

Overdose Events in British Columbia: Trends in Substances Involved, Contexts and Responses

Kate Vallance¹, Gina Martin¹, Tim Stockwell¹, Scott Macdonald¹, Clifton Chow², Andrew Ivsins¹, Jane Buxton³, Andrew Tu³, Jat Sandhu², Tim Chu² & Ben Fair²

¹ Centre for Addictions Research of BC, ² Vancouver Coastal Health, ³ BC Centre for Disease Control

Overview

- In this bulletin, we examine numbers and rates of fatal and non-fatal overdose in BC. The context of overdose events and types of substances involved are also examined.
- Data sources include: the BC Coroners Service, Vancouver Coastal Health's Public Health Surveillance Unit that reports on overdoses presenting to emergency rooms/departments (ER) and InSite (a supervised injection site), the BC Ministry of Health and CARBC surveys of drug using populations.

Fatal and Non-Fatal Overdose in BC

- There were 5,331 ER overdose presentations in Vancouver Coastal Health Authority in 2010.
- Alcohol and illicit drug overdose hospitalizations in BC increased 2002-2009, especially in Fraser and Vancouver Island Health Authorities.
- Most of the 1,654 fatal overdoses attributed to illicit drugs in BC between 2002 and 2010 were male (75.9%).
- There were 1,438 alcohol-related and 2,315 illicit drug-related overdose hospitalizations in BC between 2002-2009.
- In 2009, Interior Health Authority had the highest rate of alcohol overdose

hospitalizations (7.8) and the highest rate of illicit drug overdose hospitalizations (11.5) per 100,000 people.

- Of the five geographic areas in BC administered by the Coroners Service, the Metro Vancouver area had the highest (7.6) and the Northern area had the lowest (2.15) rates of illicit drug deaths per 100,000 people in 2010.
- InSite reported 778 non-fatal illicit drug-related overdose events and no deaths for the period 2004-2010.
- Street-involved youth in Victoria and Vancouver reported higher rates of recent overdose events than street-involved adults or people who use substances recreationally.

Substances Involved in Overdose Events

- Alcohol was the primary substance involved in non-fatal overdose events among high risk populations surveyed in Victoria and Vancouver.
- Multiple substances were involved in 50-60% of overdose events among these populations.
- At InSite, 589 (76%) of overdoses reported involved heroin and, of these, 224 (29%) involved naloxone administration, an opiate antagonist.

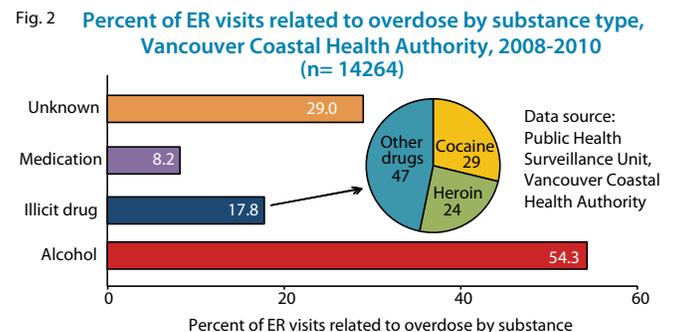
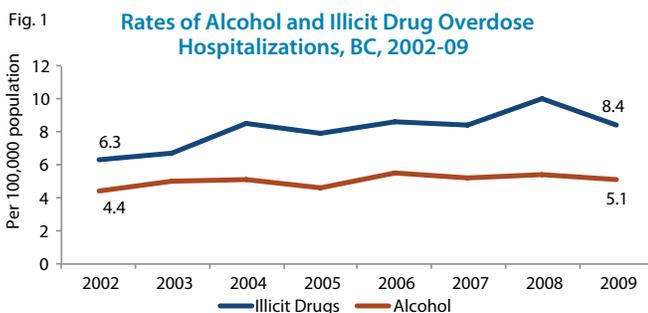
- Alcohol was involved in 2.5 times as many overdose presentations to ERs as prescribed and/or illicit drugs in Vancouver Coastal Health Authority in 2010.

Health Services Utilized for Overdose

- 9.5 of every 1,000 ER hospital visits in Vancouver Coastal Health involved an alcohol-related overdose in 2010.
- 66% of street-involved adults and 43.4% of street-involved youth in Victoria and Vancouver received emergency medical care at their most recent overdose event.

