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## Using linked data to identify pathways of reporting overdose events in British Columbia, 2015–2017

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### Abstract

#### Introduction

Overdose events related to illicit opioids and other substances are a public health crisis in Canada. The BC Provincial Overdose Cohort is a collection of linked datasets identifying drug-related toxicity events, including death, ambulance, emergency room, hospital, and physician records. The datasets were brought together to understand factors associated with drug-related overdose and can also provide information on pathways of care among people who experience an overdose.

#### Objectives

To describe pathways of recorded healthcare use for overdose events in British Columbia, Canada and discrepancies between data sources.

#### Methods

Using the BC Provincial Overdose Cohort spanning 2015 to 2017, we examined pathways of recorded health care use for overdose through the framework of an injury reporting pyramid. We also explored differences in event capture between linked datasets.

#### Results

In the cohort, a total of 34,113 fatal and non-fatal overdose events were identified. A total of 3,056 people died of overdose. Nearly 80% of these deaths occurred among those with no contact with the healthcare system. The majority of events with healthcare records included contact with EHS services (72%), while 39% were seen in the ED and only 7% were hospitalized. Pathways of care from EHS services to ED and hospitalization were generally observed. However, not all ED visits had an associated EHS record and some hospitalizations following an ED visit were for other health issues.

#### Conclusions

These findings emphasize the importance of accessing timely healthcare for people experiencing overdose. These findings can be applied to understanding pathways of care for people who experience overdose events and estimating the total burden of healthcare-attended overdose events.

#### Highlights

In British Columbia, Canada:

- Multiple sources of linked administrative health data were leveraged to understand recorded healthcare use among people with fatal and non-fatal overdose events
- The majority of fatal overdose events occurred with no contact with the healthcare system and only appear in mortality data
- Many non-fatal overdose events were captured in data from emergency health services, emergency departments, and hospital records
- Accessing timely healthcare services is critical for people experiencing overdose

#### Keywords

overdose; opioid; emergency department; hospitalization; ambulance; emergency medicine

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## Introduction

Overdose events due to highly toxic drugs in the unregulated supply are a significant public health concern in Canada. In 2021, the province of British Columbia comprised approximately 13% of Canada's total population, but nearly 30% of opioid toxicity deaths occurred in this province [1]. In British Columbia, drug toxicity mortality began climbing steeply in late 2015. From 2015 to 2017, British Columbia reported 3,014 illicit drug toxicity deaths, more than 3 times the previous 3-year period (2012–2014) [2]. From 2018 to 2020, cumulative overdose deaths reached 4,269 [2]. Mortality has increased substantially during COVID-19 and 4,520 deaths were recorded during the 2-year period of 2020 to 2021 [2]. The emergence of fentanyl and fentanyl analogues (e.g. acetylfentanyl, carfentanil, etc.) in the drug supply beginning in 2012 drove an increase in overdose mortality, which has increased substantially since then [3].

The British Columbia Provincial Health Officer declared a public health emergency of drug-related deaths in April 2016. Programs to reduce opioid-related harms were expanded, including take-home naloxone kit distribution and training and the establishment of overdose prevention services [4]. Additionally, a public health order required that emergency health services, emergency departments, and coroners submit data to the BC Centers for Disease Control to monitor patterns of overdose and create a linked dataset to better understand the context of overdose events. Infrastructure was put in place to create the BC Provincial Overdose Cohort (ODC), which links drug-related toxicity events observed in administrative data, including death, emergency health services (including ambulance), emergency department, hospital, physician, and prescription drug records and is housed in a secure data repository. The criteria for inclusion in the cohort is an identified toxicity event in at least one of the datasets [5]. The BC ODC can be used to characterize the opioid epidemic, examine patterns of contact with healthcare services, and identify sub-populations at risk [5].

To understand the full range of harms related to the toxic unregulated drug supply, it is important to consider both fatal and non-fatal overdose events. Deaths, hospitalizations, and use of emergency health services (including ambulance) for suspected overdose events are core surveillance indicators to monitor the overdose crisis in Canada. A single overdose event may be captured in multiple data sets. Linked datasets such as the BC ODC can help elucidate the burden of overdose events that have contact with the health system, reduce double counting the same event, characterize the pathways of reporting in the health care system, and allow the estimation of the frequency of each pathway. Linking death data with administrative data also allows for estimation of how many overdose events occur without contact with the healthcare system. Understanding how often and where those who experience an overdose are connecting with healthcare services can help identify barriers and design more effective public health interventions.

The objective of this study was to describe how individuals experiencing an overdose event in British Columbia were captured in health care administrative data and mortality data. A secondary objective was to identify differences in capturing overdose events between data sources, noting where data may

be incomplete due to linkage or other quality issues. Findings from this study can contribute to estimating the total burden of drug toxicity events, pathways through the healthcare system, and inform the scope of policy and prevention related to overdose events.

