Original quantitative research

Patterns of health care utilization among people who overdosed from illegal drugs: a descriptive analysis using the BC Provincial Overdose Cohort

Michael C. Otterstatter, PhD (1,2); Alexis Crabtree, MD, PhD (1,2); Sabina Dobrer, MA (1);
Brooke Kinniburgh, MPH (3); Salman Klar, MPH (3); Anthony Leamon, MSc (4,5); Jennifer May-Hadford, MPH (6,7);
Christopher Mill, MPH (1,7); Mina Park, MSc (1,5); Andrew W. Tu, PhD (8); Lu Zheng, BSc (9)

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Abstract

Introduction: British Columbia (BC) declared a public health emergency in April 2016 in response to a rapid rise in overdose deaths. Further understanding of health care utilization is needed to inform prevention strategies for individuals who overdose from illegal drugs.

Methods: The Provincial Overdose Cohort includes linked administrative data on health care utilization by individuals who experienced an illegal drug overdose event in BC between 1 January 2015 and 30 November 2016. Overdose cases were identified using data from ambulance services, coroners' investigations, poison control centre calls and hospital, emergency department and physician administrative records. In total, 10 455 overdose cases were identified and compared with 52 275 controls matched on age, sex and area of residence for a descriptive analysis of health care utilization.

Results: Two-thirds (66%) of overdose cases were male and about half (49%) were 20–39 years old. Over half of the cases (54%) visited the emergency department and about one-quarter (26%) were admitted to hospital in the year before the overdose event, compared with 17% and 9% of controls, respectively. Nevertheless, nearly one-fifth (19%) of cases were recorded leaving the emergency department without being seen or against medical advice. High proportions of both cases (75%) and controls (72%) visited community-based physicians. Substance use and mental health–related concerns were the most common diagnoses among people who went on to overdose.

Conclusion: People who overdosed frequently accessed the health care system in the year before the overdose event. In light of the high rates of health care use, there may be opportunities to identify at-risk individuals before they overdose and connect them with targeted programs and evidence-based interventions. Further work using the BC Provincial Overdose Cohort will focus on identifying risk factors for overdose events and death by overdose.

Keywords: drug overdose, harm reduction, healthcare, opioids, street drugs

Highlights

- BC's Provincial Overdose Cohort is a linked database with data on health care utilization of individuals overdosing from illegal drugs. People's health histories provide insight into patterns of acute and primary care prior to overdose events.
- Overdose cases have high rates of health care use, suggesting opportunities to identify at-risk individuals before they overdose and connect them with targeted programs and evidence-based interventions.
- A substantial proportion of people who went on to overdose left the emergency department without being seen or against medical advice, which suggests missed opportunities for engagement in care.
- Substance use and mental health–related concerns were the most common diagnoses among people who went on to overdose.

Author references:

1. BC Centre for Disease Control, Vancouver, British Columbia, Canada
2. School of Population and Public Health, University of British Columbia, Vancouver, British Columbia, Canada
3. Fraser Health Authority, Surrey, British Columbia, Canada
4. Island Health Authority, Victoria, British Columbia, Canada
5. BC Observatory for Population and Public Health, BC Centre for Disease Control, Vancouver, British Columbia, Canada
6. First Nations Health Authority, Vancouver, British Columbia, Canada
7. Public Health Agency of Canada, Ottawa, Ontario, Canada
8. BC Coroners Service, Burnaby, British Columbia, Canada
9. BC Emergency Health Services, Victoria, British Columbia, Canada

Correspondence: Michael Otterstatter, BC Centre for Disease Control, 655 W 12th Avenue, Vancouver, BC V5Z 4R4; Tel: 604-707-2853; Email: michael.otterstatter@bccdc.ca

Introduction

British Columbia (BC) declared a public health emergency in April 2016 due to a rapid rise in opioid overdose deaths.[1] Despite expanded opioid-related harm reduction and public health efforts, deaths from illegal drug overdose continue to rise, with 1422 deaths in 2017 alone. More than 80% of these deaths involved the potent opioid fentanyl.[2]

Established strategies to prevent or treat an opioid overdose include the distribution of take-home naloxone kits,[3] treatment of mental illness[4] and opioid agonist therapy (OAT).[5] Understanding how people who overdose use the health care system could help identify points of contact for engagement in supportive care and in delivery of evidence-based interventions.[6] Furthermore, an investigation of health care diagnoses may reveal patterns that indicate a high risk of overdose or that can provide information on comorbidities that increase risk of death from overdose.

