

EVALUATION REPORT

THE USE OF PULSE OXIMETERS TO SUPPLEMENT OVERDOSE RESPONSE
IN BRITISH COLUMBIA: PERCEPTIONS OF EXPERIENTIAL WORKERS



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Substance Use Research



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The authors respectfully acknowledge that they live and work on the unceded traditional territory of the Coast Salish Peoples, including the traditional territories of xʷməθkʷəy̍əm (Musqueam), Sḵwx̱w̱ u7mesh (Squamish), Səlil̓wətaʔ (Tseil-Waututh), WSÁNEĆ (Saanich), Lkwungen (Songhees), and Wyomilth (Esquimalt) peoples.



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ACRONYMS

BC – British Columbia

COVID-19 – Coronavirus disease 2019

SARS-CoV-2 – Severe acute respiratory syndrome coronavirus 2

CNS – Central nervous system

GABA – Gamma-aminobutyric acid

PWUD – People who use drugs

CPR – Cardiopulmonary resuscitation



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EXECUTIVE SUMMARY

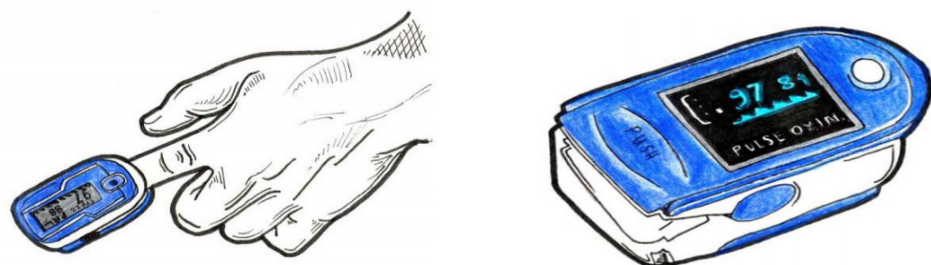
Illicit drug toxicity is the leading cause of unintentional death in the province of British Columbia (BC),¹ which led to the declaration of a provincial public health emergency in April 2016.² The vast majority of these deaths (85% in 2019) involve the opioid, fentanyl.¹ Recently, there have been increasing reports in BC of substances containing mixtures of opioids and benzodiazepines (BCCSU, 2020, personal communication) and identification of unregulated etizolam in urine drug screens (LifeLabs, 2020, personal communication). Opioids mixed with benzodiazepines complicate management of acute opioid toxicity because while naloxone can reverse the respiratory depressant effects of the opioid, it has no effect on the sedation caused by benzodiazepines. To assist the assessment and monitoring of oxygen levels during overdoses, including those involving illicit benzodiazepines, pulse oximeters were provided to experiential workers in overdose response settings.

The purpose of this evaluation was to assess and improve the pulse oximeter program at SOLID Outreach and RainCity Housing and to better support the vital roles that experiential workers play in their respective communities. Seven qualitative telephone interviews were conducted in June and July 2020 with experiential workers employed at SOLID Outreach and RainCity Housing. The interview transcripts were organized in NVivo. Inductive thematic analysis identified key themes that were shared with the experiential workers on the team for data validation.

Experiential workers reported that pulse oximeters are easy to use, acceptable to clients, and provide objective data to aid decision-making regarding interventions. They also improve clinical decision making and competencies (e.g., communication, collaboration, and professionalism) among experiential workers, increase their confidence, and save time. During the COVID-19 pandemic in which physical distancing is key to curb transmission of SARS-CoV-2, pulse oximeters have the potential to decrease unnecessary contact. Unexpectedly, we found that pulse oximeters have a calming effect on both the clients and overdose responders, which may lead to better outcomes by encouraging clients to adhere to monitoring recommendations by experiential workers.

However, pulse oximeters do present challenges. For example, false readings have been observed in various situations. Nevertheless, participants consistently demonstrated strong troubleshooting skills. Other important challenges to consider include a limited supply of pulse oximeters among experiential workers resulting in insufficient access and overreliance on the oxygen saturation and pulse rate readings during an overdose response.

Overall, we found that pulse oximeters are useful tools to supplement overdose response initiatives. We recommend increased access to pulse oximeters and adequate training for experiential workers across BC.