## Methods

We used the injury reporting framework to create an overdose reporting pyramid, a conceptual model of pathways of overdose events and recorded healthcare use (Figure 1) [6, 7]. We further separated events to create two major branches of healthcare-attended overdose events (healthcare-attended pathway) and overdose events where there was no reported contact with healthcare services (healthcare-unattended pathway) (Figure 2).

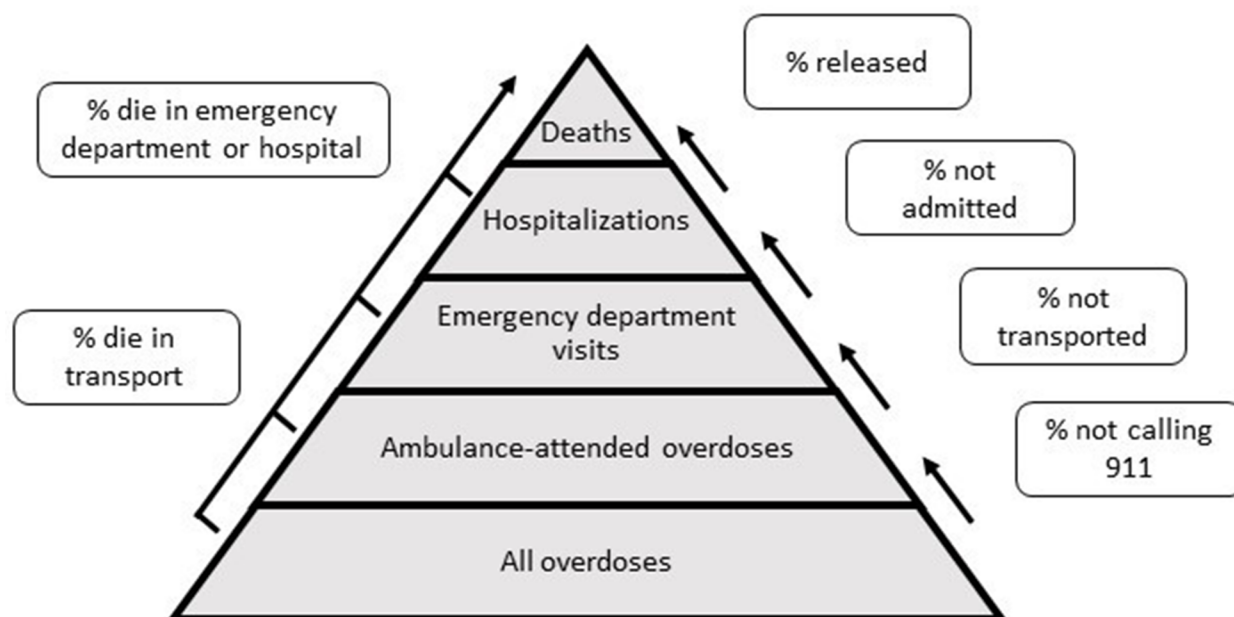
We used data from the BC Provincial Overdose Cohort (ODC) to estimate values for overdose events. The ODC includes linked administrative data on medical, prescribing, and post-mortem data for people who had a fatal or non-fatal overdose in British Columbia, Canada [5]. Information on specific data sets, data linkage, and cohort governance can be found elsewhere [5, 8].

In this cohort, an overdose episode (overdose) has been previously defined as one or more encounters with the healthcare system, each separated by less than 24 hours, with at least one encounter meeting a case definition for overdose as defined within each dataset [5]. Further information on definitions of overdose for each individual dataset is available in Supplementary Appendix 1. The study cohort in this manuscript was created using the ODC version that covered the calendar years 2015 to 2017. We excluded overdose episodes coded as medical assistance in dying (ICD-10 codes that start with a "J") in Vital Statistics records. This project was completed as part of BCCDC's public health mandate and no institutional ethics approval was required.

Within the ODC, two sources were used to identify overdose deaths. Firstly, data from the BC Coroners Service (BCCS) were used to identify accidental and undetermined illicit drug overdose deaths that were investigated. BCCS investigates all unnatural or unexpected deaths. Secondly, the Vital Statistics database was used to identify accidental deaths with an ICD-10 cause of death code for poisonings (i.e. overdoses) related to opioids, heroin, methadone, cocaine, or narcotics [9].