The purpose of this study was to describe health care utilization and associated diagnoses among individuals who experienced an illegal drug overdose event, as identified in BC's Provincial Overdose Cohort. We compared frequencies and patterns of health care use among overdose cases and matched controls, using hospital, emergency department and physician administrative data.

Methods

Data source

The Provincial Overdose Cohort includes linked administrative data on health care utilization by individuals experiencing an illegal drug overdose event in BC. Detailed information on the cohort is available from the authors upon request. Briefly, individuals experiencing overdoses were identified using data from the BC Ambulance Service (BCAS), Drug and Poison Information Centre (DPIC), BC Coroners Service (BCCS), case-based reporting from emergency departments, National Ambulatory Care Reporting System (NACRS), Discharge Abstract Database (DAD) and Medical Services Plan (MSP). Five years of health history were then appended at a patient-level from DAD (all

hospital discharge summaries), NACRS (all emergency department visits), MSP (all fee-for-service physician billing records) and PharmaNet (all prescription dispensations in community pharmacies).

The cohort includes individuals who experienced an overdose event between 1 January 2015 and 30 November 2016. This period represents the beginning of the rapid rise in opioid-related illicit drug deaths observed in BC. An overdose event is defined by any of the following criteria: administration of the opioid antagonist naloxone by paramedics; a call to the Drug and Poison Information Centre about an opioid-related event; physician-diagnosed opioid overdose at the emergency department (from case-based reporting); coroner-determined illegal drug overdose death;* visit to hospital, emergency department or physician with an associated opioid overdose diagnosis code (from DAD [ICD-10-CA codes T40.0, T40.1, T40.2, T40.3, T40.4 or T40.6 as most responsible diagnosis], NACRS [ICD-10 codes T40.1 or T40.6 in the primary discharge diagnosis field] or MSP [ICD-9 codes 965.0 or E850.0 in the primary diagnostic field]). Related events present in multiple datasets (e.g. a single overdose involving ambulance response, transport to emergency department and admission to hospital) were grouped to prevent double counting of overdoses. A detailed description of the Provincial Overdose Cohort and validation of the overdose case definition are currently being prepared for publication.

Health care utilization among cases was compared with matched controls. Controls were selected from a 20% random sample of the 2016 BC population (overdose cases removed). Cases were matched 1:5 without replacement to controls based on birth year, sex and Local Health Area of residence. For each case, health care utilization was examined over the one-year period prior to the first recorded overdose event in the cohort data; we did not consider any subsequent overdoses for an individual or their health care utilization after this first overdose event. For controls, health care utilization was compared during the same one-year period as the matched case.

Data analysis

For this analysis, we considered only diagnoses in the primary diagnostic field of each dataset. DAD and NACRS diagnoses were grouped based on the first three characters of the ICD-10-CA code. MSP visits included only those occurring in a community setting (i.e. where service location was indicated as practitioner's office in the community), because our focus was to characterize engagement with community-based physicians. We compared cases and controls in two ways: the number of individuals with at least one visit and the total number of visits in each setting. We focused on the most common diagnoses among cases in the year prior to (but not including) the first recorded overdose event. Chi-square tests were used to compare differences in proportions and exact Poisson tests to compare rates.

The Provincial Overdose Cohort included 10 456 individuals who experienced an illegal drug overdose event in BC during the study period (1 January 2015 to 30 November 2016). As suitable controls could not be found for one case, our comparisons of health care utilization used 10 455 cases and 52 275 matched controls.

Results

The demographic and health care utilization profiles of cases and controls are shown in Table 1. Two-thirds of overdose cases were male (66% vs. 34% female) and about half were 20–39 years of age (5%, 0–19 years; 49%, 20–39 years; 35%, 40–59 years; 12%, 60+ years). Over half of the cases (60%) visited the emergency department in the year before the overdose event, compared with 17% of the controls ($p < 0.001$). Approximately one-third (32%) were admitted to hospital, compared with 9% of controls ($p < 0.001$). High proportions of both cases and controls visited community-based physicians (81% vs. 72%, respectively; $p < 0.001$). Overall, 89% of cases had at least one visit to the emergency department, hospital or community physician in the year prior to the overdose event compared with 74% of controls ($p < 0.001$). There were no records of any visits during this time for 11% of cases and 26% of controls. Considering rates of health care use, cases

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* Open or closed coroner investigations involving street drugs (e.g. heroin, cocaine, MDMA, methamphetamine); medications that were not prescribed to the deceased; combinations of the above, with prescribed medications; and overdoses where the origin of the drug is not known.

