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Correlates of take-home naloxone kit possession among people who use drugs in British Columbia: A cross-sectional analysis

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ABSTRACT

Introduction: In response to North America's opioid crisis, access to naloxone has increased. However, our understanding of the correlates of possessing a naloxone kit is limited. This study seeks to determine the prevalence and correlates of kit possession among people who use drugs (PWUD) in British Columbia (BC) Canada.**Methods:** This analysis used cross-sectional survey data collected in 2018 from 27 harm reduction sites in BC. Descriptive statistics and Poisson regression with robust error variance were used to examine factors associated with naloxone kit possession.**Results:** Overall, 70.7% (n = 246) of the total sample (n = 348) reported having a naloxone kit. Having a kit was significantly associated with self-reported opioid use in comparison with non-opioid use (Adjusted Prevalence Ratio (APR): 2.39; 95% CI: 1.33–4.32). Those reporting 'injection' as their preferred drug administration method were also more likely to possess a kit compared to those that predominantly preferred inhalation, smoking, or snorting (APR: 2.39; 95% CI: 1.25–4.58). Urbanicity, age, gender, and having regular housing were not significantly associated with possessing a kit.**Conclusions:** This study is the first to examine naloxone kit possession across geographies, including non-urban areas. Lower kit possession among those that preferred inhaling, smoking or snorting drugs may reflect misconceptions around overdose risk of non-injection drug administration. Our study supports the need for enhanced awareness around the risk of opioid overdose with non-injection administration and suggests a need for comprehensive public health messaging that aims to address overdose risk and response.

1. Introduction

The United States (US) and Canada are in the midst of an evolving public health crisis related to alarming levels of illicit and prescription opioid overdose – colloquially referred to as the 'opioid crisis'. In the US, opioids were involved in more than 47,000 overdose deaths in 2017 alone (Scholl, 2019). Between January 2016 and June 2018, it is estimated that more than 9000 people lost their lives due to accidental opioid-related overdose across Canada (Health Canada, 2017). The province of British Columbia (BC) has experienced the highest rate of overdose deaths in Canada (Health Canada, 2017) largely attributed to

the increased presence of highly potent synthetic opioids, including fentanyl and carfentanyl in the illicit market (Belzak and Halverson, 2018). Indeed, fentanyl or a fentanyl analogue were involved in 87% of overdose deaths in BC in 2018 (Coroners Service of British Columbia, 2019).

In response to the recent and sudden rise in opioid overdoses, distribution of the opioid antagonist naloxone, used to temporarily reverse the effects of an opioid overdose, has been internationally identified as a key emergency measure to effectively prevent mortality (McDonald and Strang, 2016). In 2012, as part of a wider harm reduction strategy, the BC Centre for Disease Control (BCCDC) introduced the take-home

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naloxone (BCTHN) program with the goal of providing free access to naloxone kits for people at risk of an opioid overdose, and later to other individuals at risk of witnessing an opioid overdose. Naloxone kits contain three ampoules of injectable naloxone, three syringes, and ampoule snappers, as well as non-latex gloves, a rescue breathing mask, and an overdose response instruction sheet. Through the program, individuals are trained to recognize and respond to an overdose, and to administer naloxone intramuscularly. To best reach people who use drugs (PWUD), the BCCDC partnered with community-based organizations and participating harm reduction sites across BC to distribute naloxone (British Columbia Centre for Disease Control, 2019a). The BCTHN provides the vast majority of naloxone kits in the province, although as a non-prescription and unscheduled drug approved for sale in BC, naloxone can also be purchased by individuals or businesses through pharmacies and third parties. Since the BCTHN program was introduced in 2012, more than 147,000 naloxone kits have been distributed across the province, and over 40,000 have been reported as used to reverse an overdose (British Columbia Centre for Disease Control, 2019b).

Previous studies have examined correlates of naloxone possession and use among youth (Goldman-Hasbun et al., 2017; Mitchell et al., 2017) and PWUD in North America (Nolan et al., 2017; Rowe et al., 2015; Tobin et al., 2018) and elsewhere (Madah-Amiri et al., 2019), but have primarily drawn on information from large cities and urban centers. In BC, these studies have almost exclusively relied on data from BC's largest city, Vancouver, and may not be generalizable across the province. To our knowledge, there are currently no quantitative assessments in the literature of naloxone possession among PWUD outside of Vancouver's Downtown Eastside community, and little is known regarding uptake of community-based take-home naloxone programs outside of large urban centers. As deaths from accidental opioid overdose continue to rise (Coroners Service of British Columbia, 2019), there is an immediate need to evaluate the effectiveness of such programs across municipalities in BC and beyond.