Conclusions

- There is evidence of increasing trends of both alcohol and illicit drug overdose events in BC.
- Alcohol is a major substance of concern, both on its own and in combination with other drugs. Alcohol's contribution is also likely underestimated.
- Strategies to prevent overdose as well as treat and reduce harms are recommended, such as community information networks, supervised drug consumption sites, access to harm reduction education, wider availability of naloxone, an opiate antagonist, and efforts to make sure fear of police involvement does not impede seeking help.



Introduction:

This bulletin was produced in collaboration with a number of different agencies to look at trends in both prevalence and characteristics of fatal and non-fatal overdose in BC. Tracking changing patterns of substance use and related harms such as overdose can be valuable for addressing negative health outcomes and planning community services more effectively. Monitoring substance use is also important for examining BC policies and evaluating how effective implementation has been on the ground. Preventing overdose events and reducing associated harms would reduce costs associated with emergency responses, hospital stays and any longer term health effects.

Fatal and non-fatal overdose events are one of the major health risks related to using substances (Powis et al., 1999). However, in many instances, overdose events can be prevented or minimized. There is increasing evidence showing the efficacy of harm reduction services such as supervised injection sites in reducing numbers of overdose hospitalizations and deaths (Marshall, 2011; Kerr et al., 2005). In fact, since 2003 when the supervised injection site opened in Vancouver, BC, there have been no overdose deaths at the site, and fatal overdose events decreased by 35% in the area surrounding InSite between 2003 and 2005 (Tyndall et al., 2006; Marshall et al., 2011). A number of studies have also shown that increased education around appropriate responses to overdose events and availability of products such as naloxone can reduce deaths and save costs related to ambulance and paramedic trips as well as ER visits (Marshall, 2011; Strang et al., 2008).

Overdose experiences can vary based on the social context of the event, for example, being alone or with others, and symptoms also vary depending on the quantity and type of substances used. Fatal and non-fatal overdoses can occur due to excessive use of both legal and illegally sourced substances. In addition, particular combinations of substances such as alcohol mixed with opiates add further to the risk of overdose. This danger is often overlooked as alcohol and other drugs are often considered as separate rather than synergistic risk factors, a problem compounded by difficulties of assessing patterns of multiple substance use in commonly used surveys and administrative data sources (Buxton et al., 2009).

This bulletin provides data from various sources to create a more comprehensive and current picture of overdose hospitalizations and deaths in BC. Data on overdose deaths came from the BC Coroners Service and data on overdose hospitalizations came from the BC Ministry of Health. Vancouver Coastal Health provided data on Emergency Department visits in their region and on overdose events occurring at InSite (Vancouver's supervised injection site). Data was also contributed from one component of CARBC's BC Alcohol and Other Drug Monitoring Project, the High Risk Populations Study, which tracks changing patterns of substance use and related harms among three high risk populations in Victoria and Vancouver (www.carbc.ca/AODMonitoring/ProjectComponents/HighRiskPopulations.aspx).

Methods and Sources

BC Hospitalization data

Hospitalization data offers a useful indicator of trends in alcohol and illicit drug-caused overdoses in different geographic areas of the province. However, the hospitalization data does not provide a precise overall estimate of prevalence because they do not capture individuals presenting to ERs with overdoses who are then discharged without being assigned to a hospital ward. In addition, the onus is on the medical doctor to indicate a diagnosis involving alcohol or illicit drug and so some cases may be missed. Furthermore, there may be biases in terms of which drugs are identified as being primarily responsible for an overdose when more than one drug is present (e.g., illicit versus licitly sourced substances).

Hospitalization data was received from the BC Ministry of Health by age group, sex, Health Service Delivery Area and year. All data is securely held at BC Centre for Disease Control. The most responsible diagnosis codes (MRD) were used in the computation of alcohol, tobacco, and illicit drug attributable hospitalizations. All rates were standardized by age and sex using the 2001 BC population as the standard population.

BC Coroners Service overdose deaths

Coroners Service death data offers the most comprehensive source of overdose deaths as a substantial proportion of overdose fatalities are not admitted to the hospital. Summary data of illicit drug overdose deaths in BC was provided by the BC Coroners Service. Data includes closed cases where the cause of death has been concluded by the coroner and open cases which appear to be illicit drug-related based on scene evidence. Data is subject to change as open cases are concluded by the coroner. Including open cases allows for a more current monitoring of trends. Cases reported to the coroner between January 1, 2004 and December 31, 2010 were included. Deaths are recorded by place of death rather than place of residence. It should be noted that there is a time lag associated with the Coroners Service data due to time required to confirm cause of death and toxicological information. The Coroners Service releases its data by its own regional areas which are similar to BC health authorities but not exactly. As such, rates may be affected (see results section below for more detail).

