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Original quantitative research

Opioid-related deaths in Kingston, Frontenac, Lennox and Addington in Ontario, Canada: the shadow epidemic

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Abstract

Introduction: In the Kingston, Frontenac, Lennox and Addington (KFL&A) health unit, opioid overdoses are an important preventable cause of death. The KFL&A region differs from larger urban centres in its size and culture; the current overdose literature that is focussed on these larger areas is less well suited to aid in understanding the context within which overdoses take place in smaller regions. This study characterized opioid-related mortality in KFL&A, to enhance understanding of opioid overdoses in these smaller communities.

Methods: We analyzed opioid-related deaths that occurred in the KFL&A region between May 2017 and June 2021. Descriptive analyses (number and percentage) were performed on factors conceptually relevant in understanding the issue, including clinical and demographic variables, as well as substances involved, locations of deaths and whether substances were used while alone.

Results: A total of 135 people died of opioid overdose. The mean age was 42 years, and most participants were White (94.8%) and male (71.1%). Decedents often had the following characteristics: being currently or previously incarcerated; using substances alone; not using opioid substitution therapy; and having a prior diagnosis of anxiety and depression.

Conclusion: Specific characteristics such as incarceration, using alone and not using opioid substitution therapy were represented in our sample of people who died of an opioid overdose in the KFL&A region. A robust approach to decreasing opioid-related harm integrating telehealth, technology and progressive policies including providing a safe supply would assist in supporting people who use opioids and in preventing deaths.

Keywords: *opioid overdose, people who use drugs, people who use substances, harm reduction, Ontario*

Highlights

- Opioid-related deaths have been steadily increasing in KFL&A, from fewer than 13 deaths per year before 2016 to 42 deaths in 2020.
- 135 people died of opioid overdose from May 2017 to June 2021. The following characteristics were present in a large proportion of decedents: a history of incarceration, use of opioids while alone, not accessing opioid substitution therapy treatment, and mental health diagnoses or chronic pain.
- To prevent further harm, a robust approach based on evidence gathered from local trends is needed.

Introduction

Opioid-related deaths have been increasing in Canada for over a decade as an ongoing and significant national public health crisis, with overdose deaths the highest ever recorded in the first six months of 2021.[1] Between January 2016 and June 2021 in Canada (the last available data at the time of writing), there were 24 626 deaths, including 1720 deaths between April and June 2021 (19 deaths per day), a 66% increase from the period April to June 2019, and the highest quarterly count ever reported at that time.[1] The reasons for this increase are multifactorial. For one, the COVID-19 pandemic likely played a role in this increase in overdose deaths by creating an increase in toxic drug alteration due to a decrease in supply, as well as reduced capacity or closing of harm reduction sites.[1-3] However, overdose deaths were increasing well before the pandemic, and more inquiry into the factors causing these deaths, and how they can be prevented, is necessary.

Studies from various jurisdictions in Canada point to specific factors as contributing to overdose deaths. For example, using substances while alone is consistently reported as an important risk factor.[4] Other risk factors reported in the literature include living in a rural area, lack of access to take-home naloxone kits and lack of access to opioid agonist therapy.[5-7] Overdose prevention sites (OPS), on the other hand, are an effective strategy to prevent overdose deaths. British Columbia (BC), the frontrunner in implementing OPS, has evaluated them at length, and there is a plethora of evidence supporting their effectiveness in reducing mortality from overdose of substances.[8]

Academic studies of overdose deaths in Ontario are more sparse,[9] and the general

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epidemiology of the opioid crisis in that province, including influencing and protective factors such as those described above, is less well understood than in more studied jurisdictions such as Vancouver. Yet, Ontario was not spared from increasing overdoses: over 1414 people lost their lives to overdose from January to June 2021 (the latest available data at the time of writing).[1] It is thus urgent that we understand the factors specific to this province that contributed to the increase in death rates. For example, in Ontario, the implementation of OPS continues to be controversial, and it is not known whether this is influencing opioid-related deaths.[10,11] There is also less willingness to provide a safe supply to people who use substances.[12,13] In light of the alarming recent increase in opioid-related deaths in Ontario, better understanding of the specific context in this province and inquiry into the factors causing and preventing such deaths is necessary to inform any actions.