To identify overdose events where individuals had contact with healthcare services (lower branch of Figure 2), we combined sources of administrative data as follows [4]. Data on emergency health services or ambulance-attended overdose events were extracted from the BC Emergency Health Services (EHS) database. Information on emergency room visits was taken from case-based reporting by Emergency Departments (ED), who provide paper-based reporting for each case of illicit drug overdose in three British Columbia Health Authorities, as well as from the National Ambulatory Care Reporting System (NACRS), which captures ambulatory care. Attendance by a physician in the ED was also estimated using the Medical Services Plan (MSP), which captures all fee-for-service visits billed to British Columbia's health insurance program, and calls to the Drug and Poison Information Centre (DPIC)

Figure 1: Overdose reporting pyramid



for clinical advice on poisoning management. Information on hospitalizations was extracted from the Discharge Abstract Database (DAD), which captures information on acute hospital care. Patients were linked in these datasets and to death data through deterministic and probabilistic linkage algorithms using name, date of birth, sex, and provincial health insurance number, if available [5].

Using the data sources above, we mapped pathways of recorded healthcare attendance for unique overdose events. The expected pathway for a fatal overdose event with complete healthcare attendance was through attendance by emergency health services, transport to the hospital, admission to the ED, admission to hospital, and death reported in mortality data. However, not all fatal events were expected to follow this pathway, as overdose mortality can also occur with limited or no contact with healthcare services. Non-fatal overdose episodes may also follow various healthcare pathways, as individuals may decline ambulance transport to hospital, arrive at the ED without emergency health services transport, or leave the ED without a standard discharge. We used records from administrative datasets to elucidate the various pathways of healthcare attendance for an overdose event and to build an overall picture of overdose burden in British Columbia.

To describe fatal overdose events that were not recorded in healthcare data, we identified deaths in BCCS and Vital Statistics for which there was no record in any administrative healthcare dataset. We could not quantify non-fatal overdose events that were not attended by healthcare services, but have included this box in our diagram to represent these cases.

For our secondary aim of quantifying discrepancies in healthcare data, we made several assumptions. We assumed that an overdose episode found in hospitalization data (DAD) should also be found in emergency department records (ED), as most people hospitalized for overdose would have been admitted through the ED. If there was no ED record associated with a hospital discharge, we assumed that we were not

able to identify the record due to limitations of ED data coding, transfers that were not captured, linkage mismatch, data quality, or other issues. We also assumed that if an overdose record was only found in MSP or DPIC, in which physicians have reported an overdose attended in the ED, but not found in ED records, then this was a discrepant ED case with similar limitations. Finally, accidental overdose deaths identified in Vital Statistics but not in the BCCS were considered under-reported overdose deaths.

## Results

We created pathways of recorded healthcare attendance for overdose events for opioids and other substances in the ODC, with data sources listed in Table 1 and pathways shown in Figure 2. We identified 3,056 overdose deaths reported in the OCD from 2015 to 2017. Nearly 80% of overdose deaths observed in the cohort occurred with no contact with the healthcare system ( $n=2,432$ , Figure 2 Box D). Among overdose events with a record of healthcare attendance, only 1.8% ended in a death ( $n=624$ , Figure 2 Boxes E, K, P). The corresponding proportion of overdose deaths among those experiencing an overdose with no healthcare contact was not estimable, as it was not known how many overdose events were survived without healthcare contact (Figure 2 Box C).

There were 34,113 unique overdose events with healthcare contact in the ODC from 2015 to 2017, including fatal overdose events. A total of 17,395 had records of contact with EHS (ambulance) services only (51.0% of healthcare-attended overdose events, Figure 2 Boxes E, F). Approximately 97% of EHS-attended overdose events were non-fatal ( $n=16,922$ , Figure 2 Box F), indicating a high degree of survival after contact with EHS services. A total of 16,718 overdose events had a record of contact or assumed contact with the ED, noted here as ED attachment (49.0% of healthcare-attended overdose events, Figure 2 Box G, H, I, J). Of these, 7,029 had EHS records, indicating a pathway of care from EHS

Table 1: Definitions and data sources for overdose events, BC provincial overdose cohort, 2015–2017