Vancouver Coastal Health emergency department visits

Number of overdoses recorded in ERs is an excellent source of data as it captures those who present at the hospital with an overdose and includes those who leave without being admitted to a ward. One of the strengths of the ER data is the insight it provides into alcohol-related overdose hospitalizations. Unfortunately we were only able to access this data from Vancouver Coastal Health, though its jurisdiction includes the Downtown Eastside - an urban impoverished neighbourhood with significant substance misuse and drug distribution - and therefore its data is of particular interest for monitoring purposes.

ER visit data came from 9 of 13 public hospitals in the urban Vancouver Coastal Health area. A combination of examining presenting complaint fields, discharge diagnosis with ICD9-CM code and keyword searches of other fields is used to identify all visits related to overdose from alcohol and other drugs. A person may present with multiple substance type use in a single ER visit.

Overdose events at InSite supervised injection site

Data from InSite, North America's only federally sanctioned supervised injection site, provides another important window into injection drug use patterns, trends and related overdoses. InSite provides 12 injection booths where clients inject their own illicit drugs under the supervision of nursing staff. Other healthcare services and referrals are also provided (Tyndall et al., 2006). InSite records data on overdoses, such as drug type involved and medical interventions by the nurses on staff. However, the data on overdose is limited to those who overdose on site and only those who use drugs by injection. It is not generalizable to other populations of people who use drugs or the greater community that do not use InSite.

Data was provided by Vancouver Coastal Health. Use of naloxone was also monitored in the intervention of an overdose. Naloxone (trade name Narcan) is an opiate antagonist that quickly reverses respiratory suppression in opiate overdoses and has been shown to prevent opiate overdose deaths (Strang et al., 2006, 2008). Naloxone has previously been administered predominantly via injection but more recently an intranasal spray has become available.

Alcohol and other drug monitoring interviews with people who use illicit drugs

The BC Alcohol and Other Drug (AOD) Monitoring Project's High Risk Population Surveys contributed another piece of the puzzle as these include many individuals reporting overdose events that may not have been captured elsewhere. A strength of this data source is that it collects information directly from those who experienced an overdose. Individuals were asked which substances they believed were the primary cause of overdose as opposed to the perspectives of medical personnel. The main drawback of this dataset is that it is individual level data for a very specific population and cannot be generalized to the wider population or other regions.

Data is available for three high risk populations from mid-2007. (For more background on the project, see Duff et al., 2009). These populations comprise: street-involved individuals aged 19 years and older who use illicit drugs; street-involved youth aged 15 to 24 years who regularly use illicit drugs; and nightclub and rave party attendees who use illicit drugs recreationally. Eligibility criteria for the adult street-involved cohort changed to include non-injection drug use at the start of the second wave of 2009. By fall of 2011, a total of 2,324 completed interviews were available for analysis, with equal representation across Victoria and Vancouver.

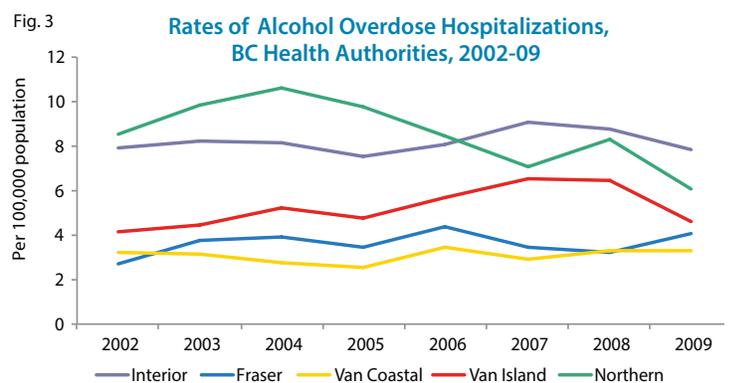
Results

BC hospitalization data

There were 1,438 alcohol-related and 2,315 illicit drug-related overdose hospitalizations in BC between 2002 and 2009. As Figure 1 shows, the rate of alcohol-related hospitalizations in BC was around five per 100,000 people in 2009. Rates over time from 2002 to 2009 remained relatively stable, and rates of alcohol-related overdose hospitalizations were lower than those of illicit drug-related overdose hospitalizations in BC.

Rates of illicit drug-related overdose hospitalizations have been increasing in BC between 2002 and 2009 (see Fig. 1). In 2009, the rate per capita, aged 15 years and over, of illicit drug-related hospitalizations was 8 per 100,000 people.