BACKGROUND

ILLCIT DRUG OVERDOSE CRISIS

Illicit drug toxicity is the leading cause of unintentional death in the province of British Columbia (BC).¹ In 2016, the provincial government declared a public health emergency due to the unprecedented increase in illicit drug toxicity deaths.² While mortality is occurring across the province, the three cities with the highest burden are Vancouver, Surrey, and Victoria.¹

The vast majority of these deaths (85% in 2019) involve illicit fentanyl.¹ Opioids, such as fentanyl, can induce central nervous system (CNS) and respiratory depression. This opioid-induced respiratory depression decreases blood oxygenation, which, in turn, decreases oxygen delivery to the brain. A fentanyl overdose can rapidly result in brain injury or death unless the overdose is reversed, and blood oxygen levels are restored.³ Therefore, key components of the management of acute opioid toxicity are to give rescue breaths to restore blood oxygen levels and to administer the opioid antidote, naloxone, to reverse the opioid-mediated effects.⁴

Recently, drug checking services in BC have identified illicit benzodiazepines and benzodiazepine analogues (e.g., etizolam, flualprazolam, and flubromazolam) in samples of street drugs sold as opioids (BCCSU, 2020, personal communication).

Benzodiazepines and their analogues depress the CNS by potentiating the inhibitory neurotransmitter, gamma-aminobutyric acid (GABA). In pure benzodiazepine overdose, supportive care provided in hospital is generally adequate.⁵ However, in select patients, the benzodiazepine antidote, flumazenil, can be used to reverse the effects of benzodiazepines.⁶ Nevertheless, flumazenil can be harmful and is only used in hospital settings in rare cases of severe, pure benzodiazepine overdose when the patient has no contraindications to its use.⁵

Importantly, benzodiazepines have no activity on the opioid receptor. Mixing opioids and benzodiazepines is concerning because they may produce synergistic CNS and respiratory depression and can increase the risk of overdose and death.^{7,8} Furthermore, opioids mixed with benzodiazepines complicate management of acute opioid toxicity because while naloxone can reverse the respiratory depressant effects of the opioid, it has no effect on the sedation caused by benzodiazepines. In other words, naloxone reverses respiratory depression due to the opioid, but the person remains sedated as the benzodiazepine is still active. This is in contrast to a pure opioid overdose in which consciousness and an adequate respiratory rate can be restored after a single or multiple dose(s) of naloxone.

THE PEER-2-PEER PROJECT

In BC, experiential workers—persons with lived/living experience of substance use who support people who use drugs (PWUD)—are at the forefront of harm reduction and overdose response efforts. Working in overdose response settings can be stressful and traumatizing and can have lasting social, emotional, and mental health effects for individuals.^{9,10,11} Therefore, there is a critical need to equip experiential workers with the resources to support them in their roles. The Peer-2-Peer research project aims to identify, implement, and evaluate supports for experiential workers in overdose response environments in BC. The Peer-2-Peer research project is based at two organizations: SOLID Outreach Society on Vancouver Island and RainCity Housing in the Vancouver Coastal and Fraser Health regions.

Some experiential workers at SOLID Outreach and RainCity Housing had previous training with standard equipment used by many first responders. This equipment includes pulse oximeters, which are small portable devices that measure pulse rate and the oxygen saturation of hemoglobin. However, the majority of experiential workers at SOLID Outreach and RainCity Housing did not have ongoing access to pulse oximeters. To address this need and investigate their utility before a broader distribution, the Peer-2-Peer project provided pulse oximeters to these two pilot sites.

This support intervention was timely as pulse oximeters can assist with the assessment and monitoring of oxygen levels during overdoses, including those involving illicit benzodiazepines. When incorporated into the management of acute drug toxicity, pulse oximeters have the potential to provide clarity and aid decision-making by demonstrating the need for and effectiveness of resuscitation efforts. By reducing the need to provide unnecessary rescue breaths, pulse oximeters also have the potential to reduce the risk of transmission of infection, including SARS-CoV-2.



METHODOLOGY

EVALUATION PURPOSE

The overall purpose of this evaluation was to assess and improve the pulse oximeter program at SOLID Outreach and RainCity Housing and to better support the vital roles that experiential workers play in their respective communities.