| Box | Description                                                  | Definition                                                                                                                                                                    | Data sources                             |
|-----|--------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| A   | Overdose with no healthcare record                           | Overdose events with no contact with the healthcare system (EHS, ED, or hospitalization data).                                                                                | Not directly estimable                   |
| B   | Overdose with healthcare record                              | Overdose events recorded in EHS, ED, or hospitalization data.                                                                                                                 | EHS, ED, MSP, DPIC, NACRS, DAD, BCCS, VS |
| C   | Non-fatal overdose with no healthcare record                 | Non-fatal overdose events with no record of contact with the healthcare system (EHS, ED, or hospitalization data).                                                            | Not directly estimable                   |
| D   | Fatal overdose with no healthcare record                     | Overdose deaths with no record of contact with the healthcare system (EHS, ED, or hospitalization data).                                                                      | BCCS, VS                                 |
| E   | Fatal overdose with EHS record                               | Overdose events with an EHS record and death record, where EHS services arrived but the person had died on the scene or in transport to the ED.                               | EHS, BCCS, VS                            |
| F   | Non-fatal overdose with EHS record, no transport             | Overdose events with an EHS record, where EHS services arrived but the person was not transported to the ED (assumed non-fatal).                                              | EHS                                      |
| G   | Non-fatal physician-attended overdose with no ED record      | Overdose events presumed to be in ED due to MSP or DPIC record, but with no ED record (assumed non-fatal). Events may have been miscoded due to data linkage or other issues. | MSP, DPIC                                |
| H   | Admitted to ED with EHS record                               | Overdose events recorded in EHS and ED data.                                                                                                                                  | EHS, ED, NACRS                           |
| I   | Admitted to ED with no EHS record                            | Overdose events with an ED record but no EHS record. Assumed admitted through sources other than EHS (e.g. walk-in) or miscoded due to data linkage or other issues.          | ED, NACRS                                |
| J   | Record of overdose-related hospitalization with no ED record | Overdose events with a hospitalization record but no ED record. Events are assumed to have been seen in the ED.                                                               | DAD                                      |
| K   | Fatal overdose with ED record                                | Overdose deaths with an ED record and a death record.                                                                                                                         | ED, NACRS, BCCS, VS                      |
| L   | Non-fatal overdose with record of discharge from ED          | Overdose events with an ED record discharged from the ED (assumed non-fatal).                                                                                                 | ED, NACRS                                |
| M   | Left ED without being seen / against medical advice          | Overdose events with an ED record that indicated left the ED without being seen or against medical advice (LWBS/LAMA).                                                        | NACRS                                    |
| N   | Hospital record for reason other than overdose               | Overdose events with an ED record and a hospitalization record, hospitalization record does not include overdose (assumed non-fatal).                                         | ED, NACRS, DAD                           |
| O   | Hospital record for overdose                                 | Overdose events with a hospitalization record related to overdose.                                                                                                            | DAD                                      |
| P   | Fatal overdose with hospital record                          | Overdose deaths with a hospitalization record related to overdose and a death record indicating overdose.                                                                     | DAD, BCCS, VS                            |
| Q   | Non-fatal overdose with hospital record                      | Overdose events with a hospitalization record related to overdose who were discharged from hospital (assumed non-fatal).                                                      | DAD                                      |

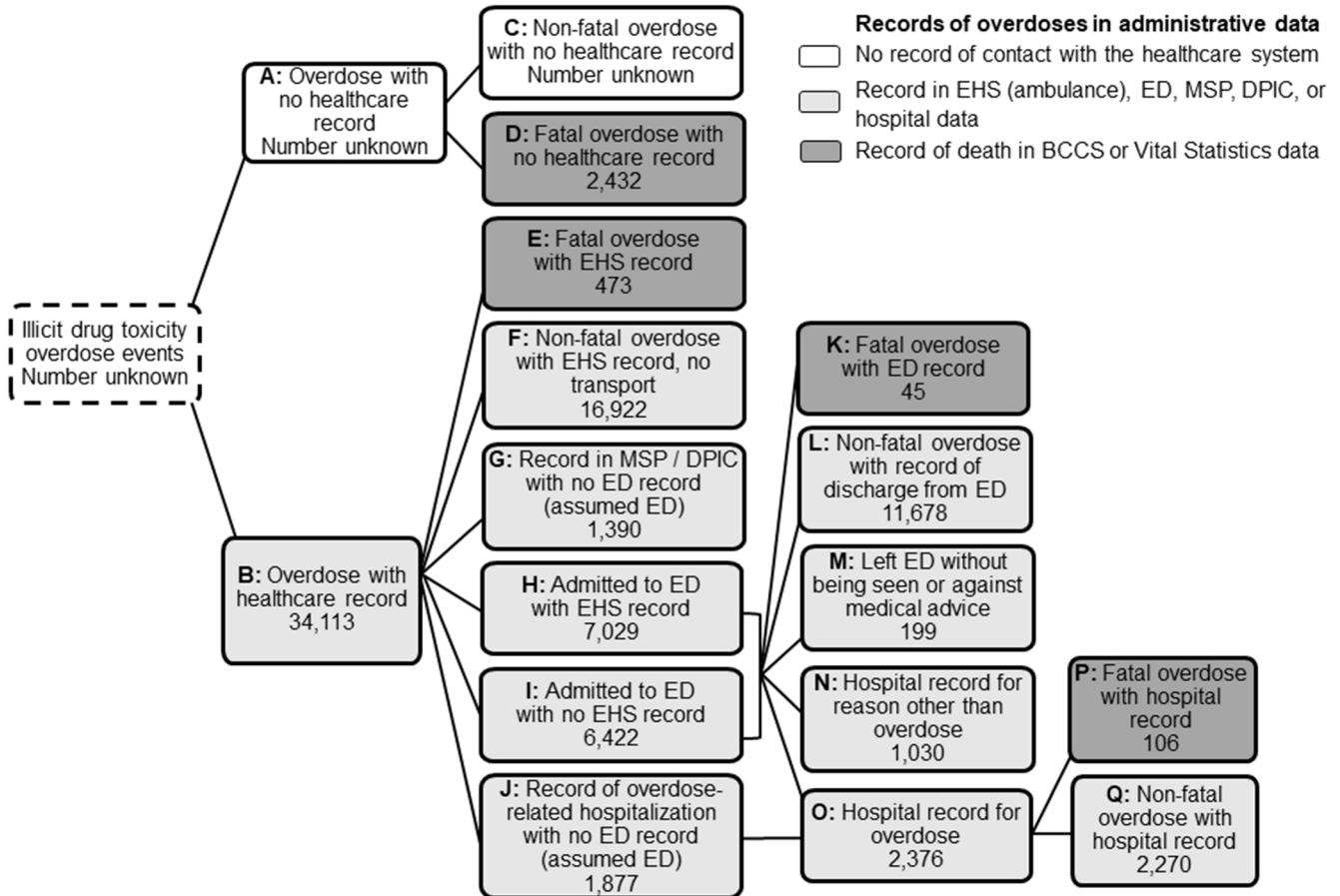
BCCS = BC Coroners Service, DAD = Discharge Abstract Database, DPIC = Drug Poison and Control Centre, ED = Emergency Department, EHS = BC Emergency Health Services, LAMA = Left Against Medical Advice, LWBS = Left Without Being Seen, MSP = Medical Services Plan, NACRS = National Ambulatory Care Reporting System, VS = BC Vital Statistics.