The Harm Reduction Client Survey (HRCS) was introduced in 2012 to assess substance use trends and harm reduction service use among clients of harm reduction sites from all regions of BC (Kuo et al., 2014). Harm reduction sites, of which there are more than 200 across all five geographic health authorities in BC, aim to reduce drug-related harms by distributing supplies for safer sex, injection, and inhalation practices. The current study uses the latest iteration of the cross-sectional HRCS, conducted over four months in 2018 across the province of BC (excluding Vancouver), to examine the prevalence and correlates of naloxone possession among PWUD. Results from this study will provide a better understanding of access to naloxone achieved through the BCTHN and inform the practice or implementation of similar programs across North American jurisdictions.

2. Methods

2.1. Study design

Data for this study was obtained through the HRCS conducted between May 2018 and August 2018. The HRCS was first designed and executed in 2012 and repeated annually until 2015; previous publications have reported methodological details (Davis et al., 2016; Kuo et al., 2014). For the 2018 iteration, the 2015 survey tool was amended to reflect current harm reduction needs and address feedback from stakeholders and peers. An important difference in the implementation of the 2018 survey was to purposefully exclude sampling of harm reduction sites in Vancouver, which has a high concentration of public services for vulnerable populations (including large numbers of people who use drugs), and information on drug use within these communities is available through three longitudinal cohort studies (Vancouver Injection Drug Users Study (British Columbia Centre on Substance Use, 2018a), At-Risk Youth Study (British Columbia Centre on Substance

Use, 2018b), and AIDS Care Cohort to Evaluate Exposure to Survival Services study (British Columbia Centre on Substance Use, 2018c)). Only rural or small urban communities in the Vancouver Coastal Region were chosen for sampling for this survey.

Briefly, a two-stage convenience sampling method was used. First, regional harm reduction coordinators suggested harm reduction sites for participation, which were then contacted to discuss capacity (e.g., number of onsite staff, hours of operation) and willingness. A total of 37 sites were approached for participation, ten of which ultimately did not participate due to lack of capacity. Harm reduction sites that agreed to take part determined how to best administer the survey and recruit clients for participation and were given two weeks for completion. Participants were offered \$5 CAD for their participation, and harm reduction sites were offered \$5 CAD per participant for resources, cost, and time incurred by the site. The survey tool was four pages long and took approximately 10 min for the interviewer to administer. Eligibility criteria for participation included being 19 years of age or older, capable of giving verbal informed consent at the time of the survey, having used any illicit drugs other than cannabis (self-reported) in the last six months, and having not previously participated in the current survey cycle. The survey was anonymous, and no personal identifiers were collected.

2.2. Analytic sample

The current analysis used survey data collected from 27 harm reduction sites across BC— see Fig. 1 for a map of sites. Complete case analysis (CCA) was used in this study and excluded individuals who had missing responses to any of the independent or dependent variables used for each analysis. Further, in the regression analyses, we limited the covariates used based on their statistical and conceptual relevance, as well as excluded individuals who responded 'Prefer not to say' to the primary outcome and independent variables.

2.3. Study variables

The primary outcome variable in this study was 'having a naloxone kit'. Respondents were asked "Do you have a Naloxone/Narcan kit?" and answered one of 'yes', 'no' or 'Prefer not to say'. The independent variables included health authority (Fraser Health, Interior Health, Northern Health, Vancouver Coastal (rural communities), and Island Health), age group (≤ 29 , 30–39, 40–49, ≥ 50), gender (women, men, and other [trans-men, trans-women, and gender non-conforming individuals]), First Nations self-identification (yes, no, prefer not to say), current employment status (yes, no, prefer not to say), and sexual orientation (heterosexual and LGBTQ, prefer not to say). Having regular housing (yes, no, prefer not to say), and urban/rural status (rural, small urban, med/large urban) were also included. The survey question related to regular housing asked participants 'How long have you lived at your current address?'. Respondents were categorized as 'yes' if they reported having regular housing, or as 'no' if they reported 'I have no regular place to stay (homeless, shelter, couch surf, no fixed address)'. An internal classification system developed by the BC Ministry of Health was used to determine rural, small urban, and medium and large urban areas. Briefly, the system uses the standard definitions set by Statistics Canada for Canadian census and population statistics purposes (Government of Canada, 2017), but further takes into account a set of criteria at the community health service area level, including an index of remoteness, population density, and adjacency to urban areas, to best represent BC's unique geography (British Columbia Ministry of Health, 2019).