The public health systems in Ontario are administered by 34 independent public health units, each with its particular catchment region and population make-up. In the Kingston, Frontenac, Lennox and Addington (KFL&A) public health unit in southeastern Ontario, hospital visit data reflected a record-high number of opioid-related overdoses for late April and early May 2021,[14] and opioid-related deaths have been steadily increasing from 12 cases or fewer per year before 2016 to 42 cases in 2020. The KFL&A region differs from larger urban centres in its size and culture, and the current overdose literature that is focussed on these larger areas is less well suited to enhance understanding of the context within which overdoses take place in regions such as KFL&A. Accordingly, the objective of this study was to describe the population who died of opioid overdose to delineate the local factors driving the overdose crisis in this smaller community.

Methods

Ethics approval

Ethics approval was obtained from Queen's University Research Ethics Board (# 6033165).

Study design

This was a retrospective study of the opioid-related deaths that occurred in KFL&A between 1 May 2017 (the day the Coroner's Opioid Investigative Aid [OIA] was launched) and 30 June 2021 (latest available data at the time of writing).

The OIA is a standardized database of information regarding the circumstances surrounding opioid-related deaths in Ontario. The OIA contains exhaustive information on the decedent and the circumstances around their death. This information is gathered by the investigating coroner using a multitude of sources including health records, toxicology results, and collateral information from family and people present at the time of death.

We analyzed data of people who experienced death caused by opioid overdose as per the OIA, defined as "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."[3,p.4] Opioid overdose deaths were further stratified as accidental deaths or suicides.

Decedents' data collected for analysis were clinical (comorbid diagnosis), demographic (age, sex, ethnicity, marital status, employment status, history of incarcerations) and location of death (home, public space, correctional facility). We also included other factors that might help explain the increase in opioid-related deaths, including substances involved and whether substances were used alone. The variables were selected based on conceptually relevant variables from the literature, and from discussion with local experts.

Data analysis

Because the objective of this study was to provide a description of the situation related to opioid-related deaths in KFL&A, descriptive analyses were appropriate. Number and percentage were conducted on demographic and clinical characteristics of the population. For transparency, we added missing data as "undetermined." In addition, we performed subanalyses on whether relevant characteristics were changed before and after the beginning of the COVID-19 pandemic. To do so, we considered years prior to 2020 "pre-pandemic" years, and 2020 and 2021 "post-pandemic" years, with deaths pooled into pre- versus post-COVID time periods. Chi-square tests were conducted to determine the significance of any variability between characteristics pre- and post-pandemic. Analyses are presented in text and tables. To prevent identifiability, counts less than 5 have been supressed; we also suppressed some numbers greater than 5 that would permit participant identification of other cells by subtracting. However, we left numbers less than 5 for "undetermined" cells, since there is no risk of identification for this category. All data analyses were verified by a data analyst at Queen's university. All statistical analyses were conducted using R Version 4.0.2 (R Foundation for Statistical Computing, Vienna, AT).

Results

A total of 135 people died of opioid overdoses in the KFL&A health region from May 2017 to June 2021. Of those, 93.3% of deaths were deemed accidental, 5.2% were ruled suicides and the remaining were undetermined. The mean age was 42 years, with people as young as 17 and as old as 78 dying of opioid overdoses. The OIA captures both sex and gender identity, with gender identity being determined with the sources available to the coroner, including interviews with decedents' friends or family. Sex and gender identity were the same for all people who died. The majority (71.1%) of participants were male. The majority of participants (94.8%) were White (note that ethnicity data for other ethnicities are not shown to preserve confidentiality due to small numbers). Most were unemployed at the time of death (59.3%), and only 5.9% had no stable housing. The majority (57.8%) were neither married nor living common-law. Table 1 highlights demographic characteristics of the people who died of opioid overdoses over time.