services to the ED (42.0% with ED attachment; Figure 2 Box H). Additionally, 6,442 overdose events were reported in ED records without an EHS record, suggesting that contact with the health services was initiated at the ED (e.g. walk-in, transported to ED by means other than ambulance) (38.5% with ED attachment; Figure 2 Box I). A total of 1,390 overdose events were reported only in DPIC or MSP and were assumed to have been in the ED although there was no ED record (8.3%

with ED attachment; Figure 2 Box G). Finally, 1,877 overdose events had hospitalization records indicating overdose but did not have an ED record (11.2% of overdose events with ED attachment, Figure 2 Box J). These overdose events were also assumed to have come through an ED.

A total of 15,328 overdose events had information on discharge or hospitalization from the ED (Figure 2 Box H, I, J), noted here as ED discharge. A total of 45 people died

Figure 2: Pathways of care for overdose events, BC Provincial Overdose Cohort, 2015–2017



after being seen in the ED (0.3% with ED discharge, Figure 2 Box K). A further 11,678 overdose events were survived and discharged from the ED, representing the majority of overdose events in the ED (76.2% with ED discharge, Figure 2 Box L). In 199 cases, ED records indicated that the person left the ED against medical advice or left without being seen (1.3% with ED discharge, Figure 2 Box M). A total of 3,406 overdose events resulted in hospitalization (22.3% with ED discharge; Figure 2 Boxes N, O). However, only 2,376 overdose events with hospitalization were for reasons related to overdose (15.5% with ED discharge; Figure 2 Box O). Among overdose events with hospitalization records for overdose, 2,270 had a record of hospital discharge (95.3% of hospitalized, Figure 2 Box Q) and 106 died in hospital (4.7% of hospitalized, Figure 2 Box P).

The proportion of total overdose events and deaths captured by each data source is shown in Figure 3. Approximately 71.6% overdose events were captured in emergency health services records and indicated paramedic attendance. Approximately 39.4% of overdose events were captured in ED data or case-based reporting. Only 6.7% of overdose events were reported in hospital records with a code for overdose. Similarly, 15.5% of overdose deaths (healthcare-attended and unattended) were reported in emergency health services data, while 1.4% were reported in ED data and 3.5% were reported in hospitalization records (Figure 3).