The variable that examined drug use in the last seven days asked participants 'Have you used any of these in the last seven days?', followed by a list of options. If respondents listed any opioid drug, (including methadone, morphine, hydromorphone (Dilaudid), oxycodone, fentanyl, heroin), they were categorized in this study under 'Opioid use',

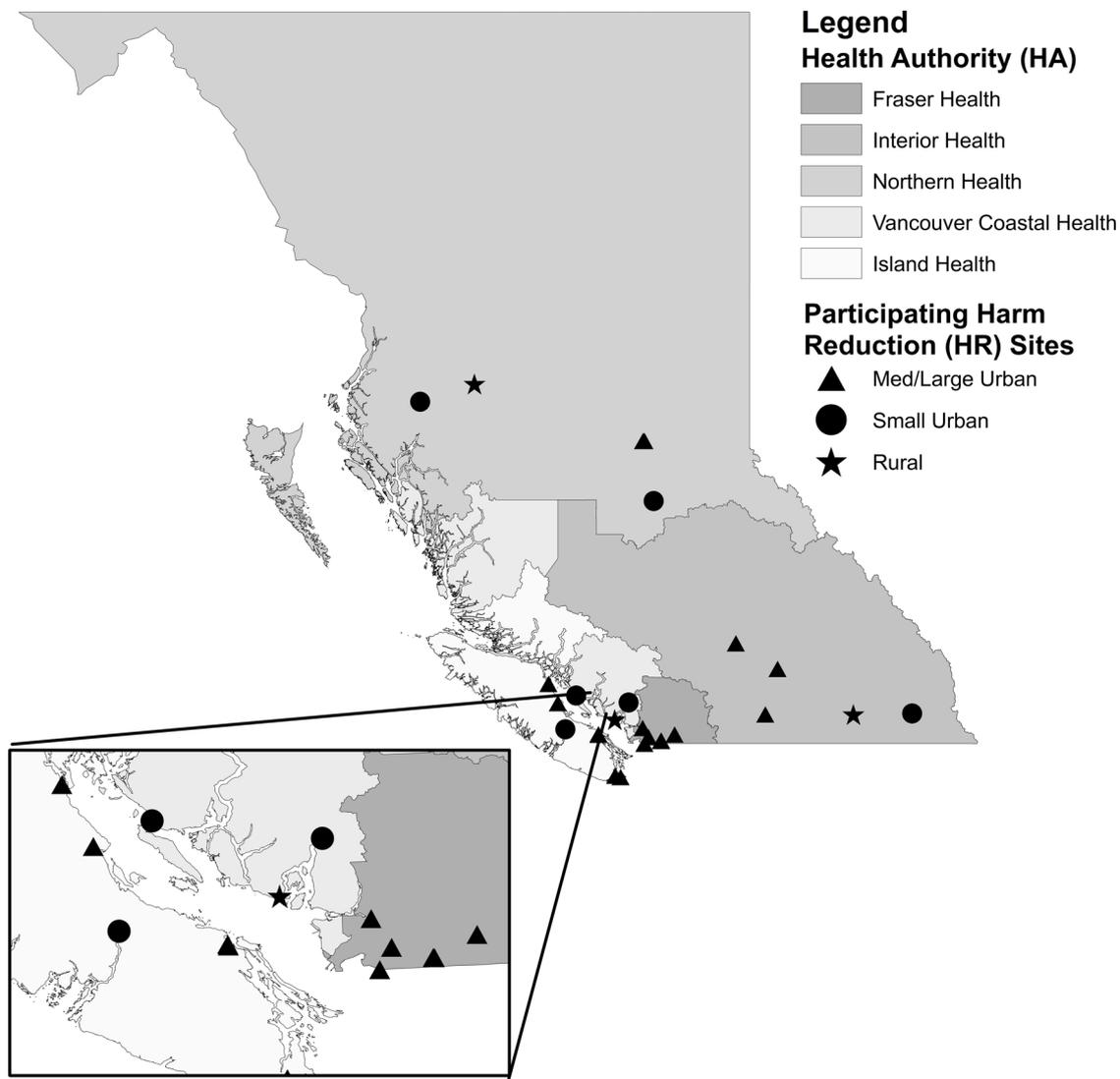


Fig. 1. Harm Reduction Sites that participated in the 2018 Harm Reduction Client Survey (HRCS).

regardless of other drugs used. If they listed any other non-opioid drug (including alprazolam (Xanax), crystal meth, cocaine, crack, methylphenidate (Ritalin), amphetamine/dextroamphetamine (Adderall), lorazepam (Ativan), diazepam (Valium), tobacco, alcohol, cannabis), and did not report using opioids, they were categorized under 'Non-opioid use'. Other variables indicating drug use including preferred drug use method (injection, inhalation/smoking, snorting, rectal/oral, prefer not to say), witnessing an opioid overdose in the last six months (yes, no, prefer not to say), and experiencing an opioid overdose in the last six months (yes, no, prefer not to say) were also included.

