	407(89.8%)
Other polysubstance deaths	282	249 (88.3%)

Over three-quarters of people who died of a substance-related toxicity had a healthcare encounter for a mental health-related diagnosis in the 5 years prior to death across all contributing substance(s) (77.3%–92.9%). The prevalence of prior mental health-related encounters was the highest among deaths involving benzodiazepines only (92.9%), opioids and benzodiazepines (90.5%), followed by those involving opioids only (89.8%) and a combination of opioids, stimulants, and benzodiazepines (89.8%). Notably, high prevalence of mental health-related encounters among deaths involving benzodiazepines (either alone or in combination with other substances) is in line with high degree of pharmaceutical benzodiazepine dispensing prior to these deaths.[6] Deaths attributed to stimulants only had the lowest prevalence of prior healthcare encounters for mental health-related diagnoses (77.3%) relative to other contributing substance(s).

Limitations

1. We restricted our analyses of coronial records to confirmed substance-related toxicity deaths involving alcohol, stimulants, benzodiazepines, and/or opioids. Therefore, suspected deaths that may later be confirmed to be substance-related are not included in our study, although we expect that differences in numbers are small.
2. We only included acute substance-related toxicity deaths in our analyses, therefore we did not capture secondary fatal outcomes such as chronic conditions (e.g., alcohol-related cirrhosis) or other acute injuries (e.g., vehicle collision resulting from impaired driving) where substance use played a contributory role to death.
3. Involvement of other substances in the drug supply, such as other sedatives, xylazine, and psychedelics, was not captured in our analyses.
4. It is important to note that we were not able to determine the reasons for leaving BMA from hospital settings in our analyses.
5. Finally, due to data limitations, we were not able to describe health service utilization patterns across race/ethnicity, gender identity, or sexual orientation. Moreover, we only capture data on sex in our analyses, which may not reflect self-identified gender.
6. We rely solely on quantitative data in this report, therefore next steps should involve engagement of people who use substances and front-line workers to further contextualize findings and help inform future directions.

Discussion

Between 2018 and 2022, we observed a total of 12,115 confirmed accidental substance-related toxicity deaths (involving any of alcohol, stimulants, benzodiazepines, and/or opioids) in Ontario, corresponding to six substance-related deaths every day over this period. Similar to findings in our previous reports,[2,6] most substance-related toxicity deaths directly involved a combination of opioids and stimulants without the involvement of another substance (38.9%), followed by opioids only (27.8%) and stimulants only (12.6%). Moreover, we found rising rates of substance-related toxicity deaths attributed to 3 or more substance classes in 2022, reaching 11% of all deaths, further highlighting the evolving dynamics of toxicity deaths involving multiple substances over time. As noted in our previous report, the unregulated drug supply (driven primarily by non-pharmaceutical fentanyl and stimulants) is responsible for the vast majority of these preventable deaths.[2] In this current report, we found a high prevalence of concurrent mental health-related diagnoses and recent healthcare interactions where people left before medically advised among substance-related toxicity deaths. This reveals potential missed opportunities to engage this population with timely interventions and supports at critical junctures with the healthcare system.

Evolving Dynamics of Substance-Related Toxicity Deaths

Between 2018 and 2022, there was a 68% increase in the annual number of fatal substance-related toxicities from 1,660 (4.5 deaths per day on average) to 2,796 deaths (8 deaths per day on average). The proportion of deaths involving only one substance declined over this period, with a corresponding increase in deaths involving multiple substances (2 or ≥3 substance classes). Importantly, there was a shift from deaths involving opioids alone making up the highest proportion of substance-related toxicity deaths in 2018 to the combination of opioids and stimulants most commonly contributing to deaths in 2022. The combination of opioids, stimulants, and benzodiazepines also played an increasing role in polysubstance deaths by 2022 (5.0%). Together, this likely reflects increasing toxicity of the unregulated opioid supply, and the synergistic effects of co-use of different substance classes on risk of death. Importantly, the presence of multiple substances complicates overdose response, which has traditionally relied on naloxone administration, as it only reverses the effects of opioids. While naloxone continues to play an important role in overdose response, when it is continuously administered in large doses to unresponsive patients experiencing prolonged toxicities involving both opioids and benzodiazepines, they may experience severe opioid withdrawal which can be accompanied with considerable discomfort and potential harm.[7] Excessive use of naloxone in such instances is ineffective as naloxone has no effect on reversing benzodiazepine-induced sedation. As a result, newer directives profile the need to put people in a recovery position, monitor breathing, avoid giving multiple doses of naloxone when breathing is normal, and continuously monitor people during prolonged sedation.[7] Furthermore, there has been increasing recognition of the use of oxygen for supporting stabilization during substance toxicities to avoid the unnecessary or excessive use of naloxone.[8] However, oxygen has limited accessibility for overdose response in a wide range of settings due to the regulatory requirement for a medical directive and need for specialized training, which is currently restricting its use despite its proven utility within supervised consumption sites.[8,9] Despite changing directives, overdose response remains complicated with increasing volatility of the unregulated drug supply and exposure to multiple substances, as first responders may not know which substances are involved in the toxicity. This introduces challenges to appropriate and adequate overdose response, particularly for responders with less training and experience in this field. Therefore, there is a need to increase awareness and improve training to ensure that rather than focusing on the harms of opioids in isolation, a comprehensive approach to overdose training and response that addresses the shifting dynamics of unregulated substances is adopted.