TABLE 1
Summary of demographics and health care utilization by overdose cases and matched controls in the BC Provincial Overdose Cohort

Parameter		Overdose cases		Matched controls		p-value
		Number (n)	Proportion (%)	Number (n)	Proportion (%)	
Sex	Male	6 927	(66.3)	34 635	(66.3)	1.00
	Female	3 528	(33.7)	17 640	(33.7)	1.00
Age group, years	0–19	469	(4.5)	2 405	(4.6)	0.63
	20–39	5 123	(49.0)	25 655	(49.1)	0.89
	40–59	3 652	(34.9)	18 181	(34.8)	0.78
	60+	1 211	(11.6)	6 034	(11.5)	0.92
Health care, number (and proportion) of individuals with any visits	Any emergency department visits	6 310	(60.4)	8 990	(17.2)	< 0.001
	Any hospital admissions	3 295	(31.5)	4 912	(9.4)	< 0.001
	Any community physician visits	8 445	(80.8)	37 425	(71.6)	< 0.001
	Any emergency department or hospital or community physician visits	9 284	(88.8)	38 480	(73.6)	< 0.001
Health care, number (and rate) of total visits	Emergency department visits	30 830	(2 948.8)[a]	16 105	(308.1)[a]	< 0.001
	Hospital admissions	7 356	(703.6)[a]	6 790	(129.9)[a]	< 0.001
	Community physician visits	156 944	(15 011.4)[a]	279 385	(5 344.5)[a]	< 0.001

[a] Rate per 1000 individuals.

visited the emergency department 9.6 times more often than controls, were admitted to hospital 5.4 times more often than controls and visited community physicians 2.8 times more often than controls ($p < 0.001$ for each comparison; Table 1).

Among cases, 3 of the top 10 emergency department diagnoses and 4 of the top 10 hospital diagnoses concerned drug- and alcohol-related disorders (Table 2). Across all visits, substance-related diagnoses (includes all diagnoses related to alcohol and drugs) were more common among cases than controls in emergency departments (18% vs. 2% of all visits with diagnosis; $p < 0.001$) and as a primary reason for hospitalization (21% vs. 1% of all admissions; $p < 0.001$). Similarly, across all visits, mental health–related diagnoses (includes all diagnoses related to mental health conditions excluding those implicating drugs or alcohol) were more common among cases than controls in emergency departments (11% vs. 5% of all visits with diagnosis; $p < 0.001$) and in hospitals (14% vs. 5% of admissions; $p < 0.001$). A notably larger proportion of cases than controls (19% vs. 4% of individuals; $p < 0.001$) left the emergency department without being seen or against medical advice.

A large proportion of the visits made by cases to community-based physicians were coded as drug dependence (37% among cases vs. 6% among controls; $p < 0.001$). The majority of these drug dependence visits (72.8% for cases; 88.3% for controls) were during periods when the individual was on opioid agonist therapy, as determined by prescription dispensation history. Aside from visits related to drug dependence, the frequencies of common community physician diagnoses were similar among cases and controls. However, when numbers of individuals rather than numbers of visits are compared, a greater proportion of cases were diagnosed with depression (18% vs. 6%; $p < 0.001$), anxiety (14% vs. 6%; $p < 0.001$), neurotic disorders (12% vs. 4%; $p < 0.001$) and schizophrenic psychoses (3% vs. 1%; $p < 0.001$) in the year before the overdose event.

Other diagnoses that were more common among cases than controls included chronic obstructive pulmonary disease (COPD: 3% vs. 1% of hospital admissions; $p < 0.001$) and skin infections (cellulitis: 5% vs. 3% of emergency department visits; $p < 0.001$). Pain-related diagnoses represented a slightly smaller fraction of visits among cases than among controls (abdominal, pelvic and back pain: 5% vs. 7% of emergency department visits; $p < 0.001$).