EVALUATION OBJECTIVES

1. Undertake quality assurance of the program (e.g., protocol, cleaning, level of difficulty of use, and reporting).
2. Assess the effectiveness of training that was provided to experiential workers for using the pulse oximeters.
3. Assess the uptake and utility of pulse oximeters among experiential workers.
4. Assess the impact of pulse oximeters on experiential workers and overdose responses.
5. Assess the effect of pulse oximeters on experiential workers during the COVID-19 pandemic.
6. Gain input (e.g., attitudes, perceptions, and beliefs) from experiential workers on the pulse oximeter program.
7. Inform the future implementation and expansion of the pulse oximeter program to overdose response settings elsewhere.

EVALUATION DESIGN

This evaluation was a formative evaluation, with components of constructive process and outcome evaluations that provide information about the strengths and weaknesses of the program's implementation processes as well as program outcomes.¹² This structure will identify program components that are helping the program to achieve its goals.

This evaluation incorporated a community-based research design, whereby experiential workers were involved in multiple parts of the evaluation, from the development of the evaluation questions to data validation.

DATA COLLECTION AND ANALYSIS

This evaluation used a qualitative design for data collection. Qualitative telephone interviews were conducted in June and July 2020 with experiential workers employed at SOLID Outreach and RainCity Housing. We used purposeful sampling of participants with varying levels of experience with pulse oximeters. Participants were recruited by the organizational managers at each of the sites. The inclusion criteria for participants were as follows: work in an overdose response setting, identify as a peer/experiential worker, over the age of 18, and able to complete an interview in English.

Written informed consent was obtained. All interviews were conducted by one member of the academic research team. Each interview lasted approximately 45-minutes, and participants received \$20 CAD as an honorarium. Demographics were obtained at the end of each interview to ensure that a diversity of participants were included; however, because of the small scale of experiential work in BC, demographic identifiers are not associated with quotes presented here to protect anonymity.

Interviews were guided by a semi-structured interview guide that was informed by the research objectives and literature review. The content areas included questions about experiential workers' training related to pulse oximeters, experience with pulse oximeters in overdose response, and input on the project. The interviews began with a brief review of the background, key points of the consent form, and purpose of the interview. As the interviews progressed, the guide was adjusted to remove questions that elicited repetitive responses, and new questions were added based on interim findings. Interviews were conducted until data saturation was reached (i.e., when no new themes emerged).

The interviews were audio-recorded, and the recordings were transcribed verbatim by an external transcriptionist. De-identification and memoing were performed on raw transcripts to reveal the key themes, which formed the basis of the coding framework developed by two academic researchers. This coding framework was inputted into NVivo (QSR International, version 12), where segmenting and coding were performed by one researcher. These steps of inductive thematic analysis were then reviewed by another researcher. The key themes were summarized and presented to the experiential researchers on the Peer-2-Peer team for data validation and assistance with interpretive description to generate practical and applied knowledge from the data and situate the findings within the real-world context.

This study received research ethics approval from the University of British Columbia Research Ethics Board (REB #: H12-02557-A025).



FINDINGS

DETAILS ABOUT THE INTERVIEWS

A total of seven interviews were conducted. Three academic researchers on the team confirmed that no new themes were emerging by the seventh interview. The interviews were conducted with:

- Five experiential researchers from SOLID Outreach
- Two experiential researchers from RainCity Vancouver

TRAINING

We found that experiential workers learned how to use pulse oximeters in overdose response from three types of instructors. These instructors were managers, paramedics working at an overdose prevention and supervised consumption site, and other experiential workers with previous experience using pulse oximeters. The training was categorized as theoretical (i.e., reviewing instructions or literature and discussing how to use pulse oximeters), observational (i.e., watching other first responders use pulse oximeters), and practical (i.e., hands-on experience using pulse oximeters).

Training provided by management was received specifically in the context of this project. For example, the management at SOLID Outreach reviewed with their staff the instructional handout created by the Peer-2-Peer project entitled, *“Using Oximeters During an Overdose Response.”* This document contains information on normal ranges of oxygen saturation and pulse rate, how to incorporate pulse oximetry into an overdose response, sources of error, and cleaning instructions. This training was categorized as theoretical.

Several experiential workers had also received training from paramedics even before the pulse oximeters were distributed by the Peer-2-Peer project. For example, multiple individuals at SOLID Outreach learned how to use pulse oximeters during their *“hand-in-hand [work] with B.C. Ambulance”* at an overdose prevention and supervised consumption site in Victoria. As one participant explained:



“You can have really good conversations with the paramedics about all the different things throughout the overdoses [...] And so we got to sit there and pick these paramedics’ brains and ask them questions. [...] It was really helpful having somebody there.”