Previous Interactions in Hospital and Outpatient Settings

Over half (56%) of people who died of a substance-related toxicity had an healthcare encounter in the month before death, and 1 in 7 people (14.1%) had a healthcare contact in a hospital setting in the week before death, representing critical opportunities to support people who use substances prior to fatal toxicity. Specifically, the high prevalence of healthcare contact in ED settings (13.7% in the prior week) further reinforces the need to ensure that hospitals are well-equipped to provide comprehensive assessment, care and linkages to support for people at risk of substance-related harms. Emerging care models such as addictions consult services (ACS) integrate services within hospital care to help support the needs and preferences of people who use substances including: patient-centered compassionate approaches, substance withdrawal and/or pain management, psychosocial supports, and on-demand initiation or continuation of evidence-based pharmacotherapy (as necessary).[10-12] As a part of ACS, patient-tailored discharge planning facilitates transition of care through linkage of patients to outpatient primary care, harm reduction, and community-based treatments and supports. Growing evidence suggests benefits of ACS models for improving substance-use related care for people who use substances through linkage to - or engagement with - SUD treatment post-discharge.[11,13,14] While ACS have been expanding across Ontario hospitals in recent years, there is a clear opportunity to expand as well as improve comprehensiveness of these services across hospitals to better provide care for people who use substances within these settings. Similarly, rapid-access addiction medicine (RAAM) clinics are also an integrated care model that aim to connect people with SUD from different pathways within the healthcare system to low-barrier evidence-based outpatient substance-use care, and subsequently facilitate linkage to primary care for long-term follow up.[15]

Notably, we found that approximately 1 in 12 people received outpatient services from a primary care provider in the week before death. While primary care is uniquely positioned to provide ongoing coordinated care, it is important that primary healthcare providers are equipped with the appropriate knowledge and training, and are properly funded to provide specialized supports for people who use substances in their care. Moreover, people who use substances face continuous barriers to securing, retaining, and accessing primary care.[16,17] Evidence suggests that physicians may be unwilling to accept patients with SUD into their practice due to stigma, complex healthcare needs, discomfort prescribing opioids, and a general sense of being unprepared to treat this population due to lack of specialized training.[18-20] Therefore, efforts for expanded access to primary care are warranted, including standardization of physician training on care for this population, integration of multidisciplinary team-based care, as well as implementation of compensation models that reflect the clinical complexity of people who use substances.[21,22] One model that has shown considerable success is the integration of primary care and harm reduction practices within many CHCs in the province, which frequently engage with people at risk of substance-related harms and provide a comprehensive range of healthcare to this population.

Leaving the Hospital Before Medically Advised

There was a high prevalence of people leaving before medically advised from hospital settings recently before substance-related toxicity death. For example, over the study period, approximately 1 in 10 ED visits in the week prior to death resulted in people leaving BMA, while 1 in 4 inpatient admissions resulted in people leaving BMA over the same time frame. Importantly, proportions of ED visits in the week before death where patients left BMA more than doubled over time (6.5% in 2018 vs. 14.4% in 2022)—coinciding with rising ED wait times across Ontario over this period.[23] Our findings align with previous research from other jurisdictions that have reported a high prevalence of BMA discharges from hospitals among people who use substances.[24] We also observed a higher proportion of ED stays where people left BMA among males (12.5%) relative to women (6.4%) (despite more frequent ED visits among women), which may potentially reflect gender-related differences in healthcare behaviours, but warrants further investigation.[25] Although we were unable to determine reasons cited for leaving BMA in this report, high prevalence of leaving BMA from hospitals among people who use substances likely