Discussion

People who overdosed from illegal drugs used the health care system frequently in the year prior to the event as observed in terms of emergency department visits, inpatient admissions and appointments with community physicians. Previous studies in Australia and the United States found similar high levels of emergency department and hospital use among drug users.[7–10] Although other studies have suggested that people who use drugs visit primary care and preventive health services at lower rates,[8] we found the proportion accessing community physicians to be about the same as matched controls. An important caveat is that about one-quarter of community physician visits coincided with periods of opioid agonist therapy (e.g. methadone, suboxone) and thus may have been regular clinic check-ins and urine drug testing.[5]

A small but significant percentage of cases (11%) had no contact with emergency departments, hospitals or community physicians in the year before the overdose event. Preventing these overdoses should focus on identifying and reducing barriers to caring for people who use drugs, including stigma among health care providers. The proportion of people not engaged with medical care also highlights a need for interventions outside a clinical

TABLE 2
Health care diagnoses in the year prior to the first recorded overdose among illegal drug overdose cases compared with matched (non-overdose) controls, BC Provincial Overdose Cohort

Type	Rank	ICD-9/10 code[a]	Diagnosis	Overdose cases		Matched controls	
				Visits, %[b] (n)	Individuals, %[b] (n)	Visits, %[b] (n)	Individuals, %[b] (n)
Emergency department visits	1	Missing	No diagnosis recorded[c]	21.4 (5 132)	35.5 (1 987)	24.4 (3 936)	28.6 (2 567)
	2	Z76	LWBS / AMA[d]	7.1 (1 707)	19.0 (1 063)	2.7 (433)	4.3 (390)
	3	L03	Cellulitis/acute lymphangitis	5.0 (1 213)	11.5 (643)	2.7 (432)	2.9 (262)
	4	F10	Alcohol-related disorders	4.6 (1 114)	7.6 (424)	0.5 (82)	0.8 (74)
	5	F19	Mental/behavioural disorders from multiple drugs	2.8 (684)	8.8 (492)	0.2 (27)	0.3 (24)
	6	R10	Abdominal and pelvic pain	2.7 (650)	7.1 (399)	4.3 (693)	6.2 (554)
	7	T51	Toxic effect of alcohol	2.6 (635)	3.8 (214)	0.2 (39)	0.4 (35)
	8	Z51	Other medical care	2.4 (582)	6.1 (341)	2.1 (346)	2.9 (262)
	9	F23	Brief psychotic disorder	2.2 (524)	5.4 (303)	0.6 (91)	0.7 (59)
	10	M54	Back pain	2.0 (487)	5.6 (313)	2.4 (392)	3.9 (347)
Hospital admissions	1	F10	Alcohol-related disorders	6.6 (372)	8.4 (230)	0.4 (25)	0.5 (23)
	2	F19	Mental/behavioural disorders from multiple drugs	4.6 (260)	7.7 (211)	0.2 (12)	0.2 (11)
	3	F15	Mental/behavioural disorders from stimulants	3.7 (208)	5.8 (157)	0.5 (35)	0.5 (23)
	4	J44	COPD	3.2 (182)	3.5 (95)	0.9 (59)	0.9 (45)
	5	F11	Mental/behavioural disorders from opioids	2.4 (138)	4.5 (122)	0.1 (6)	0.1 (5)
	6	Z51	Other medical care	2.4 (137)	2.1 (56)	3.4 (228)	1.9 (91)
	7	F20	Schizophrenia	2.4 (135)	3.0 (81)	1.2 (79)	1.0 (47)
	8	F29	Unspecific psychosis (non-drug)	2.2 (123)	3.6 (99)	0.6 (38)	0.6 (31)
	9	L03	Cellulitis/acute lymphangitis	2.1 (121)	3.7 (101)	0.4 (26)	0.4 (22)
	10	J18	Pneumonia	1.8 (102)	3.3 (91)	0.7 (46)	0.9 (44)
Community physician visits	1	304	Drug dependence	36.7 (45 012)	29.9 (2 356)	5.6 (15 669)	1.4 (522)
	2	01L[e]	Laboratory tests	2.9 (3 622)	11.1 (879)	1.0 (2 827)	3.1 (1 143)
	3	311	Depression	2.6 (3 233)	18.1 (1 428)	2.0 (5 671)	6.4 (2 397)
	4	781	Nervous and musculoskeletal symptoms	2.1 (2 593)	14.9 (1 176)	2.1 (5 940)	9.5 (3 570)
	5	50B[e]	Generalized anxiety	1.9 (2 369)	14.4 (1 138)	1.3 (3 767)	5.5 (2 041)
	6	780	General symptoms	1.9 (2 299)	14.8 (1 164)	2.4 (6 787)	12.0 (4 509)
	7	300	Neurotic disorders[f]	1.6 (2 009)	12.2 (959)	1.1 (3 084)	4.0 (1 506)
	8	724	Other/unspecified back disorders	1.3 (1 587)	8.3 (652)	1.1 (2 993)	4.1 (1 551)
	9	250	Diabetes	1.1 (1 401)	5.2 (409)	2.6 (7 140)	6.0 (2 246)
	10	295	Schizophrenic psychoses	0.9 (1 126)	3.2 (256)	0.3 (901)	0.5 (196)

Abbreviations: AMA, Against Medical Advice; COPD: chronic obstructive pulmonary disease; ICD, International Classification of Diseases; LWBS, Left Without Being Seen

[a] Ten most common health care diagnoses, in terms of number of visits.