2.4. Analysis plan

All analyses were conducted using R version 3.5.2 (The R Foundation, 2019). Study-related ethics approval was obtained through the University of British Columbia Office of Behavioural Research Ethics, # H07-00570 (The University of British Columbia, n.d.). A demographic table was used to describe the study sample from the 2018 iteration of the HRCS. Frequency distributions were then used to describe differences in study sample characteristics by naloxone possession.

The model building strategy described by Hosmer and Lemeshow (Hosmer et al., 2013), and further operationalized by Zhang (Zhang, 2016), was employed. Variables were chosen on a conceptual basis for

bivariable and multivariable analysis to explore trends and examine distributions by the outcome variable. Variables were cross-tabulated with the outcome variable and those with a p -value < 0.25 , and/or which were deemed to be conceptually relevant, were included for further multivariate analysis. Conceptually relevant interaction terms were tested, including the interaction between the preferred drug use method and type of drug used. Given the high prevalence of the outcome, a Poisson regression model with robust error variance (Zou, 2004) was chosen to investigate factors associated with possessing a naloxone kit among harm reduction site clients. Adjusted prevalence ratios (APR), 95% confidence intervals (CI), and p -values are reported. P -values less than 0.05 were considered statistically significant.

2.5. Dealing with missing data

Complete case analysis (CCA) was used for the primary analyses in this study. This resulted in 127 (26.1%) individuals with missing data associated with any of the dependent or independent variables being removed from the analysis. After also removing those who reported 'prefer not to say' from the multivariate analysis, a total of $N = 323$ observations was used in the multivariable model. While observations were assumed to be missing at random, results were verified by running a parallel analysis using ten imputed datasets using multiple imputations by chained equation (MICE) (Azur et al., 2011).

Table 1
Demographics of the Harm Reduction Client Survey (2018) by Surveyed Health Authorities.

Demographic Characteristics	Fraser Health Sites = 7 n (%)	Interior Health Sites = 5 n (%)	Northern Health Sites = 4 n (%)	Vancouver Coastal (Rural communities) Sites = 3 n (%)	Island Health Sites = 8 n (%)	TOTAL Sites = 27 N (%)
Participants*	199 (40.9)	69 (14.2)	72 (14.8)	48 (9.9)	98 (20.2)	486 (100)
Gender						
Women	74 (37.2)	23 (33.3)	32 (44.4)	8 (16.7)	36 (36.7)	173 (35.6)
Men	121 (60.8)	44 (63.8)	39 (54.2)	36 (75.0)	61 (62.2)	301 (61.9)
Other ^A	2 (1.0)	1 (1.4)	1 (1.4)	4 (8.3)	1 (1.0)	9 (1.9)
Prefer not to say	2 (1.0)	1 (1.4)	0 (0.0)	0 (0.0)	0 (0.0)	3 (1.7)
Age						
≤ 29	37 (18.6)	15 (21.7)	18 (25.0)	5 (10.4)	19 (19.4)	94 (19.3)
30 – 39	53 (26.6)	20 (29.0)	26 (36.1)	9 (18.8)	26 (26.5)	134 (27.6)
40 – 49	50 (25.1)	27 (39.1)	19 (26.4)	7 (14.6)	26 (26.5)	129 (26.5)
50 – 59	50 (25.1)	5 (7.2)	6 (8.3)	15 (31.3)	16 (16.3)	92 (18.9)
≥ 60	8 (4.0)	2 (2.9)	1 (1.4)	11 (22.9)	10 (10.2)	32 (6.6)
Prefer not to say	1 (0.5)	0 (0.0)	2 (2.8)	1 (2.1)	1 (1.0)	5 (1.0)

^A Other genders reported include being a trans man, trans woman, and gender non-conforming.

* Row percentage shown.

3. Results

3.1. Survey demographics

A total of 486 individual client surveys were collected. [Table 1](#) represents the demographic characteristics of the completed 2018 Harm Reduction Client Survey (HRCS), stratified by health authority. The overall survey sample was unevenly distributed across health authorities, with the majority (40.9%) of participants from Fraser and only 9.9% of surveys conducted in Vancouver Coastal rural communities. Across all health authorities, the sample consisted of fewer women (35.6%) than men (61.9%), and a very small minority reported being another gender (1.9%). A total of 19.3% of clients surveyed were between the ages of 19–29, another 54.1% were between the ages of 30–49, and 25.5% were above the age of 50.