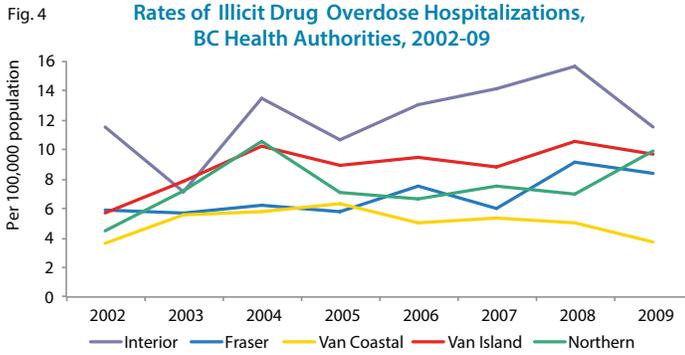
Between 2002 and 2009, the Northern Health Authority reported the highest rates of hospitalizations related to alcohol overdose (per capita aged 15+) but these rates dipped below that of the Interior Health Authority from 2007 until 2009. Vancouver Island Health Authority has the third highest rates of alcohol-related overdose hospitalizations followed by Fraser Health Authority and Vancouver Coastal Health Authority. Trend analysis using linear regression was conducted in order to assess for linear trends in overdose occurrence over time in each of the five Health Authorities (Rosenberg, 1997).



For a map of BC Health Authorities, please see: www.bcstats.gov.bc.ca/StatisticsBySubject/Geography/ReferenceMaps/Health.aspx.

As shown in Figure 3, of the five health authorities in BC, Interior Health had the highest rates of alcohol overdose hospitalizations, followed by Northern, Vancouver Island, Fraser and Vancouver Coastal Health. Northern Health Authority showed a significantly decreasing trend between 2002 and 2009.

Overall, there was a significant increase in illicit drug hospitalizations in BC and, of the five health authorities, both Fraser and Vancouver Island Health Authorities showed significantly increasing rates between 2002 and 2009 (Fig. 4). Interior Health had significantly higher rates of illicit drug hospitalizations than the others and Vancouver Coastal had significantly lower rates than the other four health authorities.

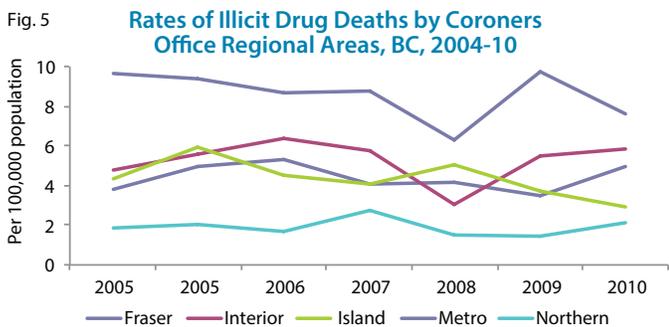


BC Coroners Service overdose deaths:

There were over 1,200 overdose deaths specified as due to illicit drugs and involving males, compared with 400 involving females in BC between 2004 and 2010.

The overall rate of overdose deaths related to illicit drugs in BC in 2010 was 4.79 deaths per 100,000 people. Rates of illicit drug-related overdose deaths have remained fairly steady between 2004 and 2010 and there were no significant changes over time in any of the different regions.

Comparing the different regions in BC, the Metro Vancouver area reported the highest rate of overdose deaths related to illicit drugs in 2010 at 7.6 deaths per 100,000 people, followed by the Interior region at 5.84 deaths per 100,000 people (see Fig. 5). The Fraser region had 4.94 deaths per 100,000, with the Island and Northern regions reporting rates of 2.91 and 2.15 illicit drug-related deaths respectively per 100,000 people in 2010.