This training began with theory and observation and evolved into practice incorporating a pulse oximeter into an overdose response protocol. As another participant explained, *“[then we] applied it [...] till we got good at it.”* Therefore, this training has elements of all three categories that emerged from the data.

Training provided by experiential workers with previous experience using pulse oximeters was also received in the context of this project. As one participant new to using pulse oximeters explained, their training was provided by a *“senior peer”* who was *“very well versed in all of the techniques.”* Indeed,

these individuals have “[tried] to pass on what [they’ve] learned” by teaching other experiential workers “how to do it and what it’s for” and “how to use them.” Therefore, this training was categorized as theoretical and observational.

Overall, experiential workers consistently thought that the training they’d received was adequate; however, managers and experiential workers with previous experience using pulse oximeters suggested the implementation of more extensive training.

UTILITY OF PULSE OXIMETERS

Table 1 summarizes the strengths and challenges of pulse oximeters that emerged from the interviews. Each of the themes is described below in more detail.

TABLE 1. Strengths and Challenges of Pulse Oximetry in Overdose Response

STRENGTHS	CHALLENGES
Acceptability	Batteries
Objectivity	False readings
Portability	Insufficient access
Rapid and simple	Overreliance
Usefulness during COVID-19	

STRENGTHS

Acceptability

Overall, the pulse oximeters were accepted well by experiential workers as an additional tool to complement their overdose response. There were also no concerns from the community of PWUD on the use of pulse oximeters during an overdose response.



“I’ve never heard of or seen anybody who’s concerned.”



“I’ve had no one ever say no or they don’t really want it on their finger.”

Objectivity

Multiple experiential workers explained that pulse oximeters brought an objective component to their assessment. Furthermore, the ability to quantify a person's condition affected the dynamic between the client and first responder, and the ability to monitor interventions impacted decision-making regarding interventions.



"Being able to quantify the effect of an overdose...it just changes everything."



"It shows them that it's not just your opinion [...] It's provable that they're not breathing enough."

Portability

The pulse oximeters distributed for this project were small and battery-operated. As such, many participants explained that they carried one throughout their shift at an overdose prevention site or on a mobile outreach team.



"I usually have one in my bag or on me at all times while I'm working in an overdose prevention site. So, I think it's really handy to have one at least on you or in the place that you're working."

Rapid and simple

Experiential workers consistently expressed that pulse oximeters were quick and easy to use in overdose response.



"On a scale of one to ten, one being very easy and ten being very difficult, I would honestly say maybe a two. They are extremely easy to use. They're quick to work."

Usefulness during COVID-19

Many participants thought that pulse oximeters provided the same advantages regardless of the COVID-19 pandemic. However, one experiential worker explained that a key advantage of using pulse oximeters during the COVID-19 pandemic is that they facilitated assessment from a safe physical distance.



"We can know whether we have to actually be working with that person in close quarter or not [...] I can monitor the heart rate and blood oxygen from a safe distance until I decide to do otherwise."

CHALLENGES

Batteries

One of the challenges described by experiential workers was that the battery-operated pulse oximeters distributed for this project are susceptible to running out of power. This emphasizes the importance of ensuring adequate battery power at the beginning of each shift and/or having access to spare batteries.



"Yeah, a couple of times the batteries were dead, and nobody had any batteries to put in them. And then we just go back to the old school of judging their colour. But we're more prone to call 911 if we don't have the backup of the oximeter."

False or inadequate readings

Another challenge that experiential workers described with pulse oximeters was false readings. Situations in which pulse oximeters were found to be less reliable included the presence of fake nails, calloused fingers, dirt, henna, poor circulation, cold extremities, and condensation on the pulse oximeter. However, experiential workers consistently demonstrated strong troubleshooting skills, including rotating the pulse oximeter, cleaning and/or wiping it, and/or trying a different finger, a toe, or an ear lobe.



"I've had to clip it onto a fellow's ear once just because his legs and his arms weren't vascular at all. Like he had done so much damage that [the pulse oximeter didn't get a reading]."

Insufficient access

Some experiential workers expressed that they had insufficient access to pulse oximeters. For example, one participant explained the difficulties of having only one per site:



“But the drawbacks are you only have perhaps one like we do per site. So, if one person is carrying it around, they may not be in the location to use it. Or so the others can apply it.”