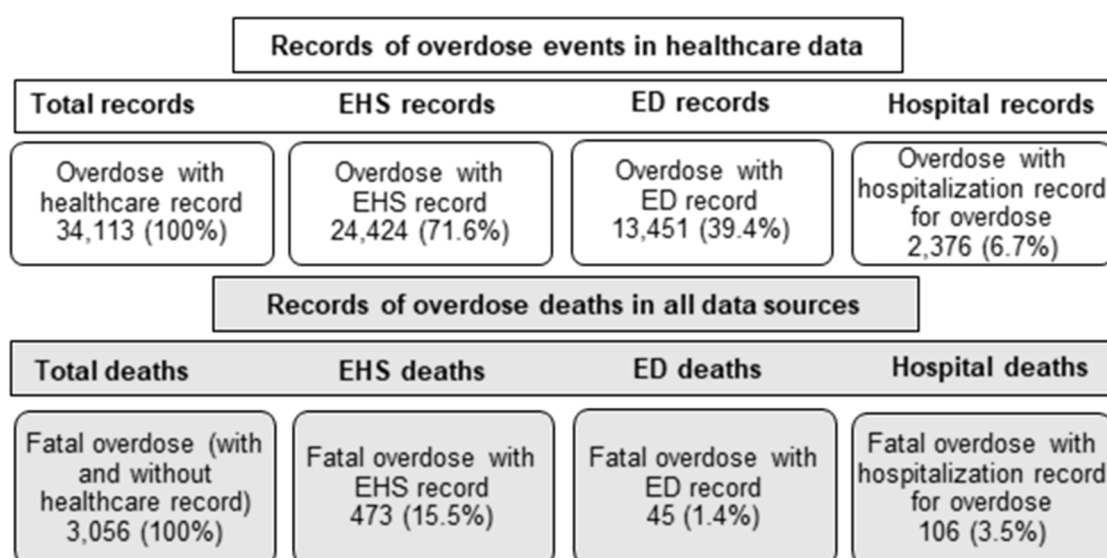
For our secondary objective, we compared data sources to identify discrepancies across administrative data. About

9.6% ( $n=3,267$ ) of all overdose events were assumed to be seen in the ED but did not have an ED record. These events had either a hospital record ( $n=1,877$ , Figure 2 Box J) or a record of physician attendance in MSP or DPIC ( $n=1,390$ , Figure 2 Box G). This may indicate lower estimation of overdose events when using case-based ED data alone. When examining hospitalization data, 3,406 overdose events assumed to have been seen in the ED also had hospitalization records (Figure 2 Box N,O). Nonetheless, only 2,376 of these records indicated overdose in the hospital record (69.6% of all hospitalizations, Figure 2 Box O), suggesting that hospitalizations with an overdose code may underestimate the number of hospitalizations following overdose events in the ED. Finally, not all drug overdose deaths are captured in both sources of death data in BC, as 6.2% of overdose fatalities were observed in the Vital Statistics database but not in data from the BC Coroner's Service.

## Discussion

This study describes pathways of overdose events in administrative and mortality records from 2015 to 2017 in British Columbia, Canada. We used the BC Provincial Overdose Cohort to quantify reporting of overdose events in linked administrative data from emergency medical services, emergency departments, health visit billing, calls to the poison control centre, hospitals, coroners' investigations, and vital

Figure 3: Proportions of overdose events and deaths recorded in healthcare data by source, BC Provincial Overdose Cohort, 2015–2017\*



\*Overdose events may be recorded in multiple sources of administrative data.

statistics. The cohort included 3,056 overdose-related deaths recorded in either coroners' data or vital statistics, and nearly 80% of these had no record of contact with the healthcare system. We further identified 34,113 fatal and non-fatal overdose events with at least one record of contact with the healthcare system. Of these, only 624 (less than 2%) were fatal. These findings are consistent with other reports that many overdose events occur without contact with health services. For instance, Canadian evidence indicates that in 35% to 65% of drug poisoning situations, bystanders at an overdose event did not call 911 to seek help from emergency medical services [10]. Additionally, nearly 70% of people who died of an overdose related to illicit drugs in BC in 2016 and 2017 were alone at the time of consumption [11]. Other findings from this cohort have shown that in 78% of overdose deaths there was no associated ambulance response, and that 62% of fatal overdoses occurred in private residences [5]. The evidence presented here further highlights the burden of fatal overdoses among people who do not seek health services.

This analysis also contributes to the literature by quantifying pathways of healthcare records and associated service use during an overdose event, which has not previously been reported. Most pathways followed the overdose reporting pyramid from EHS services through ED and hospital, with discharges at each stage. However, other pathways of recorded healthcare use were also observed. Many overdose events had a record of admission to the ED with no emergency health services record, indicating alternate transport to the hospital (e.g. walk-in, driven by friend or family member) or data linkage or event reporting issues. Additionally, approximately 1% of events in the ED were recorded as left without being seen or left against medical advice rather than discharge. In this cohort, prior research suggests that between 4.2% and 7.1% of emergency department visits may be recorded as left without being seen or against medical advice [12, 13]. As well, among people with an ED visit for overdose who were subsequently hospitalized, only 70% had a hospitalization

record that included overdose, suggesting that not all pathways of care from ED to hospital are related to overdose. As such, the overdose reporting pyramid may not capture all pathways of care.