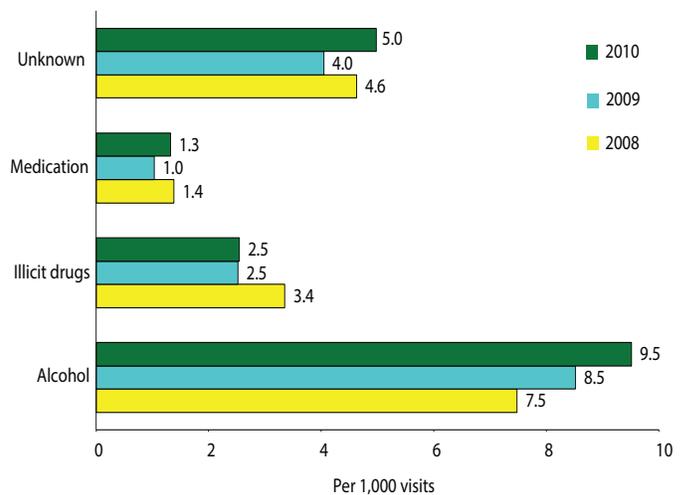


Please note: The regions used by the BC Coroners Service are fairly different from BC Health Authorities. Street-weighted interpolation (Reibel & Bufalino, 2005) was used to derive population estimates for the Coroners Service regional areas were based on BC Stats estimates of the population for BC Health Authorities. For a map of the Coroners Service regional areas, please see: www.pssg.gov.bc.ca/coroners/publications/docs/annualreport2009.pdf.

Vancouver Coastal Health emergency department overdose visits

In total there were 7,742 emergency department visits related to an overdose involving alcohol between 2008 and 2010 in Vancouver Coastal Health Authority. In 2010, alcohol-related overdoses accounted for 9.5 out of every 1000 visits and illicit drug-related overdoses accounted for 2.5 out of every 1000 visits (See Fig. 6). About fifty-four percent of all ER visits between 2008 and 2010 were related to overdoses categorized as being caused by alcohol. Twenty-nine percent were related to overdoses categorized as being caused by 'unknown' substances followed by 17.8% for illicit drugs and 8.2% for medication (see Fig. 2). The data showed an increase in overdoses related to alcohol from 2008 to 2010.

Fig. 6 Number of ER visits related to overdose involving alcohol or other drugs per 1000 visits, Vancouver Coastal Health Authority, 2008-2010

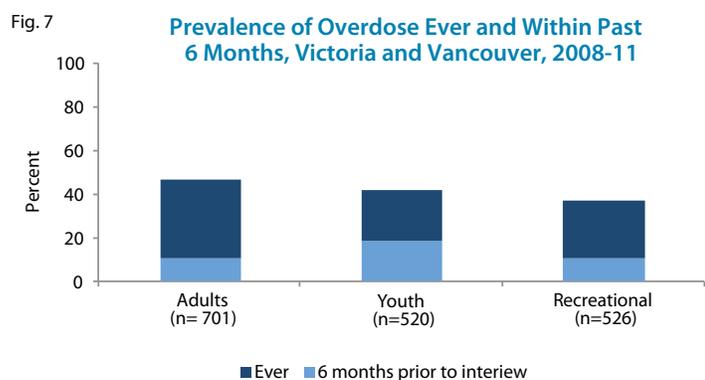


Overdoses at InSite supervised injection site

There were a total of 778 overdose events at InSite between 2004 and 2010. Of the total number, 589 or 76% involved injected heroin. Naloxone, the medical intervention used to treat serious overdoses, was administered for 256 individual visits and nearly 90% of the time it was used to treat heroin overdoses. There have been no fatal overdoses at InSite to date.

Overdoses reported among high risk populations

A total of 2,324 surveys were completed with three groups of high risk substance using populations, including street-involved youth and adults, and people who use recreational drugs in Victoria and Vancouver. Of the total sample, 54% of adults, 49% of youth and 43% of those who use recreationally reported ever having an overdose. People who use recreationally were significantly less likely to report ever having an overdose than the other two groups (see Fig. 7). For overdoses occurring within the past six months, the street-involved youth had a significantly higher prevalence of overdose reporting, nearly twice as many as both the street-involved adults and those who use substances recreationally.



Looking at the substances involved in overdose events among the three high risk groups, alcohol was the main substance reported in the most recent overdose. The people who use recreational drugs reported the highest prevalence of alcohol-related overdoses (64.6%), followed by the street-involved youth (51.8%). The street-involved adults reported just slightly less than half the number of alcohol-related overdoses (24.4%) between 2008 and fall of 2011 (see Table 1).

Among injection drug-related overdoses, heroin was most commonly reported as the primary substance involved in overdose for the adults (30.5%), youth (4.4%) and people who use recreational drugs (1.5%). For non-injection overdoses, after alcohol, "other" drugs were most frequently reported among all three groups, which includes substances such as prescription medications, ketamine (an anesthetic) and crystal meth.