The majority of people died in a private home (79.3%) and were alone at the time of overdose death (69.3% of known). A total of eight (5.9%) of people died in a correctional facility, while 32 (23.7%) had a prior history of incarceration. Of those, five (15.6%) were released in the four weeks before death. The majority of people (89.4% of known) had used opioids for more than five years. Of the participants with known prior diagnoses gathered by the coroner from medical records, 26.7% had a chronic pain diagnosis, 35.6% were diagnosed with depression and 18.5% were diagnosed with an anxiety disorder. Six (4.4%) people who died

TABLE 1
Summary statistics of people who died of an opioid overdose in KFL&A, by year (2017–2021)

	2017 (n = 21)	2018 (n = 23)	2019 (n = 33)	2020 (n = 42)	2021 (n = 16)	Total (N = 135)
Age (years)						
Mean (SD)	44 (15.5)	44 (12.3)	39 (12.1)	41 (12.5)	43 (13.4)	42 (12.9)
Range	22–78	18–64	25–74	17–67	22–62	17–78
Sex and gender identity						
Female	5 (23.8%)	8 (34.8%)	9 (27.3%)	11 (26.2%)	6 (37.5%)	39 (28.9%)
Male	16 (76.2%)	15 (65.2%)	24 (72.7%)	31 (73.8%)	10 (62.5%)	96 (71.1%)
Marital status						
Married or common-law	[a]	[a]	[a]	[a]	[a]	20 (14.8%)
Not married or common-law	12 (57.1%)	16 (69.6%)	19 (57.6%)	22 (52.4%)	9 (56.2%)	78 (57.8%)
Undetermined	[a]	[a]	[a]	[a]	[a]	37 (27.4%)
Housing						
Housed	21 (100.0%)	16 (69.6%)	25 (75.8%)	39 (92.9%)	14 (87.5%)	115 (85.2%)
No stable housing	[a]	[a]	[a]	[a]	[a]	8 (5.9%)
Correctional facility	[a]	[a]	[a]	[a]	[a]	8 (5.9%)
Undetermined	0 (0.0%)	2 (8.7%)	1 (3.0%)	0 (0.0%)	1 (6.2%)	4 (3.0%)
Employed						
Yes	[a]	[a]	[a]	[a]	[a]	13 (9.6%)
No	12 (57.1%)	17 (73.9%)	19 (57.6%)	26 (61.9%)	6 (37.5%)	80 (59.3%)
Undetermined	[a]	[a]	[a]	[a]	[a]	42 (31.1%)
Location of death						
Private home	17 (81.0%)	18 (78.3%)	25 (75.8%)	34 (81.0%)	13 (81.2%)	107 (79.3%)
Public space	[a]	[a]	[a]	[a]	[a]	9 (6.7%)
Correctional facility	[a]	[a]	[a]	[a]	[a]	8 (5.9%)
Undetermined	2 (9.5%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (6.2%)	3 (2.2%)
Used substances alone						
Alone	14 (66.7%)	12 (52.2%)	16 (48.5%)	20 (47.6%)	8 (50.0%)	70 (51.9%)
Others present	[a]	[a]	[a]	[a]	[a]	31 (23.0%)
Undetermined	[a]	[a]	[a]	[a]	[a]	34 (25.2%)
Past incarceration						
Yes	[a]	[a]	[a]	[a]	[a]	32 (23.7%)
No	[a]	[a]	[a]	[a]	[a]	35 (25.9%)
Undetermined	18 (85.7%)	17 (73.9%)	10 (30.3%)	16 (38.1%)	7 (43.8%)	68 (50.4%)
Opioid use disorder diagnosis						
Yes	11 (52.4%)	16 (69.6%)	26 (78.8%)	32 (76.2%)	12 (75.0%)	97 (71.9%)
Undetermined	10 (47.6%)	7 (30.4%)	7 (21.2%)	10 (23.8%)	4 (25.0%)	38 (28.1%)
Previous overdose						
Yes	[a]	[a]	5 (15.2%)	9 (21.4%)	[a]	23 (17.0%)
No	[a]	[a]	28 (84.8%)	33 (78.6%)	13 (81.2%)	91 (67.4%)
Undetermined	15 (71.4%)	[a]	[a]	[a]	[a]	21 (15.6%)
Duration of substance use						
< 5 years	[a]	[a]	[a]	[a]	[a]	7 (5.2%)
> 5 years	11 (52.4%)	8 (34.8%)	13 (39.4%)	20 (47.6%)	7 (43.8%)	59 (43.7%)
Undetermined	[a]	[a]	[a]	[a]	[a]	69 (51.1%)