3.2. Study sample

[Table 2](#) represents the baseline characteristics of the study sample ($n = 348$) after excluding cases who reported 'prefer not to say' for the dependent variable, and for which there were missing responses to any of the dependent or independent variables, stratified by naloxone kit possession. Fewer women (35.6%) were surveyed compared to men (62.6%). The majority of survey participants preferred inhaling or smoking substances (53.4%) as opposed to injecting (35.1%), snorting (6.0%), or rectal or oral administration (1.7%). A majority of survey respondents had reported witnessing an overdose (60.9%), though a majority had not personally experienced an overdose (76.4%) in the last six months. The majority of the sample were non-First Nations (72.7%), unemployed (77.9%), identified as heterosexual (88.2%), lived in a medium or large urban area (72.7%) and reported having regular housing (64.7%).

Across the study sample, 70.7% of clients reported having a naloxone kit (see [Table 2](#)). A higher proportion of women (73.4%) reported having a kit compared to men (68.8%). Having a kit was reported by a higher proportion of those who reported using opioids within the last seven days (77.9%), and who had witnessed (75.0%) or experienced (73.1%) an overdose in the last six months, compared to those who did not. A higher proportion of those who preferred to inject drugs owned a naloxone kit (85.2%) compared to those that preferred to smoke or inhale (63.4%) or snort drugs (61.9%).

3.3. Correlates of naloxone possession

[Table 3](#) shows the adjusted prevalence ratios and 95% confidence intervals for correlates of naloxone kit possession among harm

reduction site clients across BC (excluding Vancouver). In the multivariate analyses, First Nations self-identification, current employment status, experiencing an overdose in the last six months, and sexual orientation were excluded due to statistical and conceptual non-significance. In addition, inhalation/smoking and snorting were collapsed into a single group to better compare injection vs non-injection drug use, given their distinct prevention/intervention needs ([Novak and Kral, 2011](#)). Urbanicity has not been explored previously and was included in the model to examine geographical variations in naloxone kit possession that cannot be otherwise explained by Health Authority geographical boundaries.

After adjustment, individuals who used opioids were more than twice as likely to possess a naloxone kit compared to individuals who used non-opioid drugs (APR = 2.39 [95% CI: 1.33–4.32]). The likelihood of possessing a naloxone kit was also positively and significantly associated with injection as the preferred method of drug use (APR = 2.39 [95% CI: 1.25–4.58]) when compared to inhalation, smoking, or snorting drugs. An interaction analysis revealed that the effect of preferred drug use method did not significantly differ between opioid and non-opioid drug use (all $p > 0.2$). Gender, age, urbanicity, and regular housing were not significant predictors of owning a naloxone kit. Individuals having witnessed an overdose in the previous six months were more likely to possess a kit compared with those who had not witnessed an overdose (APR = 1.56 [95% CI 0.90–2.71]) though this was not significant ([Table 3](#)).

[Table 1](#) in the supplemental files presents the results of the multivariate regression model using imputed data. A total of $n = 25$ responses (5.4%) were missing for having a naloxone kit, $n = 3$ (0.62%) for gender, $n = 23$ (4.7%) for drug use (opioid vs non-opioid), $n = 40$ (8.2%) for preferred drug use method, $n = 38$ (7.8%) for witnessed an overdose, $n = 42$ (8.6%) for experienced an overdose, $n = 24$ (4.9%) for First Nations status, $n = 5$ (1.0%) for age category, $n = 4$ (0.82%) for employment status, $n = 8$ (1.6%) for sexual orientation, and $n = 13$ (2.7%) for having a regular address. There were no missing variables for Health Authority or urbanicity. The imputed data included a final sample size of 415, after excluding those who responded 'prefer not to say' for dependent and independent variables. The direction and strength of associations were generally consistent with regression results from the complete case analysis, although having witnessed an overdose in the last six months was a statistically significant predictor of possessing a naloxone kit in the multiply imputed analysis (APR = 1.99 [95% CI: 1.23–3.24]).

4. Discussion

The current study sought to determine the prevalence and correlates

Table 2
Summary characteristics of the 2018 Harm Reduction Client Survey (HRCS), investigation of characteristics associated with having a naloxone kit.