This was exacerbated by some experiential workers forgetting to return a pulse oximeter at the end of their shift. However, at the time of the interviews, none of the pulse oximeters provided by the Peer-2-Peer project were reported to be permanently missing.



“Initially [each experiential worker having a pulse oximeter for the duration of their shift] was the plan and that worked for a while. That worked when we had one site and we were able to provide more oversight. But once we started to spread the team out, they went missing too often for that to work. [...] So, we’ve gotten to a point where [...] we’re going to buy more so people have them on them.”

Overreliance

A critical challenge was that some experiential workers relied too heavily on (single) oxygen saturation and pulse rate readings while responding to an overdose. This challenge emphasizes the importance of adequate training, highlighting that pulse oximeters provide supplemental information to the regular assessment. Furthermore, the trend of the readings is more informative than single data points.



“Certain people are almost handcuffed when they think about the numbers too deeply. [...] The numbers just give you an idea of what’s happening inside of the person. It’s not something tangible or concrete [...]. But it helps us. It’s a tool. [...] So, it’s a matter of knowing and understanding the process of bringing a person back from an overdose and then putting those numbers into it.”

IMPACT OF THE PULSE OXIMETRY PROGRAM

Table 2 summarizes the impact of pulse oximetry on the overdose response protocol and responder that emerged from the interviews. Each of the themes is described below in more detail.

TABLE 2. Impact of Pulse Oximetry on Overdose Response and Responder

CLINICAL DECISION MAKING	COMPETENCIES	PSYCHOLOGY	TIME
Assessment	Collaboration	Confidence	Timesaving
Type of drug(s)	Communication	Mood	
Decision-making regarding interventions	Leadership		
Monitoring	Professionalism		
Preparedness			
Usefulness outside of overdose response			

CLINICAL DECISION MAKING

Assessment

Most participants explained that pulse oximeters aided their assessment of a person’s condition.



“It gives me a starting point. Okay, so this is what’s going on. And then I can tell other people and we can go from there. Or I can just take in that knowledge—or take in what I see and then proceed myself, if I’m by myself. But it just really helps. It gives that, okay, this is what’s happening inside the body that I can’t see. And this is something that—these are my friends, my peers. I need to help them not get brain damage. So, it’s like, what’s my best course of action? How do I help them?”

Type of drug(s)

Interestingly, multiple participants described how a pulse oximeter could be used to predict the type of drug(s) involved in an overdose. These drugs included stimulants, opioids, and benzodiazepines.



“Well, I think, again, oximeters are going to be very, very helpful [...] at telling any type of benzo overdoses. Now unfortunately there is no medication during a benzo overdose that is used or effective as naloxone doesn’t work.”



“Well, if it’s a benzo-involved overdose, then basically once their air’s staying steady at or above 90, it’s pretty safe to assume that they’ve been benzoed, and they’re just sleeping. The crappy part comes in with them sometimes sleeping eight or nine hours. In that case, if they’ve been sleeping for more than a couple hours, we’re supposed to phone the ambulance and have them brought to the hospital.”

Decision-making regarding interventions

Participants consistently expressed that pulse oximeters helped guide their decision-making regarding interventions in an overdose response. These interventions included calling 911, giving rescue breaths, and administering naloxone.



“Yeah. Absolutely. If his oxygen level is good, then I don’t need to give him breaths.”



“Well, before we had them there was people getting Narcanned that didn’t necessarily need to be Narcanned. They were not overdosing. They were just sleeping.”

Monitoring

Pulse oximeters were used broadly by experiential workers to monitor oxygen saturation. One participant explained the importance monitoring oxygen saturation over time:



“The most important part is to identify the trends and know what’s happening over a period of time. ‘Cause we’ve already given someone Naloxone. We’re expecting them to respond to that and start to come around. And if their numbers aren’t going up, likely that means that there’s a benzo in the dope or something like that. And we change the way that we’re working on the patient. So, the numbers are important on their own. But it’s more about the progress that the person is making once we start to work with them.”

Other situations included monitoring response to rescue breaths and naloxone. The monitoring of pulse rate was less common.

Preparedness

Many participants expressed that pulse oximeters became a central tool in their overdose response protocol. Furthermore, pulse oximeters helped experiential workers feel more prepared when approaching an overdose.



