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Reported impacts and workplace needs of transit operators related to passenger drug misuse on transit vehicles

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Running Head Title: Needs of transit operators' due to drug exposure

Abstract

Objective: Transit operators have reported health effects and safety concerns from drug misuse occurring on public transit vehicles in the Pacific Northwest (USA). As transit operators are essential to providing safe and reliable transportation to their communities, it is important to investigate these impacts and methods to control these hazards.

Methods: Qualitative interviews of 19 transit operators (WA, OR) explored operators' experiences, risk perceptions, impacts, and needs related to passenger drug use.

Results: Interviewees identified various impacts to health and well-being, including physical health effects, mental health outcomes, and emotional effects. Operators reported lacking support from their agencies, and highlighted engineering controls as a need that is currently unfulfilled.

Conclusions: Evaluation and implementation of interventions to control this hazard may be effective in improving operator health and well-being, and in ensuring that transit systems can continue to serve communities.

Key words: Occupational health; transit operators; perceived risk; impacts; workplace supports

Learning Outcomes

- Describe the impact that passenger drug use has on transit operators, and identify methods to reduce these impacts
- Describe unfulfilled supports for transit operators as it pertains to passenger drug use
- Identify methods to reduce transit operators' exposure to passenger drug use

Introduction

Transit operators are an essential component of a city's transportation infrastructure, providing safe and reliable transportation for the communities they serve. With drug misuse occurring on public transit vehicles in the Pacific Northwest (USA), recent research has shown that transit operators are at risk of secondhand exposure to drug residue.[1] An exposure assessment of air and surfaces in public transit vehicles in the Pacific Northwest[1] found fentanyl residue in 25% of air samples and 46% of surface samples, and methamphetamine in all air samples and nearly all surface samples. These findings correspond with recent trends in drug misuse in the Pacific Northwest, including the increasing prominence of synthetic opioids such as fentanyl and high rates of methamphetamine misuse.[2–6] While research has yet to evaluate the impact of these exposures among transit operators, research among first responders who respond to drug-related incidents has shown low risk of toxicity.[7] However, previous research among physicians in operating rooms has also hypothesized that repeated secondhand exposures to opioids may be a risk factor for substance use and adverse health outcomes[8,9]; research has yet to investigate whether transit operators are at similar risk.

Operators have reported feeling sick, have required time off from work, and have filed for workers' compensation due to exposure to drug misuse on transit.[10,11] Short-term fentanyl inhalation exposure can result in symptoms such as respiratory depression and hypotension; however, these symptoms are typically associated with direct use of fentanyl via smoking rather than second-hand exposure.[12] In contrast, symptoms of short-term methamphetamine exposure include increased wakefulness, hyperventilation, hypertension, high body temperature, and rapid or irregular heartbeat,[13] and third-hand exposure to methamphetamine can produce behavioral effects, respiratory issues, sleep issues, and skin and eye effects.[14] However, among transit

operators who feel sick after drug use incidents on their vehicle, it is unclear whether symptoms correspond with that of secondhand exposures to fentanyl or methamphetamine. Witnessing drug-related critical incidents at work such as overdoses can also be distressing for transit operators, who are not trained medical professionals and therefore should not be expected to intervene during such incidents. These experiences can adversely impact operator mental health.[15–17] Furthermore, these drug misuse incidents pose a safety risk to operators, as passengers under the influence of drugs can display unpredictable behaviors, leading to potentially dangerous interactions between operators and passengers.

In addition to the impacts of secondhand exposure to drug misuse, public risk perception of secondhand exposure to drugs, especially fentanyl, remains high.[18–23] Previous research among transit operators in the Pacific Northwest has shown that risk perceptions of secondhand exposure to drug use can impact operators' intent to leave their job.[24] Concern over potential exposure to drugs such as fentanyl may contribute to increased stress among transit operators, who may feel unsafe at work[25]; this can increase the likelihood of burnout and reduce job satisfaction, further contributing to attrition.[26] The fear of overdose or other adverse health outcomes from secondhand exposure to illicit drugs may contribute to increased stress and adverse mental health outcomes among exposed workers [18,19,22,23]; however, risk perception theory states that those who are exposed less might be more likely to experience stress and adverse mental health outcomes, as the exposure feels more unfamiliar.[27] Research has shown that when workers perceive their workplace as having a poor safety climate and high health risk, job satisfaction decreases,[28,29] regardless of the actual health risk posed by the workplace. When workers perceive an unsafe work environment, they are more likely to leave and exhibit symptoms consistent with stress, anxiety, and burnout.[30] Outrage factors (i.e., emotional aspects

of risk that influence how people perceive risk) can also impact individuals' perceived risk[31]; in the context of secondhand drug exposures on transit, factors such as controllability (whether the exposure is in one's control or someone else's control), process (how trustworthy and fair employer decision-making seems to the worker, and whether decisions address worker concerns), and fairness (whether the exposure is distributed among everyone, or unique to the worker or worker population), may impact transit operators' risk perceptions.