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TABLE 1 (continued)
Summary statistics of people who died of an opioid overdose in KFL&A, by year (2017–2021)

	2017 (n = 21)	2018 (n = 23)	2019 (n = 33)	2020 (n = 42)	2021 (n = 16)	Total (N = 135)
Chronic pain						
Yes	[a]	[a]	[a]	[a]	[a]	36 (26.7%)
No	13 (61.9%)	12 (52.2%)	23 (69.7%)	33 (78.6%)	13 (81.2%)	94 (69.6%)
Undetermined	[a]	[a]	[a]	[a]	[a]	5 (3.7%)
Depression						
Yes	8 (38.1%)	11 (47.8%)	12 (36.4%)	10 (23.8%)	7 (43.8%)	48 (35.6%)
No	10 (47.6%)	10 (43.5%)	21 (63.6%)	32 (76.2%)	8 (50.0%)	81 (60.0%)
Undetermined	3 (14.3%)	2 (8.7%)	0 (0.0%)	0 (0.0%)	1 (6.2%)	6 (4.4%)
Anxiety disorder						
Yes	[a]	[a]	8 (24.2%)	8 (19.0%)	[a]	25 (18.5%)
No	[a]	[a]	25 (75.8%)	34 (81.0%)	11 (68.8%)	88 (65.2%)
Undetermined	16 (76.2%)	[a]	0 (0.0%)	0 (0.0%)	[a]	22 (16.3%)
Schizophrenia						
Yes	[a]	[a]	[a]	[a]	[a]	10 (7.4%)
No	16 (76.2%)	20 (87.0%)	30 (90.9%)	39 (92.9%)	13 (81.2%)	118 (87.4%)
Undetermined	[a]	[a]	[a]	[a]	[a]	7 (5.2%)
Bipolar disorder						
Yes	[a]	[a]	[a]	[a]	[a]	10 (7.4%)
No	16 (76.2%)	20 (87.0%)	31 (93.9%)	39 (92.9%)	12 (75.0%)	118 (87.4%)
Undetermined	[a]	[a]	[a]	[a]	[a]	7 (5.2%)
Naloxone used						
Yes	[a]	[a]	10 (30.3%)	17 (40.5%)	5 (31.2%)	42 (31.1%)
No	16 (76.2%)	14 (60.9%)	15 (45.5%)	18 (42.9%)	8 (50.0%)	71 (52.6%)
Undetermined	[a]	[a]	8 (24.2%)	7 (16.7%)	3 (18.8%)	22 (16.3%)

Data source: Opioid Investigative Aid.

Abbreviations: KFL&A, Kingston, Frontenac, Lennox and Addington region; SD, standard deviation.

Notes: Percentages were calculated by column for each variable.
Sex and gender identity were the same for all people who died.

[a] Suppressed to prevent participant identification.

were known to have previously attempted suicide.

All decedents received the same toxicology screening. Fentanyl and carfentanil were the most common opioids causing death (n = 103, 76.3%). Seventy (51.9%) people also used methamphetamines, and the use of methamphetamines increased significantly in 2019 and 2020 when compared to previous years. Nearly one-fifth (28, 20.7%) had cocaine in their blood at the time of death, and the number of people with cocaine in their blood at the time of death was highest in 2020 compared to previous years. Benzodiazepine, hydromorphone and oxycodone were present in the blood of less than 15% of people. Few people had naloxone, buprenorphine or methadone in their blood at time of death. Table 2 describes the toxicology results over time.

Interestingly, there were no differences in characteristics for the pre- and post-COVID-19 pandemic years, including in whether substances were used alone (p = 0.762). There were also no differences in whether decedents had opioid substitution therapy (OST) in their blood at time of death (p = 0.086). Tables 3 and 4 present the pre-and post-pandemic results.