“Oh, yeah, absolutely. Now that I’ve always had one with me, it would be—I would feel [that I am] lacking necessary equipment if I didn’t have it.”

Usefulness outside of overdose response

Interestingly, multiple participants explained that pulse oximeters are useful in situations outside of overdose response. These included an individual monitoring their pulse rate as part of an anger management strategy, staff monitoring oxygen saturation of a co-worker with pulmonary disease, and an experiential worker responding to acute coronary syndrome in the community.



“A couple of nights ago I used one for a heart attack. I can only imagine how badly we would have hurt him if I hadn’t of used the oximeter and found that he had a pulse. He had—he’s a big guy, so it was hard to find his [arteries] to check his pulse. And the oximeter found it. It took about a minute of it being on his finger before it registered. But it was nice to see that his air was slowly going up and he had a pulse so there was no point in giving him CPR [cardiopulmonary resuscitation].”

COMPETENCIES

Having objective data about a person's condition allows experiential workers to improve their communication, professionalism, and interprofessional collaboration. As one participant discussed:



"You've now got information to give [your coworkers] and they know what that information means so they know how they can help. It changes the entire situation. It changes the dynamics between staff. It changes the dynamics between the person who's overdosed and staff. And it has us ready for if and when—we hope never to need it—but if the paramedics have to come, we have information before they get there. We've already done a portion of the job. Which means they can react faster. We're dealing with something that a person will go braindead if they don't breathe for a short period of time. So that's hugely important."

As this quote describes, through the use of pulse oximeters, experiential workers have developed and demonstrate key competencies related to work as frontline workers, including collaboration, communication, and professionalism. Each of these are described in more detail below.

Collaboration

The objectivity of the readings provided by the pulse oximeters facilitated collaboration between first responders. For example, as this participant described:



"And then if [...] [the oxygen saturation] was under 90, I'd go and get another staff with me. And then we'd go from there and assess the situation."

Communication

The objectivity of the readings also improved communication between experiential workers and other first responders as well as with clients and their families.



"And it's just really handy for everybody not just myself. [...] say [someone's] boyfriend [...] might be overdosing, it's handy for them too to see the numbers and explain to them, okay, this is what's happening. Under 90 is bad. Over 90 is good. And you can put it on their finger and show them, see you're at, like, 98. And so you're alive."

Leadership

Experiential workers with previous experience using pulse oximeters demonstrated strong leadership skills. When SOLID Outreach and RainCity Housing received the pulse oximeters, these individuals adopted them immediately and taught other workers how to use them.



"When I came to work for RainCity we didn't have any in the beginning. But as soon as we got them, I was using them right away and showing everybody else how to use them."

Professionalism

Multiple participants demonstrated professionalism in the context of using pulse oximeters. This included educating and reassuring clients of an overdose prevention and supervised consumption site and knowing one's limitations.



"[At the site, there are] ten booths and you could have two people on a really heavy nod. So, you just throw [on] the [pulse oximeter] and people are, like, oh, are you checking on that person? Yeah, we are and if you want to come over and you can see that their oxygen's good. They're just very tired, and if they need anything else, we'll help them as it comes about. But at this particular point, they're good."



"I think the main thing is I know my limitations. That's what's really important too. What I can do and what I can't do. That's why paramedics are coming."

PSYCHOLOGY

Confidence

Participants consistently expressed that pulse oximeters increased their confidence when responding to an overdose. This effect was mainly due to the objectivity that pulse oximetry provides and the impact of quantification on decision-making.



“For me as a peer it’s helpful because it gives me a little bit of confidence in what I’m doing, to make that call.”

Mood

Surprisingly, pulse oximeters affected the dynamic between the responder and the client. As one participant explained, this resulted in individuals adhering to recommendations to be monitored during recovery from an overdose:



“It almost has a calming effect and the person is okay. [...] I don’t know what it is that changes. But it changes the way that we interact with the person. It gives— maybe it’s a more professional feel. [...] it calms the person down and they sit down, and they oftentimes take the time necessary to get better.”

This calming effect is crucial as the half-life of many opioids is longer than that of naloxone. Therefore, someone could overdose again if the opioids in their system still have sufficient activity after the naloxone has been metabolized.