Table 1. Main Substance Involved in Most Recent Overdose, Victoria and Vancouver, 2008-2011 (%)

Adults	Alcohol	Heroin	Cocaine	Crack	Other
Non-Injection	24.4	4.9	4.9	13.4	13.3
Injection		30.5	13.4	1	12.2
Youth	Alcohol	Heroin	Cocaine	Crack	Other
Non-Injection	51.8	1.8	4.4	5.3	37.8
Injection		4.4	0	0	0
Recreational	Alcohol	Heroin	Cocaine	Crack	Other
Non-Injection	64.6	1.5	6.2	0	33.8
Injection		1.5	0	0	0

Notes: 1. Percents do not add up to 100 as more than one substance was reported. 2. Criteria of adult cohort changed in 2009 to include non-injection drug use.

Looking at the context of the most recent overdose event, over half of all three high risk groups reported more than one substance being involved in the overdose (see Table 2). The adult group was significantly more likely than the youth and recreational drug using groups to report being aware of the potency of the substance they were consuming ($p < 0.001$).

The surveys were tailored to address issues relevant to each cohort, thus not all questions were asked of all cohorts. The remaining questions were not asked of the recreational drug using cohort as they report different patterns of substance use. Three quarters of adults and nearly all of the youth reported being with someone else at the time of the overdose event, and the adults were significantly less likely than the youth to be with someone else ($p < .001$) (see Table 2). Two-thirds of street-involved adults (66.1%) and less than half of the street-involved youth (43.3%) received some form of medical attention, either being seen by a paramedic or being taken to an ER. Three-quarters of adults (73%) and the majority of the youth (85.9%) were assisted by someone at their most recent overdose event, with adults significantly less likely than the youth to receive some form of assistance ($p < .01$).

Table 2. Characteristics of Most Recent Overdose Event, Victoria and Vancouver, 2008-2011 (%)

	Adults	Youth	Recreational
Multiple substance use	58	53	63
With someone at overdose	72.9	90.8	
Received paramedic or hospital care	66.1	43.3	
Were assisted by someone	73	85.9	

Discussion and conclusions

The information compiled in this bulletin from various sources suggests that overdose from alcohol and/or other drugs has been a substantial and growing problem in British Columbia in recent years. There were 1438 alcohol-related overdose hospitalizations between 2002 and 2009 and the rate per 100,000 people increased by 16% during that time. Likewise, the rate of illicit drug-related overdose hospitalizations increased by 33% and there were a total of 2315 overdose hospitalizations between 2002 and 2009. Furthermore, it can be concluded that alcohol, whether alone or in combination with other drugs, contributed the bulk of overdose hospitalizations and ER visits among both high risk groups and the wider population. Rates of alcohol overdose events are likely underestimated in hospital data due to individuals not seeking assistance or medical staff not including alcohol in their diagnosis in cases of multiple substance use.

The increasing rate of overdose hospitalizations underscores the need for prevention which targets both illicit drug and alcohol-related overdoses. The relatively low rate of alcohol versus illicit drug overdoses identified in the hospitalization dataset suggests some under-reporting of alcohol-

related incidents. The hospitalization data are inconsistent with the higher rates of alcohol-caused overdose observed both in the Vancouver ER data and in the self-reports of substance users in the CARBC high risk monitoring surveys.

In cases of multiple substance use, targeted medical training to identify the actual cause of the overdose, rather than defaulting to whatever illicit substance was found in their system, could address some under-reporting of overdoses that involve alcohol. In many cases, alcohol could have been the primary “cause” of the overdose, as has been reported by many individuals in the BC AOD Monitoring Project’s High Risk Population surveys. Data from other ERs in the province could confirm if this was an overall trend or a regional difference.

Among the five regional areas administered by the Coroners Service in BC for 2010, the Metro Vancouver area had the highest rate of overdose deaths related to illicit drugs. The Metro Vancouver area is a very large urban centre that includes the Downtown Eastside, which may account for the higher rates of illicit drug deaths. The high proportion of male overdose deaths may reflect higher overall use of drugs among males in the general population.

Among high risk populations in Victoria and Vancouver, the primary substance involved in non-fatal overdose events was alcohol, particularly for the youth and those who use recreationally. Relatively high use of multiple substances suggests more awareness is especially needed among younger street-involved individuals and those who use recreationally around the potential risks of using multiple substances, especially in combination with alcohol. Younger street-involved people who use substances may be at a higher risk of overdose due to having less experience with and a lower tolerance for different substances.

Education around safer consumption and dosage aimed at younger at-risk individuals who use substances could be an effective preventative measure.