Discussion

In this study, we describe the characteristics of people who died of opioid overdoses in KFL&A, and the circumstances surrounding their deaths. A large proportion of people who died of opioid overdoses had a history of incarceration. This issue is particularly important for Kingston, as the region hosts four prisons, and over 2000 prisoners use Kingston health services. Numerous studies have identified a high risk of opioid overdose in the 14-day period following discharge from prison, and the substance-related mortality rate for prisoners and ex-prisoners is 32 times higher than in the age- and sex-matched general population.[15-17] In light of the relatively high number of deaths both in prison and upon release, strategies to address this vulnerable population are urgently needed. High-quality studies have already suggested approaches for addressing opioid overdoses in incarcerated populations and those newly released from jail, including robust OST programs,

TABLE 2
Toxicology findings, by year (2017–2021)

	2017 (n = 21)	2018 (n = 23)	2019 (n = 33)	2020 (n = 42)	2021 (n = 16)	Total (N = 135)
Fentanyl and carfentanil						
Yes	13 (61.9%)	14 (60.9%)	26 (78.8%)	37 (88.1%)	13 (81.2%)	103 (76.3%)
No	8 (38.1%)	9 (39.1%)	7 (21.2%)	[a]	[a]	30 (22.2%)
Undetermined	[a]	[a]	[a]	[a]	[a]	2 (1.5%)
Morphine						
Yes	7 (33.3%)	6 (26.1%)	5 (15.2%)	[a]	[a]	23 (17.0%)
No	14 (66.7%)	17 (73.9%)	28 (84.8%)	38 (90.5%)	13 (81.2%)	110 (81.5%)
Undetermined	[a]	[a]	[a]	[a]	[a]	2 (1.5%)
Hydromorphone						
Yes	[a]	6 (26.1%)	5 (15.2%)	[a]	[a]	17 (12.6%)
No	17 (81.0%)	17 (73.9%)	28 (84.8%)	41 (97.6%)	13 (81.2%)	116 (85.9%)
Undetermined	[a]	[a]	[a]	[a]	[a]	2 (1.5%)
Oxycodone						
Yes	[a]	[a]	[a]	[a]	[a]	12 (8.9%)
No	17 (81.0%)	20 (87.0%)	29 (87.9%)	41 (97.6%)	14 (87.5%)	121 (89.6%)
Undetermined	[a]	[a]	[a]	[a]	[a]	2 (1.5%)
Methamphetamine						
Yes	9 (42.9%)	7 (30.4%)	20 (60.6%)	26 (61.9%)	8 (50.0%)	70 (51.9%)
No	12 (57.1%)	16 (69.6%)	13 (39.4%)	16 (38.1%)	6 (37.5%)	63 (46.7%)
Undetermined	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (12.5%)	2 (1.5%)
Cocaine						
Yes	5 (23.8%)	[a]	[a]	15 (35.7%)	[a]	28 (20.7%)
No	16 (76.2%)	20 (87.0%)	29 (87.9%)	27 (64.3%)	13 (81.2%)	105 (77.8%)
Undetermined	[a]	[a]	[a]	[a]	[a]	2 (1.5%)
Benzodiazepine						
Yes	5 (23.8%)	[a]	[a]	[a]	[a]	13 (9.6%)
No	16 (76.2%)	22 (95.7%)	30 (90.9%)	38 (90.5%)	14 (87.5%)	120 (88.9%)
Undetermined	[a]	[a]	[a]	[a]	[a]	2 (1.5%)
Naloxone						
Yes	[a]	[a]	[a]	[a]	[a]	2 (1.5%)
No	20 (95.2%)	23 (100.0%)	33 (100.0%)	41 (97.6%)	14 (87.5%)	131 (97.0%)
Undetermined	[a]	[a]	[a]	[a]	[a]	2 (1.5%)
OST (methadone, buprenorphine)						
Yes	[a]	[a]	[a]	[a]	[a]	17 (12.6%)
No	18 (85.7%)	21 (91.3%)	31 (93.9%)	35 (83.3%)	11 (68.8%)	116 (85.9%)
Undetermined	[a]	[a]	[a]	[a]	[a]	2 (1.5%)

Data source: Opioid Investigative Aid.

Abbreviation: OST, opioid substitution therapy.

Note: Percentages were calculated by column for each variable.