reflect the roles of stigma, discrimination, suboptimal management of healthcare needs, poor pain and withdrawal management, in-hospital policies and conditions (including lack of embedded harm reduction services) and worsening wait times during the pandemic.[23,26-28] Particularly, abstinence-only policies that prohibit and punish substance use in hospitals, the absence of safe spaces for substance use while admitted, as well as inadequate pain management and support for continuation of OAT plays an important role, as leaving before recommended discharge might be the only option for people who use substances seeking to prevent or manage withdrawal or cravings. Moreover, long wait times in ED settings can precipitate self-directed discharge as people may leave the hospital while waiting for care to avoid going into substance withdrawal, amidst lack of access to embedded harm reduction services and rapid access to pharmacotherapy for withdrawal management within hospitals. Importantly, evidence shows that people who leave hospital before receiving or completing care are at a heightened risk of poor outcomes, including repeat toxicities, hospital readmissions, and death,[29-31] reinforcing the importance of supporting people who use substances in ED and inpatient settings to ensure prioritization of their health and substance use needs. Taken together, our findings reveals a crucial need for systematic provision of withdrawal and pain management (including appropriate dosing) for people who use substances in these settings. Additionally, ensuring efforts towards non-stigmatizing care and improving embedded harm reduction services (such as supervised consumption sites) within hospital settings is needed to improve outcomes.[26,27] Finally, given disproportionate impacts of substance-related harms among racialized, lower-income, vulnerably housed, and other marginalized populations,[32-36] there is need to ensure equitable access to healthcare for these populations who often experience broader barriers to care.

Concurrent Diagnoses and Integrated Care Models

We found a high degree of concurrent diagnoses among people who died of substance-related toxicity, including mental health and hepatitis C diagnoses. While the prevalence of these diagnoses has not changed considerably over time, our findings suggest the importance of interventions that promote access to a broad range of healthcare services for people who use substances who have concurrent conditions. The integration of wraparound services (e.g., housing and income supports, primary care, and mental health services) into SUD treatment and harm reduction programs is important for addressing the co-occurring health and social needs of people who use substances. Moreover, research has shown the importance of leveraging hepatitis C treatment programs as a means to initiate patients who use substances on SUD treatment, with concurrent OAT with hepatitis C treatment often associated with reduced substance-related harms.[37] Similarly, integrated care models that provide care for SUD and other mental health diagnoses in a standardized manner may confer better outcomes than those that provide SUD treatment in isolation.[38] Particularly, the high prevalence of co-occurring SUD and mental health conditions reveals the importance of better coordination of care across various fields (e.g., primary care, addiction medicine, psychiatry, etc.) for diagnoses and integrated treatment of these dual conditions.[39,40]

Conclusion

This final report builds on the existing reports on substance-related toxicity deaths in this series, finding that substance toxicity death rates continue to grow, in particular those involving multiple substances. This report also highlights the high prevalence of healthcare utilization and healthcare needs among people who died of a substance-related toxicity death in Ontario. With notable proportions of people having recently visited the ED and outpatient settings prior to death, there is a clear need to strengthen and leverage critical junctures within the healthcare system that can provide life-saving interventions and connections to care for people at risk of substance-related harms. Specifically, there is an urgent need for provision of comprehensive substance

use care within the healthcare system as well as improved coordinated care for community-based follow-up. A high frequency of people leaving hospital before medically advised in the week before substance toxicity death reveals opportunities for enhanced healthcare that prioritizes pain and withdrawal management needs as well as compassionate, harm reduction-centered hospital care, to improve engagement for this population. Moreover, improving access to a broad range of health and social services, as well as treatment models within primary care that integrate support for concurrent diagnoses, are needed to address health needs among people who use substances. Finally, it is imperative that the needs and preferences of people who use substances are centred in policies and interventions regarding their health and substance use care.

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**.