These results also demonstrate differences in estimates of opioid overdose events that may arise when using multiple sources of data, the secondary objective of this manuscript. The main differences we identified were overdose events that did not have a record in case-based ED data but indicated an ED visit in other data sources (i.e. MSP, DPIC). These differences may have arisen from limitations in recording or linking data such as errors in provincial healthcare numbers, errors in data coding, transfers to the emergency department that were not captured in one or more data sources, or other data quality issues. As well, approximately 6% of overdose decedents identified in Vital Statistics were not identified in the BC Coroners Service data. This may indicate differences in classifications of deaths, errors in record linkage, cases that were not investigated by coroners, or mismatch in the datasets due to timing and reconciliation of differences in data linkage. Information from these data sources is continually being examined to correct differences. Taken together, these findings indicate the potential for improved case identification when relying on more than one source of administrative data.

The findings from this work demonstrate the need for interventions for overdose both within and outside of the healthcare system. Nearly 80% of fatal overdoses had no reported healthcare contact, indicating potential structural barriers to access to the healthcare system. Reluctance in calling emergency health services, being absent when emergency health services arrive, or declining transport to hospital after an overdose have been long-standing concerns in British Columbia [14, 15]. People who use drugs may be reluctant to call 911 due to concerns about police presence, illicit drug position, lack of access to a phone, or thinking the person experiencing an overdose would be OK [15–17]. Existing policies to reduce hesitancy in seeking healthcare

include reducing police presence and the Good Samaritan Drug Overdose Act (2017) [15, 18]. These findings further suggest the potential need for low-barrier interventions that can be accessed outside of the healthcare system, such as peer-supported overdose prevention services [19].

The findings also have several practical applications to understanding the burden of overdose events in other contexts. Firstly, as other Canadian jurisdictions may have access to similar data at the provincial or territorial level, provinces or territories may consider linking their datasets to develop similar comprehensive overdose event records. Similar linked datasets have been reported in the provinces of Alberta and Ontario, Canada, as well as in Maryland, USA, and may be leveraged to understand pathways to care for people experiencing overdose in these contexts [20–23]. Secondly, these data can also contribute to estimating the overdose burden when using only a single data source. For instance, 72% of healthcare-attended overdose events were observed in emergency health services data, while 39% were observed in ED records. These proportions may provide one line of evidence that can contribute to estimating the population burden of reported overdose events using similar data sources. Thirdly, these results can be applied to understanding the implications of using multiple data sources on overdose reporting. In estimating overdose events in the ED, we included events with records in the BC Medical Services Plan and the Drug Poison and Control Centre as well as from case-based ED data. MSP and DPIC data identified 1,390 additional overdose events when compared to ED data alone (6% of total healthcare attended overdoses). As such, large sources of administrative data such as ED records may capture the majority of overdose events but could also be supplemented when additional data are available.

In future work, these findings will contribute to understanding the total burden of overdose events in British Columbia. These results provide a partial picture of overdose burden as observed in healthcare records and mortality data, but do not include non-fatal overdose events that did not have contact with health services. This can be approximated by combining information on naloxone use and healthcare contact. Karamouzian et al. estimated that emergency health services were called for 56% of people receiving naloxone from bystanders in BC from 2015 to 2017 [15]. When emergency health services were not called, a small proportion of overdose events were reported as fatal while the majority responded to naloxone and survived the event with no record in health administrative data [13]. Using the pathways diagram presented here as well and background literature, future research will use statistical modelling techniques to estimate the total number of healthcare-attended and healthcare-unattended overdose events [24]. This will enhance our understanding of the true burden and contribute to assessing the impact of policy and interventions at a systems level [25].

This analysis has several strengths. The pathways approach used here avoids overestimates of overdose events that may occur by simply adding numbers from different sources of data. The use of a linked dataset, the BC Provincial Overdose Cohort, illustrates the value of using linked administrative data to understand how people experiencing overdose events are captured in healthcare data [5]. Another strength of this work

is its replicability, particularly in other Canadian contexts that use the same or similar sources of administrative data. Finally, this work quantifies discrepancies in data sources that can be considered in future estimates of overdose events that leverage multiple data sources.

Several limitations should also be noted. The data used in these analyses were not collected for research purposes and the case definitions for overdose events may vary by dataset (Supplementary Appendix 1). Secondly, while we were able to identify and quantify discrepancies between records in different sources of administrative data, the sources of these discrepancies are not clear. In addition, there may be some overlap in data sources that was not accounted for due to miscoding or errors in matching algorithms. There are also limitations to individual data sources, such that we could not determine whether people who had contact with EHS who were not transported to hospital were gone on arrival or refused transport. Data from the ODC from 2015–2016 indicated that 16% of EHS-attended overdoses were not transported to hospital [14]. Finally, this analysis only included overdose events from 2015 to 2017, and patterns of overdose and capture in healthcare data sources may have changed since this time.