[b] Percentages are the proportions of all visits or individuals, not just of those in the top 10 diagnoses.

[c] Similar proportions of case and control visits to emergency departments lacked a diagnosis code, reflecting incompleteness of the data submitted to the National Ambulatory Care Reporting System (NACRS).

[d] Emergency department diagnosis Z76 modified to include only Left Without Being Seen / Against Medical Advice (LWBS / AMA) and excludes issues of repeat prescriptions.

[e] Codes 01L and 50B are specific to Medical Services Plan (MSP) and not part of standard ICD classification.

[f] Neurotic disorders include various anxiety, dissociative and somatoform disorders, but not depression.

setting, such as supervised consumption sites/overdose prevention sites[11,12] and advocacy organizations of people who use drugs.

It is troubling, but not entirely unexpected, to note the high rates of subsequent overdose among people who leave the emergency department without being seen or against medical advice. This finding is consistent with a recent systematic review that found that drug use is a risk factor for leaving inpatient treatment against medical advice.[13] Interventions to reduce leaving against medical advice include providing harm reduction services in hospitals†, improving responses to subjective symptoms such as pain and withdrawal, and developing initiatives to challenge stigma in health care settings.[14]

Substance use and mental health–related concerns were found to be the most common diagnoses during health care visits by people who later overdose, which is consistent with previous studies.[7,15] Of particular note is that diagnoses related to alcohol, stimulant and polysubstance use were frequent in this population, highlighting (as others have found[16,17]) the role of polysubstance use in predisposing to overdose.

Several other physical health diagnoses were more common among cases than controls. COPD stands out as a relatively frequent reason for hospitalization among cases. Tobacco use—the most important risk factor for developing COPD—is more prevalent among people with mental health and substance use disorders.[18,19] In addition, hospitalization is typically recommended when a patient with COPD is known to have unstable housing or is otherwise at risk of being lost to follow-up, which may be true of many people with problematic substance use. A similar rationale may be applied when ensuring adequate supervision of care for patients with pneumonia and cellulitis. Cellulitis, in particular, is known to be more common among injection drug users.[20]

Given that our results are based on available administrative data, some limitations should be noted. These data do not capture all individuals who overdosed and may not be equally representative across time and health regions due to differences in reporting and completeness. Furthermore, diagnoses recorded in administrative datasets do not necessarily indicate the specific context of a health care visit. The lack of specific information on exposure substances, for example, makes it difficult to distinguish overdoses from street drugs versus overdoses from prescription medication. In addition, approximately 20% of the emergency department (NACRS) data did not have a physician diagnosis, both for cases and controls, which therefore limited our understanding of these visits. In addition, coroner cases included both suspected and concluded investigations; suspected cases are based on preliminary circumstances and may change to a different classification or cause of death once the coroner investigation is concluded.

This study was conducted in collaboration with data providers and the provincial and regional stakeholders involved in overdose response. Findings were disseminated through these partners to inform service delivery and improve our understanding of opportunities for overdose prevention. Further analyses are under way to incorporate other patient characteristics (e.g. age, gender, socioeconomic status, comorbidities) that may be important in determining health care utilization and risk of overdose death. Understanding patterns of health care use among people who use illegal drugs could help to identify at-risk individuals, as well as inform targeted treatment efforts that connect individuals to further follow-up and evidence-based interventions.

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Conflicts of interest

The authors have no conflicts of interest to declare.

Authors' contributions and statement

MCO designed, analyzed and interpreted the data and drafted and revised the paper; AC interpreted the data and drafted and revised the paper; SD analyzed and interpreted the data and revised the paper; BK, SK, AL, JMH, CM, MP, AWT and LZ interpreted the data and revised the paper.

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† A growing number of BC hospitals now have a suite of harm reduction services in place, including overdose outreach teams, take-home naloxone kit distribution[21] and addiction nursing / addiction medicine teams in emergency departments and inpatient units.

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