Characteristics	Has A Naloxone Kit N = 246 n (%)	Does Not Have a Naloxone Kit N = 102 n (%)	Total Study Sample N = 348 n (%) ^a	p-value
Health Authority				0.29
Fraser Health	102 (73.4)	37 (26.6)	139 (39.9)	
Interior Health	27 (73.0)	10 (27.0)	37 (10.6)	
Northern Health	43 (75.4)	14 (24.6)	57 (16.4)	
Vancouver Coastal (Rural communities)	14 (46.7)	16 (53.3)	30 (8.6)	
Island Health	60 (70.6)	25 (29.4)	85 (24.4)	
Gender				0.73
Women	91 (73.4)	33 (26.6)	124 (35.6)	
Men	150 (68.8)	68 (31.2)	218 (62.6)	
Other ^A	5 (83.3)	1 (16.7)	6 (1.7)	
Age				0.24
≤ 29	44 (64.7)	24 (35.3)	68 (19.5)	
30 – 39	77 (77.0)	23 (23.0)	100 (28.7)	
40 – 49	72 (75.0)	24 (25.0)	96 (27.6)	
≥ 50	53 (63.1)	31 (36.9)	84 (24.1)	
Drug Use (Last 7 days)				< 0.01
Opioid ^B use	190 (77.9)	54 (22.1)	244 (70.1)	
Non-opioid ^C use	56 (53.8)	48 (46.2)	104 (29.9)	
Preferred drug use method				< 0.01
Injection	104 (85.2)	18 (14.8)	122 (35.1)	
Inhalation/smoking	118 (63.4)	68 (36.6)	186 (53.4)	
Snorting	13 (61.9)	8 (38.1)	21 (6.0)	
Rectal/Oral	4 (66.7)	2 (133.3)	6 (1.7)	
Prefer not to say	7 (53.8)	6 (46.2)	13 (3.7)	
Witnessed an opioid overdose (Last 6 months)				0.03
Yes	159 (75.0)	53 (25.0)	212 (60.9)	
No	79 (62.7)	47 (37.3)	126 (36.2)	
Don't know	5 (83.3)	1 (16.7)	6 (1.7)	
Prefer not to say	3 (75.0)	1 (25.0)	4 (1.2)	
Experienced an opioid overdose (Last 6 months)				0.77
Yes	49 (73.1)	18 (26.9)	67 (19.3)	
No	184 (69.2)	82 (30.8)	266 (76.4)	
Don't know	9 (81.8)	2 (18.2)	11 (3.2)	
Prefer not to say	4 (100.0)	0 (0.0)	4 (1.15)	
First Nations self-identification				0.33
Yes	64 (74.4)	22 (25.6)	86 (24.7)	
No	174 (68.8)	79 (31.2)	253 (72.7)	
Prefer not to say	8 (88.9)	1 (11.1)	9 (2.6)	
Currently Employed				0.08
Yes	50 (73.5)	18 (26.5)	68 (19.5)	
No	187 (69.0)	84 (31.0)	271 (77.9)	
Prefer not to say	9 (100.0)	0 (0.0)	9 (2.6)	
Sexual Orientation				0.91
LGBTQ ^D	28 (73.7)	10 (26.3)	38 (10.9)	
Heterosexual	215 (70.0)	92 (30.0)	307 (88.2)	
Prefer not to say	3 (100.0)	0 (0.0)	3 (0.9)	
Regular Housing ^E				0.15
Yes	165 (73.3)	60 (26.7)	225 (64.7)	
No	79 (65.3)	42 (34.7)	121 (34.8)	
Prefer not to say	2 (100.0)	0 (0.0)	2 (0.6)	
Urbanicity				0.39
Rural	25 (73.5)	9 (26.5)	34 (9.8)	
Small Urban	39 (63.9)	22 (36.1)	61 (17.5)	
Medium/Large Urban	182 (71.9)	71 (28.1)	253 (72.7)	

* Column percentages.

^A Other genders reported include being a trans man, trans woman, and gender non-conforming.

^B Opioids included methadone, morphine, hydromorphone (Dilaudid), oxycodone, fentanyl, heroin.

^C Non-opioid reported include alprazolam (Xanax), crystal meth, cocaine, crack, methylphenidate (Ritalin), amphetamine/dextroamphetamine (Adderall), lorazepam (Ativan), diazepam (Valium), tobacco, alcohol, cannabis.

^D LGBTQ orientations reported include gay, lesbian, bisexual, and queer.