## Conclusion

This paper describes pathways of recorded healthcare contact among adults who experienced opioid and other illicit drug overdose events in British Columbia, Canada from 2015 to 2017. The majority of fatal overdose events occurred with no contact with the healthcare system immediately prior to the death. Among overdose events that were captured in healthcare records, the majority of records indicated survival of an overdose after contact with emergency services. These findings emphasize the importance of accessing timely healthcare for people experiencing overdose. This work also demonstrates the usefulness of leveraging multiple linked sources of data to understand healthcare pathways among people who experience overdose. These findings will be further applied to understand the overall population burden of overdose events and to model the potential impacts of intervention both within and outside the healthcare system.

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## Conflicts of interest

None declared.

## Ethics statement

This project was completed as part of BCCDC's public health mandate and no institutional ethics approvals were required.

## Supplementary appendices

Supplementary Appendix 1: Definitions and Data Sources for All Pathways of Overdose Events, 2015–2017.

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## Abbreviations

|        |                                           |
|--------|-------------------------------------------|
| BCCS:  | BC Coroners Service                       |
| DAD:   | Discharge Abstract Database               |
| DPIC:  | BC Drug and Poison Information Centre     |
| ED:    | Emergency Department                      |
| EHS:   | BC Emergency Health Services              |
| MSP:   | Medical Services Plan                     |
| NACRS: | National Ambulatory Care Reporting System |
| ODC:   | BC Provincial Overdose Cohort             |
| VS:    | BC Vital Statistics Agency                |



## Supplementary Appendix 1: Definitions and data sources for all pathways of overdose events, 2015–2017

| Data source                                       | Definition of record of overdose                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BC Coroner's Service (BCCS)                       | Open and closed cases of accidental and undetermined illicit drug-related overdose deaths in British Columbia, Canada                                                                                                                                                                                                                                                                                                                                                                                   |
| Canadian Vital Statistics Deaths Database         | ICD-10 codes<br>Underlying cause of death (UCOD) starts with T40.0 (poisoning from opium), T40.1 (poisoning from heroin), T40.2, T40.3, T40.4, T40.6 (T40.2-T40.6 poisoning from other opioids), or<br>Contributing cause of death (CCOD) starts with T40.1 (poisoning from heroin), T40.2, T40.3, T40.4, T40.6 (T40.2-T40.6 poisoning from other opioids).<br>Excluded cases where ICD codes began with J (indicating medical assistance in dying).                                                    |
| BC Emergency Health Services (EHS)                | Reporting from Patient Care Information System -<br>Naloxone administered by paramedics or Recreational drug OD impression code or CARD 9 (Cardiac or respiratory arrest/death), 23 (overdose/poisoning (ingestions)), 26 (sick), 31 (unconscious), Cardiac arrest impression code and CARD 23 (overdose/poisoning (ingestion))<br>Reporting from Siren - Naloxone administered, 'Opioid Related' or 'Opioid Related / OD' impression code, Cardiac Arrest and CARD 23 (overdose/poisoning (ingestion)) |
| National Ambulatory Care Reporting System (NACRS) | ICD-10 code T40.0 (poisoning from opium), T40.1 (poisoning from heroin), T40.2, T40.3, T40.4, T40.6 (T40.2-T40.6 poisoning from other opioids) in diagnostic code fields                                                                                                                                                                                                                                                                                                                                |
| Case-based reporting by Emergency Department (ED) | Case-based reporting based on physician's assessment of clinical symptoms indicated opioid overdose, regardless of patient's self-reported drug use. Used for Interior Health Authority, Vancouver Island Health Authority, and Northern Health Authority.                                                                                                                                                                                                                                              |
| Medical Services Plan (MSP)                       | If any diagnostic code was ICD-9: 965.0 (poisoning by opiates and related narcotics) or ICD-10: E850.0<br>965.0 (poisoning by opiates and related narcotics) or<br>E850.0 (accidental poisoning by opiates and related narcotics)                                                                                                                                                                                                                                                                       |
| Drug Poison and Control Centre (DPIC)             | Any call with an AAPCCGenCode indicative of an opioid, with or without the involvement of other drugs/alcohol: 37701–05, 37707–8, 37784, 41700, 72700, 72702, 72704, 77810, 200625, 200628, 200630, 200638, 201063, 201131                                                                                                                                                                                                                                                                              |
| Discharge Abstract Database (DAD)                 | ICD-10 code T40.0 (poisoning from opium), T40.1 (poisoning from heroin), T40.2, T40.3, T40.4, T40.6 (T40.2-T40.6 poisoning from other opioids) and corresponding diagnosis type as M (most responsible diagnosis), 2 (post-admit comorbidity), W (service transfer), X (service transfer), Y (service transfer), 6 (proxy for most responsible diagnosis) in the diagnostic code fields                                                                                                                 |

