



TOPIC: Demographic Factors, Incarceration History and Risk Of Overdose-Related Death

Date: October 31st, 2019

Data Source: Provincial Overdose Cohort

Background:

- The B.C. Provincial Overdose Cohort is a set of linked datasets related to overdose events, including overdose-related deaths, ambulance, emergency room, hospital, physician, and prescription records. The datasets were brought together to better understand factors associated with overdose in order to target provincial, regional, and local response activities.
- It is well established that persons with criminal justice system involvement have poorer health outcomes compared to the general population, however no studies in Canada have estimated overdose-related death in relation to incarceration history during the fentanyl era.
- The objectives of this analysis were to: 1) measure the demographic, health care utilization, prescribing histories and neighborhood characteristics that are associated with overdose-related death among the general population in British Columbia, and 2) determine how incarceration history affects risk of overdose-related death in relation to personal and neighborhood characteristics.

Sample:

- All persons included in the 20% sample of BC general population in the Provincial Overdose Cohort (N=708,935) who were aged 18 years and over by January 1, 2015.
- Incarceration data were sourced from BC Corrections. It included both sentenced and remanded persons who spent at least one day incarcerated during the exposure period (January 1, 2010 – December 31, 2014).

Study Design and Methods:

- A cohort study design was used to examine overdose-related death from 2015-2017 in relation to incarceration in a provincial correctional institution (people with a sentence length < 2 years, less one day), demographic factors, pharmacy dispensations, and neighborhood characteristics from 2010-2014.
- Chi-square tests were used to compare categorical variables in relation to overdose-related death (Table 1). Univariate and multiple logistic regressions were used to calculate odds ratios (ORs) and 95% confidence intervals for overdose-related death in relation to selected characteristics (Tables 2 and 3).



Key Findings

Incarceration History and Overdose-Related Death:

- Overall, 20.0% of persons who had a fatal overdose-related death in 2015-2017 were previously incarcerated (2010-2014) in a provincial correctional institution compared to 0.6% of persons who did not have an overdose-related death (Table 1).
- Persons who had any incarceration history during 2010-2014 were 4.1 times more likely to die from overdose-related causes compared with those who did not have incarceration history (Table 2):
 - o History of 1 provincial incarceration: Formerly incarcerated persons were 3.5 times (250%) more likely to have a fatal drug-related overdose compared to persons who were not formerly incarcerated;
 - o History of 2-3 provincial incarcerations: 5.3 times (429%) more likely to have a fatal drug-related overdose;
 - o History of 4+ provincial incarcerations: 3.9 times (287%) more likely to have a fatal drug-related overdose.

Risk Factors for Overdose-Related Death among Formerly Incarcerated Persons:

- Incarceration history significantly modified the relationships of overdose-related death with demographic factors, for example, age and sex were not associated with overdose-related death for persons with incarceration history (Table 3).
- Diagnosis of a substance use disorder (SUD) and SUD in combination with mental illness significantly increased the risk of overdose-related death among formerly incarcerated persons.
- The dispensation of opioids for pain (from 2010-2014) and being diagnosed with multiple chronic diseases were significant risk factors for overdose-related death among persons who were formerly incarcerated.

Limitations:

- The incarceration history data only includes records from provincial correctional institutions where persons are remanded or have a sentence up to two years less a day. Persons incarcerated in federal facilities were not included in the sample.
- The descriptive analysis does not use a time to event model, therefore we were unable to measure when deaths occurred relative to release date.
- Reincarceration into a provincial correctional institution during the follow-up period (2015-2017) was not included in the model.



Summary:

- Persons with criminal justice system involvement are more likely to have an overdose-related death than the general population.
- These findings are consistent with studies in other countries which have found that people with a history of incarceration are at increased risk of overdose.
- Harm reduction and substance use treatment services in BC should be more focused on supporting persons with SUD, SUD and mental illness, and multiple chronic diseases, and persons with a history of criminal justice system involvement.

Next steps:

- The Transitions Working Group is conducting a longitudinal analysis of overdose-related deaths in relation to release from provincial corrections institutions.

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All inferences, opinions, and conclusions drawn in this Knowledge Update are those of the authors, and do not reflect the opinions or policies of the Data Steward(s).