[a] Suppressed either due to small numbers or to prevent participant identification.

access to naloxone and linkage to care upon release; lessons from these studies can be implemented in Kingston correctional facilities.[15,16]

In KFL&A, the majority of people died in a private home and were alone at the time of overdose. This is consistent with the trend in Ontario as a whole and in BC.[3,18,19] It is well known that using substances alone is a significant risk factor for overdose death, due to the unavailability of someone else to administer naloxone, provide CPR and call emergency services. Interestingly, in our study, the COVID-19 pandemic had no influence on whether people who died of opioid overdoses used alone. There is minimal research on the social and structural conditions that influence individuals to use substances alone, but the existing (though scarce) evidence

TABLE 3
Comparisons of decedents' characteristics pre- and post-pandemic

	Pre-pandemic (n = 77)	Post-pandemic (n = 58)	Total (N = 135)	*p* value
Age (years)				
Mean (SD)	42 (13.2)	42 (12.6)	42 (12.9)	0.936
Range	18–78	17–67	17–78	
Sex and gender identity				
Female	22 (28.6%)	17 (29.3%)	39 (28.9%)	0.925
Male	55 (71.4%)	41 (70.7%)	96 (71.1%)	
Marital status				
Married or common-law	13 (16.9%)	7 (12.1%)	20 (14.8%)	0.259
Not married or common-law	47 (61.0%)	31 (53.4%)	78 (57.8%)	
Undetermined	17 (22.1%)	20 (34.5%)	37 (27.4%)	
Housing				
Housed	62 (80.5%)	53 (91.4%)	115 (85.2%)	0.250
No stable housing	[a]	[a]	8 (5.9%)	
Correctional facility	[a]	[a]	8 (5.9%)	
Undetermined	3 (3.9%)	1 (1.7%)	4 (3.0%)	
Employed				
Yes	6 (7.8%)	7 (12.1%)	13 (9.6%)	0.605
No	48 (62.3%)	32 (55.2%)	80 (59.3%)	
Undetermined	23 (29.9%)	19 (32.8%)	42 (31.1%)	
Location of death				
Private home	60 (77.9%)	47 (81.0%)	107 (79.3%)	0.422
Public space	[a]	[a]	9 (6.7%)	
Correctional facility	[a]	[a]	8 (5.9%)	
Other	1 (1.3%)	3 (5.2%)	4 (3.0%)	
Undetermined	2 (2.6%)	1 (1.7%)	3 (2.2%)	
Used substances alone				
Alone	42 (54.5%)	28 (48.3%)	70 (51.9%)	0.762
Others present	17 (22.1%)	14 (24.1%)	31 (23.0%)	
Undetermined	18 (23.4%)	16 (27.6%)	34 (25.2%)	
Past incarceration				
Yes	16 (20.8%)	16 (27.6%)	32 (23.7%)	0.091
No	16 (20.8%)	19 (32.8%)	35 (25.9%)	
Undetermined	45 (58.4%)	23 (39.7%)	68 (50.4%)	
Opioid use disorder diagnosis				
Yes	53 (68.8%)	44 (75.9%)	97 (71.9%)	0.369
Undetermined	24 (31.2%)	14 (24.1%)	38 (28.1%)	
Previous overdose				
Yes	12 (15.6%)	11 (19.0%)	23 (17.0%)	< 0.001
No	45 (58.4%)	46 (79.3%)	91 (67.4%)	
Undetermined	20 (26.0%)	1 (1.7%)	21 (15.6%)	
Duration of substance use				
< 5 years	[a]	[a]	7 (5.2%)	0.193
> 5 years	32 (41.6%)	27 (46.6%)	59 (43.7%)	
Undetermined	[a]	[a]	69 (51.1%)	

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TABLE 3 (continued)
Comparisons of decedents' characteristics pre- and post-pandemic

	Pre-pandemic (n = 77)	Post-pandemic (n = 58)	Total (N = 135)	*p* value
Chronic pain				
Yes	25 (32.5%)	11 (19.0%)	36 (26.7%)	
No	48 (62.3%)	46 (79.3%)	94 (69.6%)	0.095
Undetermined	4 (5.2%)	1 (1.7%)	5 (3.7%)	
Depression				
Yes	31 (40.3%)	17 (29.3%)	48 (35.6%)	
No	41 (53.2%)	40 (69.0%)	81 (60.0%)	0.124
Undetermined	5 (6.5%)	1 (1.7%)	6 (4.4%)	
Anxiety disorder				
Yes	13 (16.9%)	12 (20.7%)	25 (18.5%)	
No	43 (55.8%)	45 (77.6%)	88 (65.2%)	< 0.001
Undetermined	21 (27.3%)	1 (1.7%)	22 (16.3%)	
Schizophrenia				
Yes	5 (6.5%)	5 (8.6%)	10 (7.4%)	
No	66 (85.7%)	52 (89.7%)	118 (87.4%)	0.271
Undetermined	6 (7.8%)	1 (1.7%)	7 (5.2%)	
Bipolar				
Yes	[a]	[a]	10 (7.4%)	
No	67 (87.0%)	51 (87.9%)	118 (87.4%)	0.171
Undetermined	[a]	[a]	7 (100.0%)	

Data source: Opioid Investigative Aid.