TIME

Timesaving

Many participants explained that incorporating a pulse oximeter into their overdose response protocol saved time. Saving time is critical as brain injury can quickly result from hypoxemia (low level of oxygen in the blood) due to opioid-induced respiratory depression.



“Saves a lot of time. ‘Cause a lot of cases we don’t have a lot of time.”

SUGGESTIONS FOR IMPROVEMENT FROM EXPERIENTIAL WORKERS

Suggestions by experiential workers to improve this pilot project included increasing the accessibility of pulse oximeters and having access to more training.

INCREASING ACCESSIBILITY

Increasing accessibility was expressed broadly among participants. They suggested that each experiential worker should have their own pulse oximeter and each worker should have access to one at all times. One participant explained that as experiential work in overdose response occurs both during and outside of designated working hours, the benefits of each worker having their own pulse oximeter would outweigh the costs of supplying them:



"I would suggest that everyone should have their own. It's such a small expense when you consider what you get out of it. [...] And then not only that but people are going home, and they probably see just as many overdoses when they're not working as they do at work. So, it's of great value."

Therefore, supplying each experiential worker with their own pulse oximeter may improve outcomes of those overdoses occurring in community and supported housing. Another participant described the benefits of carrying a pulse oximeter:



"I think by having that around my neck it makes me feel more secure moving forward. Because I don't have to yell for somebody to grab it. I have it. I can quickly check them. Or if I'm going outside and say I see somebody on the ground, I can just be, like, okay, are you okay? If they're not responding, throw it on and then call for help if I need help."

Therefore, experiential workers carrying a pulse oximeter with them at all times may further increase their confidence, improve their competencies (e.g., communication, collaboration, and professionalism), and save time in overdose response.

Given these findings, we recommend that experiential workers across the province have access to a personal pulse oximeter to use throughout their shift and, if need be, when they are at home and/or in the community. Ideally, a pulse oximeter would be carried like a naloxone kit and would be within reach at all times. Given the strengths and relatively inexpensive price of basic pulse oximeters, the benefits would most probably far outweigh the costs (there is a large variety of pulse oximeters available; the most basic ones cost as little as \$15).

MORE TRAINING

The second major suggestion was to have more training on how to use a pulse oximeter when responding to an overdose. One participant suggested that a day program should be offered to both experiential workers and the broader community of PWUD:



"I feel confident with it. But there are employees that could benefit from a definite program, right. Like a day program would be great. And for anybody even, like, if it was operating in the community it would be a great thing for everybody to be able to just go and take."

This kind of training would be analogous to how naloxone training is offered to both first responders and members of the community. Increasing the competency in overdose response of the broader community of PWUD has the potential to reduce the morbidity and mortality of the overdose crisis.

When discussing more training, another participant explained that it is important for experiential workers to have more hands-on experience using pulse oximeters in overdose response:



"Well, I think it's always good, you know, to go over [how to use a pulse oximeter] again. When to use it, how to read it. 'Cause there's a lot of people, a lot of staff, [that] don't know how to use that stuff. It's good to have the hands-on experience of using it rather than just teaching them about it."

Therefore, additional training should be a combination of theory and practice using pulse oximeters in overdose response.

Given these findings, we recommend that experiential workers have access to experiential worker-led training on how to appropriately and effectively use a pulse oximeter to supplement an overdose response. This training must equip experiential workers with the knowledge to interpret oxygen saturation and pulse rate readings and incorporate them into their usual approach to an overdose. Ideally, this training would combine theoretical and practical components. Theoretical components could review such topics as basic physiology, normal ranges, and false readings. Practical components could start with simulated overdoses (similar to first aid courses) and evolve to real-life overdose response situations where less experienced workers can apply their skills under the supervision of an experiential worker with previous experience using pulse oximeters and receive feedback. Importantly, this is similar to how some of the participants in this study with previous experience using pulse oximeters were trained. This training could be a full course for individuals without prior experience using pulse oximeters and an abbreviated yearly refresher for individuals with experience.



CONCLUSION

Pulse oximeters are easy to use, acceptable to clients, and provide objective data to aid decision-making regarding interventions at an overdose event. They also increase the confidence with which experiential workers respond to overdoses and save time. Pulse oximeters may pose minor challenges such as false readings and over-reliance; however, overall, they are useful tools to supplement overdose response initiatives by experiential workers. We recommend increased access to pulse oximeters and adequate training including hands on experience and refresher courses for experiential workers across BC.



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