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Table 1. Demographic and neighborhood characteristics for persons who did/did not have a fatal drug-related overdose in British Columbia (2015-2017)

Characteristic	Persons who had an overdose-related death (2015-2017) N (%)	Persons who <i>did not</i> have an overdose-related death (2015-2017) N (%)	<i>p</i>
Total N	510	708,425	-
Age group^a			
< 30	112 (22.0)	139,681 (19.7)	< 0.001
30-39	125 (24.5)	116,702 (16.5)	
40-49	114 (22.4)	120,844 (17.1)	
≥ 50	159 (31.2)	331,198 (46.8)	
Sex			
Male	402 (78.8)	347,099 (49.0)	< 0.001
Female	108 (21.2)	361,326 (51.0)	
Number of incarcerations (2010-2014) in provincial institutions			
0	408 (80.0)	704,266 (99.4)	< 0.001
1	34 (6.7)	2116 (0.3)	
2-3	38 (7.5)	1165 (0.2)	
≥ 4	30 (5.9)	878 (0.1)	
Mental health and substance use disorder (2010-2014)			
None	211 (41.4)	585,221 (82.6)	< 0.001
SUD	67 (13.1)	3708 (0.5)	
Mental illness ^b	102 (20.0)	111,936 (15.8)	
SUD and mental illness ^b	130 (25.5)	7560 (1.1)	
Comorbidity index (2010-2014)^c			
None	417 (81.8)	636,988 (89.9)	< 0.001
1	31 (6.1)	31,086 (4.4)	
≥ 2	62 (12.2)	40,351 (5.7)	
Dispensed benzodiazepines (2010-2014)			



No	272 (53.3)	597,020 (84.3)	< 0.001
Yes	238 (46.7)	111,405 (15.7)	
Dispensed opioids for pain (2010-2014)			
No	129 (25.3)	444,766 (62.8)	< 0.001
Yes	381 (74.7)	263,659 (37.2)	
QMDI^a			
Q 1 (Low material deprivation (MD))	76 (14.9)	145,329 (20.5)	< 0.001
Q 2	65 (12.7)	136,715 (19.3)	
Q 3	88 (17.3)	138,954 (19.6)	
Q 4	120 (23.5)	143,029 (20.2)	
Q 5 (High MD)	161 (31.6)	144,398 (20.4)	
QSDI^a			
Q 1 (Low social deprivation (SD))	64 (12.5)	135,536 (19.1)	< 0.001
Q 2	72 (14.1)	136,170 (19.2)	
Q 3	74 (14.5)	136,575 (19.3)	
Q 4	108 (21.2)	141,746 (20.0)	
Q 5 (High SD)	192 (37.6)	158,398 (22.4)	
Health Authority of residence^a			
Interior Health	100 (19.6)	108,100 (15.3)	0.003
Fraser Health	198 (38.8)	258,274 (36.5)	
Vancouver Coastal	96 (18.8)	181,204 (25.6)	
Vancouver Island	87 (17.1)	118,291 (16.7)	
Northern	29 (5.7)	42556 (6.0)	

^a Residence, age, and sex as of January 1 2015.

^b Mental illness includes depression, anxiety disorder, stress disorder, bipolar disorder, or schizophrenia.

^c Elixhauser comorbidity index.

QMDI = quintiles of material deprivation index; QSDI = quintiles of social deprivation index; SUD = substance use disorder.



Table 2. Odds ratios (OR) of overdose-related death in relation to individual and neighbourhood characteristics

	Unadjusted OR	Adjusted OR^a
Age group^b		
< 30	1.67 (1.31 - 2.13) ^c	1.78 (1.37 - 2.30) ^c
30-39	2.23 (1.76 - 2.82) ^c	1.77 (1.38 - 2.29) ^c
40-49	1.97 (1.54 - 2.50) ^c	1.59 (1.23 - 2.05) ^c
≥ 50	Reference (1.00)	Reference (1.00)
Sex^b		
Female	Reference (1.00)	Reference (1.00)
Male	3.87 (3.13 - 4.79) ^c	3.55 (2.85 - 4.43) ^c
Number of incarcerations in provincial institutions (2010-2014)		
0	Reference (1.00)	Reference (1.00)
1	27.74 (19.50 - 39.46) ^c	3.50 (2.39 - 5.13) ^c
2-3	56.30 (40.18 - 78.89) ^c	5.29 (3.64 - 7.69) ^c
≥ 4	58.98 (40.47 - 85.96) ^c	3.87 (2.56 - 5.85) ^c
Mental health and substance use disorder (2010-2014)		
None	Reference (1.00)	Reference (1.00)
SUD	50.12 (38.00 - 66.09) ^c	14.04 (10.26 - 19.20) ^c
Mental illness ^d	2.53 (2.00 - 3.20) ^c	1.85 (1.43 - 2.39) ^c
SUD and mental illness ^d	47.69 (38.29 - 59.41) ^c	11.28 (8.52 - 14.93) ^c
Comorbidity index (2010-2014)^e		
None	Reference (1.00)	Reference (1.00)
1	1.52 (1.06 - 2.19) ^c	0.97 (0.67 - 1.41)
≥ 2	2.35 (1.80 - 3.07) ^c	1.40 (1.04 - 1.87) ^c
Dispensed benzodiazepines (2010-2014)		
No	Reference (1.00)	Reference (1.00)
Yes	4.69 (3.94 - 5.58) ^c	2.05 (1.67 - 2.53) ^c
Dispensed opioids for pain (2010-2014)		
No	Reference (1.00)	Reference (1.00)