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

Table A1. Health Encounters

Type of Encounter/ Condition	Criteria	Data Source	Codes
Any healthcare encounters include:			
Any 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
Outpatient primary care	Outpatient primary care visits were defined as either of the following: • Any visit to a community health centre with a physician (i.e. General Practitioner) or nurse practitioner • A visit outside of a community health centre with a physician practicing in family medicine, pediatrics, or community medicine, or to a nurse practitioner, in which billing codes related to primary care were submitted. Visits must have occurred in an office, home care, virtual, or longterm care setting	OHIP Claims Database, CHC	**OHIP feecodes:** A001, A002, A003, A007, A903, E075, G212, G271, G372, G373, G365, G538, G539, G590, G591, K005, K013, K017, P004, K130, K131, K132, K030, K080, K081, K082, A261, A268, K267, K269
Acute inpatient 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. 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)	NACRS	N/A
Mental health-related hospital admission	Any admission to an adult-designated (i.e., people 18 years of age or older) mental health bed in a hospital	OMHRS	N/A
Opioid toxicity-related emergency department visits and hospitalizations	Emergency department visit or hospital admission for opioid-related toxicity.	NACRS, DAD	**ICD-10 diagnosis codes:** T40.0, T40.1, T40.2, T40.3, T40.4, T40.6

DAD: Discharge Abstract Database; NACRS: National Ambulatory Care Reporting System;
OHIP: Ontario Health Insurance Plan; CHC: Community Health Centre; OMHRS: Ontario Mental Health Reporting System.

Table A2. 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 5 years prior to death			
Any visit with a diagnosis code for **psychotic disorders**	OHIP Claims Database	OHIP diagnosis codes: 295, 297, 298	
Any visit with a diagnosis code for **mood and anxiety disorders**	OHIP Claims Database	OHIP diagnosis codes: 296, 300, 311	
Any visit with a diagnosis code for **substance use disorders**	OHIP Claims Database	OHIP diagnosis codes: 291, 292, 303, 304	
Any visit with a diagnosis code for **behavioural and neuro-developmental disorders**	OHIP Claims Database	OHIP diagnosis codes: 299, 313, 314, 315	
Any visit with a diagnosis code for other **mental health-related disorders**	OHIP Claims Database	OHIP diagnosis codes: 301, 302, 306, 307, 309	
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	CHC	Any ICD-10 diagnosis code between F06 and F99 in the primary diagnostic position, excluding dementia and delirium-related diagnoses	
Any emergency department visit or acute hospital admission for mental health-related reasons, or admission to an adult-designated mental health bed with a diagnosis code for the following in the 5 years prior to death			
Any mental health and addictions	NACRS, DAD, OMHRS	**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	NACRS, DAD, OMHRS	**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
Substance-related and addictive disorders	NACRS, DAD, OMHRS	**ICD-9-CM codes (OMHRS DSM-V):** 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: a. 291.x,303.x,3050 = **Alcohol** b. 3040,3047,3055 = **Opioids** c. 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	NACRS, DAD, OMHRS	**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

Criteria	Data Source	Codes	
Mood disorders	NACRS, DAD, OMHRS	**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	NACRS, DAD, OMHRS	**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	NACRS, DAD, OMHRS	**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	NACRS, DAD, OMHRS	**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	NACRS, DAD	**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

NACRS: National Ambulatory Care Reporting System; DAD: Discharge Abstract Database; OMHRS: Ontario Mental Health Reporting System.

Table A3. Health Conditions

	Criteria	Data Source	Codes
Infective Endocarditis	Any acute hospital admission with a diagnosis code for infective endocarditis in the 180 days prior to death	DAD	N/A
Invasive Infection	Defined as meeting any one of the criteria below: • Any acute hospital admission with a diagnosis code for a skin or soft tissue infection in the 180 days prior to death • Any acute hospital admission with a diagnosis code for a non-vertebral bone infection in the 180 days prior to death • Any acute hospital admission with a diagnosis code for a spinal infection in the 180 days prior to death	DAD	ICD-10 diagnosis codes: L03, L02, M76.2 M86, M00, G06.1, M46.2, M46.3, M46.4, M46.5
HIV	HIV diagnosis prior to and including death date	Ontario HIV Database	N/A
Hepatitis C	Hepatitis C diagnoses defined as meeting any one of the criteria below: • Prescription direct-acting antiviral use in the 5 years prior to and including death date (ODB) • Hospital visits (DAD, NACRS) with diagnosis codes for hepatitis C in the 5 years prior to death	ODB, NACRS, DAD	ICD-10 diagnoses codes (DAD, NACRS): B171, B182 and Z2251

DAD: Discharge Abstract Database; NACRS: National Ambulatory Care Reporting System