Street-involved adults were most likely to report being aware of the potency of the substance they had used, which may reflect more experience using substances than the other two groups. However, because illicit drugs such as heroin are unregulated, with no information on potency, contaminants or combinations, even the more experienced substance users are at risk of overdose if an unsafe batch circulates the region. For example, a public safety warning was issued by the Coroners Service in early 2011 after a spate of heroin-related fatalities occurred in the Lower Mainland of Vancouver. The RCMP later confirmed that some heroin being dealt was at least twice as potent as usual (Ministry of Public Safety and Solicitor General, 2011).

While the BC AOD Monitoring Project’s High Risk Populations study does not collect this data specifically, it is worth noting that a high proportion of overdose events occur in the time immediately after release from prison. Once back in the community, a person might return to using what for them were previously normal amounts. However, after reduced substance use during incarceration or abstinence for any

reason, the chance of overdose will increase due to reduced tolerance (Binswanger et al., 2007). Interventions targeted towards this segment of the substance using population as part of their re-entry process could reduce overdose events during this higher risk time period.

Many of the street-involved youth and adults received medical attention at their most recent overdose, which suggests high utilization of emergency services. However, in some cases no medical attention was sought, possibly out of fear of criminal repercussions or reluctance to access medical services based on previous negative experiences. People who use substances have often reported feeling stigmatized by emergency services staff and other healthcare workers, decreasing the likelihood of assistance being sought in overdose events (Phillips & Benoit, 2005). Friends or partners who witness overdose events and who might use substances themselves may also avoid involving emergency services due to the same fears (Darke & Hall, 2003; Kim et al., 2009).

Working with healthcare and law enforcement personnel to treat overdoses as health events rather than crime scenes is another important aspect of reducing serious injury and death related to substance use and encouraging bystanders to seek help (Davidson et al., 2003). Reassuring drug using populations that seeking treatment will not lead to police involvement might encourage more people to seek help with potentially fatal drug overdoses. For example, the Vancouver Police Department does not attend a 911 ambulance call unless a death or violence is suspected.

The potential for preventing overdose deaths is well illustrated by the data from InSite. There have been no overdose deaths since the facility opened in 2003 and a reduction in overdoses in the surrounding community (Tyndall et al., 2006). Use of naloxone can decrease the need for emergency services being called as nurses on site are often able to manage overdose events independently (Strang et al., 2006). Intranasal naloxone became available in 2011 and provides an alternative method of administration than the original intra-muscular shot. Increased education around effective responses to overdose events, greater cooperation among harm reduction and law enforcement agencies, and broader access to naloxone for people who inject drugs as well as their peers would also be an effective means to reduce overdose deaths (Kaye et al., 2004; Strang et al., 2008).

Scientific evaluations of InSite have shown a decrease in overdoses in the surrounding community, indicating that the supervised consumption site is meeting a need within the community. However, the increasing trend in overdose events overall suggests that perhaps increased services are necessary. Longer hours of operation and expanded capacity to facilitate more injectors at one time could also reduce the number of overdoses occurring outside of InSite where nurses are not able to intervene.

There are a number of initiatives currently being established, such as a BC Overdose Prevention Initiative and an Overdose and Alert Committee. It involves stakeholders from different community and public agencies

such as the BC Centre for Disease Control, Vancouver Police Department, BC Ambulance Services, Drug and Poison Information Centre and the Vancouver Area Network of Drug Users (VANDU) monitoring and providing alerts regarding overdose and other drug-related events. Comprehensive monitoring and prevention efforts organized through partnerships with different public and community agencies throughout the province are one part of the strategy for reducing overdose events in BC (Buxton et al., 2009). In addition to the recommendations made in this bulletin, increasing communication and data sharing among such networks and with the general public will contribute to prevention and awareness efforts over the next few years.

This bulletin has drawn on a range of data sources to create an up-to-date picture of trends in overdose events in the province. An increasing trend in overdose events overall suggests that this continues to be a serious issue in BC and warrants further monitoring and investigation. The data also suggests more emphasis on the risks surrounding alcohol consumption is required, both among higher risk groups and the general population. Services for specialized populations such as people who inject drugs are available in some regions. However, there continues to be a great need for broader harm reduction services in different parts of the province.