^E Regular housing categorized as 'yes' for those that reported having a permanent address for one month or more, and 'no' for those who reported having no regular place to stay (homeless, shelter, couch surfing, no fixed address).

of possession of take-home naloxone kits among harm reduction site clients in BC. Overall, 70.7% (n = 246) of surveyed individuals, and 77.9% (n = 190) of people who used opioids possessed a naloxone kit. Prevalence was relatively high across different health authorities, gender, and age categories, and suggests a notable uptake of the BCTHN program by harm reduction site clients. Importantly, this study suggests

that individuals who reported using opioids were more than twice as likely to possess a kit compared to those who reported using only non-opioid drugs. Additionally, the study found that individuals who preferred inhaling, smoking or snorting substances were significantly less likely to possess a naloxone kit compared with individuals who preferred injecting substances.

Table 3

Adjusted prevalence ratios and 95% confidence intervals for correlates of naloxone kit possession among harm reduction site clients (Complete case analysis).

Having a Naloxone Kit	APR (95% CI)	P-value
Gender		
Men	1.00	–
Women	1.09 (0.63 – 1.90)	0.76
Other ^A	0.80 (0.06– 9.88)	0.86
Age		
≤ 29	1.00	–
30 – 39	1.79 (0.83 – 3.88)	0.14
40 – 49	1.73 (0.78 – 3.87)	0.18
≥ 50	1.56 (0.71 – 3.46)	0.27
Drug Use		
Non-opioid use ^B	1.00	–
Opioid use ^C	2.39 (1.33 – 4.32)	< 0.01
Preferred drug use method		
Inhalation/smoking/snorting	1.00	–
Injection	2.39 (1.25 – 4.58)	0.01
Rectal/oral	0.75 (0.21 – 2.65)	0.65
Witnessed an opioid overdose (Last 6 months)		
No	1.00	–
Yes	1.56 (0.90 – 2.71)	0.11
Regular Housing ^D		
Yes	1.00	–
No	1.42 (0.82 – 2.46)	0.21
Urbanicity		
Rural	1.00	–
Small Urban	0.50 (0.16 – 1.51)	0.22
Medium/Large Urban	0.62 (0.22 – 1.70)	0.35

Abbreviations: AP, Adjusted prevalence ratios; CI, confidence interval.

N = 323 after excluding individuals with missing responses or responded 'prefer not to say' for all dependent and independent variables.

^A Other genders reported include being a trans man, trans woman, and gender non-conforming.

^B Opioids included methadone, morphine, hydromorphone (Dilaudid), oxycodone, fentanyl, heroin.

^C Non-opioid reported include alprazolam (Xanax), crystal meth, cocaine, crack, methylphenidate (Ritalin), amphetamine/dextroamphetamine (Adderall), lorazepam (Ativan), diazepam (Valium), tobacco, alcohol, cannabis.

^D Regular housing categorized as 'yes' for those that reported having a permanent address for one month or more, and 'no' for those who reported having no regular place to stay (homeless, shelter, couch surfing, no fixed address).

To our knowledge, our study is one of the first to examine correlates of naloxone kit possession among PWUD outside of urban areas. In the USA, one cross-sectional study of people who inject drugs (PWID) in the city of Baltimore found that more than two-thirds of participants had ever received a naloxone kit (Tobin et al., 2018). Another study examining naloxone possession among PWUD in Norwegian cities reported that 43% of participants possessed a naloxone kit (Madah-Amiri et al., 2019). In both studies, females were more likely to possess a naloxone kit when compared to males –also reflected in the current study, though gender was not a significant predictor in the multivariate model.

In Canada, a study by Nolan et al. conducted through two prospective cohorts between 2014 and 2015 with people who used opioids (n = 506) in Vancouver and found that 22.4% possessed a naloxone kit (Nolan et al., 2017). Similarly, analysis of the 2015 iteration of the HRCS found that 17.0% of all survey respondents (n = 812), and 20.0% of people who used opioids, possessed a naloxone kit (Davis et al., 2016). The opioid crisis was declared a public health emergency in BC in April 2016 (British Columbia Centre for Disease Control, 2017), and differences in the reported prevalence of naloxone kit possession over time may reflect heightened public awareness and changing social and public health environment. These changes include federal removal of naloxone from prescription list, provincial descheduling of naloxone, widened eligibility criteria to the BCTHN to include people at risk of witnessing an overdose, and vast expansion of the BCTHN program

(British Columbia Centre for Disease Control, 2019c).