Yes	4.98 (4.08 - 6.08) ^c	2.48 (1.99 - 3.08) ^c
QMDI^b		
Q 1 (Low MD)	Reference (1.00)	Reference (1.00)
Q 2	0.91 (0.65 - 1.27)	0.82 (0.58 - 1.15)
Q 3	1.21 (0.89 - 1.65)	1.06 (0.77 - 1.46)
Q 4	1.60 (1.20 - 2.14) ^c	1.17 (0.86 - 1.58)
Q 5 (High MD)	2.13 (1.62 - 2.80) ^c	1.36 (1.02 - 1.82) ^c
QSDI^b		
Q 1 (Low SD)	Reference (1.00)	Reference (1.00)
Q 2	1.12 (0.80 - 1.57)	1.06 (0.75 - 1.48)
Q 3	1.15 (0.82 - 1.60)	1.01 (0.72 - 1.43)
Q 4	1.61 (1.18 - 2.20)	1.39 (1.01 - 1.92)
Q 5 (High SD)	2.57 (1.93 - 3.41)	1.58 (1.17 - 2.13)
Health Authority of residence^b		
Northern	Reference (1.00)	Reference (1.00)
Interior	1.36 (0.90 - 2.05)	1.57 (1.03 - 2.39) ^c
Fraser	1.12 (0.76 - 1.66)	1.42 (0.95 - 2.12)
Vancouver Coastal	0.78 (0.51 - 1.18)	1.22 (0.79 - 1.87)
Vancouver Island	1.08 (0.71 - 1.64)	1.22 (0.80 - 1.87)

^aAdjusted for all variables in Table 2.

^bResidence, age, and sex as of January 1 2015.

^c $p < 0.05$.

^dMental illness includes depression, anxiety disorder, stress disorder, bipolar disorder, and schizophrenia.

^eElixhauser comorbidity index.

QMDI = quintiles of material deprivation index; QSDI = quintiles of social deprivation index; SUD = substance use disorder.



Table 3. Odds ratios (OR) of overdose-related death in relation to individual and neighborhood characteristics, stratified by incarceration history