Acknowledgments

We gratefully acknowledge receipt of data and technical assistance from the Office of the Chief Coroner, BC Coroners Service, Ministry of Public Safety and Solicitor General. The BC Alcohol and Other Drug Monitoring Project is supported with grants from the BC Mental Health and Addiction Services Branch of the BC Provincial Health Services Authority, the Canadian Institute for Health Research, Vancouver Island Health Authority, Vancouver Coastal Health Authority, Fraser Health Authority and the BC Ministry of Health. We would like to gratefully acknowledge the contribution of funding from the Office of Research and Surveillance, Health Canada, received via the BC Provincial Health Services Authority. Thanks to the community service agencies for their support and participation in facilitating the High Risk Populations Study, and to all the participants who have shared their time with us. Please note that the material presented here does not imply either endorsement or agreement of the project funders.

Preferred citation

Vallance, K., Martin, G., Stockwell, T., Macdonald, S., Chow, C., Ivsins, A., Buxton, J., Tu, A., Sandhu, J., Chu, T. and Fair, B. (2012). *Overdose Events in British Columbia: Trends in Substances Involved, Contexts and Responses*. CARBC Statistical Bulletin #8, Victoria, British Columbia: University of Victoria.

References

- Binswanger, I., Stern, M., Deyo, R., Heagerty, P., Cheadle, A., Elmore, J. and Koepsell, T. (2007). Release from prison – a high risk of death for former inmates. *New England Journal of Medicine*, 356: 157-165.
- Buxton, J., Skutezky, T., Tu, A., Waheed, B., Wallace, A. and Mak, S. (2009). The context of illicit drug overdose deaths in British Columbia, 2006. *Harm Reduction Journal*, 6(9).
- Darke, S., Hall, W. (2003). Heroin overdose: research and evidence-based intervention. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 88(2): 189-200.
- Davidson, P., McLean, R., Kral, A., Gleghorn, A., Edlin, B. and Moss, A. (2003). Fatal heroin-related overdose in San Francisco, 1996-2000: a case for targeted intervention. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, 80(2): 261-273.
- Duff, C., Michelow, W., Chow, C., and Stockwell, T. (2009). The Canadian Recreational Drug Use Survey (CRDUS): aims, methods and first results. *Contemporary Drug Problems*, 36(3&4): 517-539.
- Kaye, S., Darke, S. Non-fatal cocaine overdose among injecting and non-injecting cocaine users in Sydney, Australia. (2004). *Addiction*, 99: 1315-1322.
- Kerr T., Tyndall M., Li K., Montaner J. and Wood E. (2005). Safer injection facility use and syringe sharing in injection drug users. *Lancet*, 366(9482): 316-318.
- Kim D., Irwin K., and Khoshnood K. (2009). Expanded access to naloxone: options for critical response to the epidemic of opioid overdose mortality. *American Journal of Public Health*, 99(3): 402-407.
- Marshall, B., Milloy, J.-J., Wood, E., Montaner, J. and Kerr, T. (2011). Reduction in overdose mortality after the opening of North America's first medically supervised safer injecting facility: a retrospective population-based study. *Lancet*, 377: 1429-37.
- Ministry of Public Safety and Solicitor General BC; Coroners Service. (2011). Information Bulletin 2011PSSG0059-000493, http://www2.news.gov.bc.ca/news_releases_2009-2013/2011P_SSG0059-000493.pdf.
- Phillips, R. and Benoit, C. (2005). Social determinants of health care access among sex industry workers in Canada. *Sociology of Health Care*, 23, 79-104.
- Powis, B., Strang, J., Griffiths, P., Taylor, C., Williamson, S., Fountain, J. and Gossip, M. (1999). Self-reported overdose among injecting drug users in London: extent and nature of the problem. *Addiction*, 94(4): 471-478.
- Reibel, M. and Bufalino, M. (2005). Street-weighted interpolation techniques for demographic count estimation in incompatible zone systems. *Environment and Planning A* 37(1): 127-139.
- Rosenberg, D. (1997). Trend analysis and interpretation: key concepts and methods for maternal and child health professionals. Analytic paper prepared for the Maternal and Child Health Information Resource Center, Public Health Foundation.
- Strang, J., Kelleher, M., Best, M., Mayet, S. and Manning, V. (2006). Emergency naloxone for heroin overdose. *British Medical Journal*, 333 (7569): 614-615.
- Strang, J., Manning, V., Mayet, S., Best, D., Titherington, D., Santana, L., Offor, E. and Semmler, C. (2008). Overdose training and take-home naloxone for opiate users: prospective cohort study of impact on knowledge and attitudes and subsequent management of overdoses. *Addiction*, 103(10): 1648-1657.
- Tyndall, M., Kerr, T., Zhang, R., King, E., Montaner, J. and Wood, E. (2006). Attendance, drug use patterns, and referrals made from North