Abbreviation: SD, standard deviation.

Notes: Percentages were calculated by column for each variable.
Sex and gender identity were the same for all people who died.
Pre-pandemic refers to 2019 and earlier. Post-pandemic refers to 2020 and 2021.

[a] Suppressed either due to small numbers or to prevent participant identification.

points to motivations such as hiding one's substance use from others for fear of being stigmatized, fear of criminalization and unwillingness to share due to limited resources.[20] In our study, there were no differences in characteristics of people who died while using alone versus those who had someone present when they died, including in terms of age, sex, or year or location of death (data not shown). Qualitative studies are needed to elucidate the motivations behind using substances alone for people who use substances but do not access harm reduction services in the KFL&A health region.

In our study, less than 13% of decedents had OST in their blood at time of death, and there was no difference in OST use before or after the COVID-19 pandemic. Optimistically, this could mean that people who use OST do not die of opioid overdoses. Alternatively, this could indicate that there is limited access to OST in the KFL&A region. More investigation is needed to elucidate OST access and barriers in the KFL&A region.

In our study, the main substances found in the toxicity screen were fentanyl, carfentanil and methamphetamines, with fentanyl and carfentanil causing the highest number of deaths. The greatest number of deaths of people with a combination of fentanyl, carfentanil and methamphetamines in their blood occurred in 2020. This is consistent with the rest of Ontario, and with other jurisdictions such as BC, which also noted an increase in the number of people who had used opioids and methamphetamines around the time of death.[19,21]

The rise in fentanyl and methamphetamine use is correlated with a similar rise in overdose deaths. While we acknowledge that correlation does not necessarily imply causation, this is nonetheless an intriguing trend. While the co-use of opioids and methamphetamines at the same time (or in immediate succession) is an increasing trend among people who use substances,[22,23] the unpredictability of the supply means we cannot truly ascertain if the multiple substances detected at the time of death were taken simultaneously or sequentially or simply were all contained within a single substance consumed at the time of death.

There is room for future studies, ideally qualitative in nature, to explore whether people who use substances are aware of the nature of the substances they are taking, as well as to explore the motivations leading people to co-use opioids and methamphetamines, and the mechanism by which the use of both substances might lead to an increased susceptibility to overdose death. While understanding this pattern of use may not stop deaths in the near term, such studies may gather evidence to target harm reduction and education programs to prevent harms that arise from polysubstance use.