Characteristics	Never Incarcerated		Formerly Incarcerated	
	Unadjusted OR	Adjusted OR ^a	Unadjusted OR	Adjusted OR ^a
Age group^b				
< 29	1.44 (1.10 - 1.89) ^c	1.79 (1.35 - 2.38) ^c	1.10 (0.59 - 2.04)	1.23 (0.64 - 2.36)
30-39	1.85 (1.43 - 2.41) ^c	1.86 (1.41 - 2.45) ^c	1.17 (0.64 - 2.11)	1.13 (0.61 - 2.11)
40-49	1.71 (1.31 - 2.23) ^c	1.69 (1.28 - 2.23) ^c	1.09 (0.59 - 2.02)	1.02 (0.54 - 1.93)
≥ 50	Reference (1.00)	Reference (1.00)	Reference (1.00)	Reference (1.00)
Sex^b				
Female	Reference (1.00)	Reference (1.00)	Reference (1.00)	Reference (1.00)
Male	3.61 (2.86 - 4.55) ^c	3.97 (3.13 - 5.03) ^c	0.73 (0.43 - 1.26)	1.14 (0.64 - 2.00)
Mental health and substance use disorder (2010-2014)				
None	Reference (1.00)	Reference (1.00)	Reference (1.00)	Reference (1.00)
SUD	46.22 (33.58 - 63.62) ^c	19.39 (13.81 - 27.22) ^c	3.57 (1.97 - 6.48) ^c	2.49 (1.34 - 4.64) ^c
Mental illness ^d	2.62 (2.04 - 3.37) ^c	1.91 (1.45 - 2.51) ^c	1.08 (0.52 - 2.24)	0.90 (0.42 - 1.92)
SUD and mental illness ^d	39.98 (30.85 - 51.80) ^c	13.89 (10.23 - 18.85) ^c	4.00 (2.47 - 6.47) ^c	2.68 (1.54 - 4.65) ^c
Comorbidity index (2010-2014)^e				
None	Reference (1.00)	Reference (1.00)	Reference (1.00)	Reference (1.00)
1	1.53 (1.02 - 2.29) ^c	1.03 (0.68 - 1.56)	1.37 (0.59 - 3.18)	0.91 (0.39 - 2.15)
≥ 2	2.21 (1.63 - 3.00) ^c	1.29 (0.92 - 1.79)	2.91 (1.65 - 5.12) ^c	1.87 (1.01 - 3.47) ^c
Dispensed benzodiazepines (2010-2014)				
No	Reference (1.00)	Reference (1.00)	Reference (1.00)	Reference (1.00)
Yes	4.57 (3.76 - 5.55) ^c	2.34 (1.85 - 2.95) ^c	2.00 (1.35 - 2.96) ^c	1.12 (0.71 - 1.76)
Dispensed opioids for pain (2010-2014)				
No	Reference (1.00)	Reference (1.00)	Reference (1.00)	Reference (1.00)
Yes	4.18 (3.37 - 5.17) ^c	2.31 (1.83 - 2.91) ^c	4.39 (2.34 - 8.23) ^c	3.12 (1.61 - 6.01) ^c
QMDI^b				
Q 5 (High MD)	Reference (1.00)	Reference (1.00)	Reference (1.00)	Reference (1.00)
Q 1 (Low MD)	0.51 (0.38 - 0.69) ^c	0.70 (0.51 - 0.97) ^c	1.13 (0.60 - 2.14)	1.19 (0.61 - 2.33)
Q 2	0.43 (0.31 - 0.60) ^c	0.54 (0.39 - 0.76) ^c	1.03 (0.56 - 1.89)	1.17 (0.63 - 2.20)



Q 3	0.61 (0.46 - 0.82) ^c	0.76 (0.56 - 1.02)	0.98 (0.54 - 1.77)	1.03 (0.56 - 1.88)
Q 4	0.83 (0.64 - 1.08)	0.90 (0.69 - 1.18)	0.71 (0.41 - 1.24)	0.76 (0.43 - 1.34)
QSDI^b				
Q 5 (High SD)	Reference (1.00)	Reference (1.00)	Reference (1.00)	Reference (1.00)
Q 1 (Low SD)	0.43 (0.31 - 0.59) ^c	0.61 (0.44 - 0.86) ^c	0.98 (0.53 - 1.81)	0.97 (0.50 - 1.86)
Q 2	0.49 (0.36 - 0.67) ^c	0.68 (0.49 - 0.93) ^c	0.75 (0.40 - 1.38)	0.78 (0.41 - 1.48)
Q 3	0.56 (0.42 - 0.74) ^c	0.73 (0.54 - 0.98) ^c	0.33 (0.15 - 0.73) ^c	0.34 (0.15 - 0.75) ^c
Q 4	0.74 (0.57 - 0.96) ^c	0.95 (0.72 - 1.24)	0.70 (0.40 - 1.24)	0.71 (0.39 - 1.28)
Health Authority^b				
Northern	Reference (1.00)	Reference (1.00)	Reference (1.00)	Reference (1.00)
Interior	1.76 (1.07 - 2.89) ^c	1.91 (1.16 - 3.15) ^c	0.92 (0.41 - 2.08)	0.88 (0.39 - 2.02)
Fraser	1.36 (0.84 - 2.19)	1.70 (1.05 - 2.75) ^c	0.94 (0.47 - 1.89)	0.96 (0.46 - 2.00)
Vancouver Coastal	0.96 (0.58 - 1.58)	1.34 (0.80 - 2.24)	1.16 (0.53 - 2.54)	1.28 (0.56 - 2.94)
Vancouver Island	1.30 (0.78 - 2.16)	1.42 (0.85 - 2.38)	0.99 (0.45 - 2.17)	0.84 (0.38 - 1.89)

^aAdjusted for all variables in Table 3.

^bResidence, age, and sex as of January 1 2015.

^cp<.05

^dMental illness includes depression, anxiety disorder, stress disorder, bipolar disorder, and schizophrenia.

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QMDI = quintiles of material deprivation index; QSDI = quintiles of social deprivation index;

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