A higher proportion of people who use opioids possessing a naloxone kit may positively reflect training and education goals relating to the opioid-specific use of naloxone in overdose events. However, stakeholders and public awareness campaigns should be vigilant of communicating the need for naloxone kits among people who use stimulants or other drugs. While the risk of contamination remains low, there have been reported overdoses due to fentanyl-contaminated stimulants (British Columbia Centre on Substance Use, 2018d; CBC News, 2019). Given their lack of awareness and experience, people who are opioid naïve are at high risk of overdose from even small amounts of opioids, especially considering the unpredictable drug supply in BC. In addition, people who do not use opioids may be around others who do, and may be best placed to respond to an overdose event.

The current findings illustrate a need for better education around the risk of fatal opioid overdose associated with all drug administration methods. A significantly lower likelihood of having a kit among people that prefer inhaling, smoking, or snorting drugs, even after controlling for the effects of opioid use and other potential confounders, may reflect existing misconceptions that there is a lower risk of opioid overdose associated with non-injection routes of administration. Findings from the BC Coroner's investigations of illicit drug overdose deaths in BC from 2016 to 2017 show that smoking and intranasal drug use were implicated in a high proportion of illicit drug overdose deaths (39% and 29%, respectively), similar to the proportion of overdose deaths related to injection drug use (41%) (Coroners Service of British Columbia, 2018). Importantly, a 2013 qualitative survey with PWUD in BC found that participants readily agreed that 'smoking is a safer way of consuming drugs than injecting' (Persaud et al., 2013). Currently in BC, supervised consumption services largely do not allow for smoking drugs within facilities (Bourque et al., 2019). Expansion of supervised consumption services to serve people who smoke drugs, as others have called for (Bourque et al., 2019), may help shift this perception of risk and encourage practices to promote safety among people who use drugs by any route of administration.

The current study has a number of strengths and limitations. The findings provide vital insight into PWUD in communities that have been left out of previous studies and surveys (Laurent, 2002), with around 30% of the sample coming from rural or small urban communities. Validation studies in the literature also suggest that three- and seven-day recall, as used in our study, is accurate and shows good concordance with urinalysis data (Cherpitel et al., 2018). Previous surveys have asked participants to recall drug use within the past six (Nolan et al., 2017), and even 12 months (Government of Canada, 2018). Given the quickly changing nature of the opioid crisis and naloxone distribution practices, the current findings also help inform naloxone distribution and education practices across North America, where similar publicly funded programs are underway (Canadian Agency for Drugs and Technologies in Health, 2018; Hewlett and Wermeling, 2013).

As with any cross-sectional analysis, this study cannot infer causal relationships and results are vulnerable to recall and misclassification bias. Inaccurate recollection or reporting of types of substances used may have resulted in misclassification of drug use. Nonetheless, published validation studies done with PWUD suggest that self-reported drug use in survey responses is generally valid, especially if respondents are confident that their responses will be confidential and anonymous (Harrison, 1997; Weatherby et al., 1994). Another important limitation of this study is the level to which this data may infer naloxone possession among less engaged PWUD, both because the HRCS relied on surveying current clients of harm reduction sites, and because harm reduction sites may also distribute naloxone. This study used a convenience sampling strategy, which resulted in some uneven sampling across the province and may not be representative of the region as a whole. Potential differences in culture and attitudes across regions in BC were not captured in this study and require future qualitative

research. In addition, the Vancouver Coastal region was purposefully under-sampled in this study and Vancouver Coastal communities sampled for the HRCS were exclusively rural or small urban communities. Therefore, the context of the city of Vancouver, which has the highest concentration of harm reduction services, is BC's most populous city, and whose PWUD population is well studied and represented in other longitudinal cohorts (British Columbia Centre on Substance Use, 2018a, b, c), was not captured in the HRCS. Missing data also resulted in a reduction in study sample size. This limitation was addressed using multiple imputations, which largely confirmed the initial results using complete case analysis.

5. Conclusion

Community-based naloxone distribution programs like the BCTHN can be highly successful in equipping PWUD with life-saving take-home naloxone kits, especially when they are actively using harm reduction services. However, the current analysis suggests that additional efforts may be needed to inform individuals of the risk of overdose and the importance of carrying naloxone, regardless of preferred method of drug use. Comprehensive public health messaging is crucial in eliciting appropriate overdose recognition and response, especially as poly-substance use is common, the risk of opioid contamination exists, and friends and family are likely to witness overdose events.

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Contributors

Authors AMB and KP conducted analyses, data interpretation, and drafted the article. Authors AC, MK, and JB contributed to data interpretation, revision and feedback. BG was involved in coordination for the Harm Reduction Client Survey. All authors approved the final manuscript before submission.

Declaration of Competing Interest

No conflict declared.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the

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