TABLE 4
Toxicology findings pre- and post-pandemic

	Pre-pandemic (n = 77)	Post-pandemic (n = 58)	Total (N = 135)	*p* value
Fentanyl and carfentanil				
Yes	53 (68.8%)	50 (86.2%)	103 (76.3%)	
No	24 (31.2%)	6 (10.3%)	30 (22.2%)	0.005
Undetermined	0 (0.0%)	2 (3.4%)	2 (1.5%)	
Morphine				
Yes	18 (23.4%)	5 (8.6%)	23 (17.0%)	
No	59 (76.6%)	51 (87.9%)	110 (81.5%)	0.025
Undetermined	0 (0.0%)	2 (3.4%)	2 (1.5%)	
Hydromorphone				
Yes	[a]	[a]	17 (12.6%)	
No	62 (80.5%)	54 (93.1%)	116 (85.9%)	0.007
Undetermined	[a]	[a]	2 (1.5%)	
Oxycodone				
Yes	[a]	[a]	12 (8.9%)	
No	66 (85.7%)	55 (94.8%)	121 (89.6%)	0.012
Undetermined	[a]	[a]	2 (1.5%)	
Methamphetamine				
Yes	36 (46.8%)	34 (58.6%)	70 (51.9%)	
No	41 (53.2%)	22 (37.9%)	63 (46.7%)	0.074
Undetermined	0 (0.0%)	2 (3.4%)	2 (1.5%)	
Cocaine				
Yes	12 (15.6%)	16 (27.6%)	28 (20.7%)	
No	65 (84.4%)	40 (69.0%)	105 (77.8%)	0.051
Undetermined	0 (0.0%)	2 (3.4%)	2 (1.5%)	
Benzodiazepine				
Yes	[a]	[a]	13 (9.6%)	
No	68 (88.3%)	52 (89.7%)	120 (88.9%)	0.178
Undetermined	[a]	[a]	2 (1.5%)	
Naloxone				
Yes	[a]	[a]	2 (1.5%)	
No	76 (98.7%)	55 (94.8%)	131 (97.0%)	0.253
Undetermined	[a]	[a]	2 (1.5%)	
OST (methadone, buprenorphine)				
Yes	7 (9.1%)	10 (17.2%)	17 (12.6%)	
No	70 (90.9%)	46 (79.3%)	116 (85.9%)	0.086
Undetermined	0 (0.0%)	2 (3.4%)	2 (1.5%)	

Data source: Opioid Investigative Aid.

Abbreviation: OST, opioid substitution therapy.

Notes: Percentages were calculated by column for each variable.
Pre-pandemic refers to 2019 and earlier. Post-pandemic refers to 2020 and 2021.

[a] Suppressed either due to small numbers or to prevent participant identification.

Our toxicology results indicate that most of the substances in decedents' blood at the time of death were obtained from street supply as opposed to prescribed medications. This opens the question as to whether decedents died due to a toxic or unpredictable supply, since most of the deaths were accidental. It is well known that offering people who use substances a safe supply has a tremendous impact on reducing the number of lives lost to opioid overdoses and on promoting safe injection patterns.[22-36] Other jurisdictions, such as BC, Switzerland and the Netherlands, offer prescription opioids as part of a harm reduction approach.[30] While some bigger urban centres in Ontario have programs

that offer safe supply to people who use substances,[37] these programs may not be available to people living in smaller and rural communities. Telehealth may prove an excellent tool to increase access to these programs for people living in smaller communities. In the longer term, implementing progressive policies such as decriminalizing or legalizing substances would support a safe substance supply. While we acknowledge that substance decriminalization and legalization is a bigger discussion that is beyond the scope of this paper, it is worth reflecting on how such policies may support people who use substances in using safely, and thus decrease the burden of morbidity and mortality associated with opioid use on society as a whole.

Strengths and limitations

This study paints an important and much needed picture of overdose-related deaths in a smaller region in southeastern Ontario, and reports foundational issues that future studies can further explore. However, it also has some limitations. First, the study used administrative data, and some variables had missing data. On the other hand, the OIA captured all suspected opioid-related deaths, and is unlikely to have missed a case, since a coroner must attend all deaths that are sudden, unnatural or not the result of an illness treated by a doctor. Second, the study period ended in June 2021; therefore, we did not capture more recent trends in opioid-related deaths in the region. In addition, 2017 and 2021 were not full years of data, which may have impacted results, including the results of the pre- and post-COVID-19 pandemic subanalyses, and our findings should be interpreted with this limitation in mind. Third, as with any administrative dataset, some of the variables may have been inappropriately coded. Fourth, since there was no control group, it was not possible to determine odds or risk ratio.

Conclusion

This study highlighted at-risk groups for opioid-related deaths based on trends gathered from the analysis of the OIA database. People who had been incarcerated and people using alone were some of the most represented groups, and interventions to better support these two populations may contribute to reducing the number of opioid-related deaths in the KFL&A region. A robust approach to reducing opioid-related harm integrating telehealth, technology and progressive policies decriminalizing substance use would go a long way in supporting people who use opioids and in preventing deaths.

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Conflicts of interest

The authors declare no conflicts of interest.

Authors' contributions and statement

SP conceptualized and designed the study, interpreted and analyzed the data and drafted the manuscript; SB conceptualized the study, provided contributions and critically revised the manuscript; JP conceptualized the study, provided contributions and critically revised the manuscript; KM conceptualized the study.

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