Transit operators are routinely exposed to other physical and psychosocial exposures that may negatively impact their health, such as long hours spent sitting,[32] seat vibration,[33] high levels of work-related stress,[34] high job demands with little latitude (i.e., worker autonomy over decision-making at work),[34,35] and an expectation to be on time.[36] Previous literature has highlighted that transit operators experience workplace violence and inadequate social support, which can lead to burnout and negatively impact wellbeing.[37,38] The presence of drug misuse on transit vehicles can exacerbate these existing occupational psychosocial stressors among transit operators.[15–17] Reducing exposure to work-related stressors is not only important for operator health and safety,[39] but also for the community they serve, as operators are ultimately responsible for the safety of passengers on their vehicle.

Research has yet to evaluate interventions that reduce the effects of drug misuse incidents on transit operators. In 2024, the U.S. Federal Transit Administration (FTA) issued a general directive to investigate the overall safety of transit workers in urban transit systems.[40] While this directive was not specific to drug misuse on transit, results from this directive identified safety interventions most commonly being adopted by transit agencies across the country, many of which may be applicable to reduce the effects of drug-related incidents. The most prevalent interventions in the FTA report were focused on increased education, awareness, and

surveillance.[41] While these interventions may be impactful in the context of drug misuse, they do not explicitly eliminate the hazard itself, which is the most effective method to promote a hazard-free workplace.[42] The FTA report identified other interventions that have lower rates of implementation, such as protective barriers for the operator area or improved security patrolling to remove disruptive passengers[41]; these interventions do provide increased protection for transit operators from secondhand drug exposures. However, like the other interventions, it remains unclear whether these interventions result in improved well-being for operators in the context of drug misuse on transit vehicles.

Our research aims were to qualitatively elucidate characteristics of transit operators' jobs, explore their experiences with passenger drug use in the Pacific Northwest (USA), and characterize the impacts of passenger drug use on transit operators. We aimed to investigate risk perceptions related to exposure to passenger drug use, and whether outrage factors such as controllability, fairness, and process were relevant factors that impacted these risk perceptions.[31] Furthermore, we explored whether transit operators believe that existing methods of reducing the impacts of drug misuse on transit vehicles are acceptable, and if operators believe that further interventions are needed to protect both themselves and the riding public. The findings of this study can identify transit operators' workplace needs and help inform potential interventions that can subsequently be evaluated for effectiveness in reducing the impacts of drug use incidents on operators. Additionally, the qualitative study design is novel for this worker population and allows for an in-depth exploration of the daily experiences of transit operators related to passenger drug use. This is particularly useful in capturing contextual information that is difficult to characterize using quantitative methods, including the accessibility of existing supports, workplace safety climate and culture, and how operators perceive workplace trainings and

supports. This type of inductive research can serve as a starting point for future research, and offers the opportunity to shed light on operator experiences in their own words, which is important when dealing with a topic that is politically charged and sensationalized such as drug use.

Methods

We conducted a qualitative study designed to investigate the experiences of transit operators as they pertain to passenger drug use. This study was conducted in conjunction with the Amalgamated Transit Union (ATU), which represents transit workers across the United States and Canada.[43] We recruited 19 transit operators from three ATU union locals in Washington and Oregon states. Recruited transit operators participated in a semi-structured interview that asked about impacts, risk perceptions, existing workplace supports, and unfulfilled needs of transit operators related to passenger drug use. The portion of the interview guide that focused on workplace supports and unfulfilled needs was developed using the National Institute for Occupational Safety and Health's (NIOSH) hierarchy of controls[42,44] as a framework.

Recruitment:

Locals (i.e., regional union branches): In conjunction with the ATU International and leadership at ATU locals, we recruited two locals in Washington State (Seattle and Lynnwood) and one local in Oregon (Portland) into our study.

Survey participants: Potential transit operator participants were identified by a survey gauging their interest in our study (and explained that the study covered the issue of drug use on transit vehicles) that was shared by each local's leadership to their membership. Eligibility criteria were assessed in the first two questions of the online survey, and included transit operators who were at least 18 years old and were actively driving. Via the survey, operators were asked to self-select

into the participant pool, and every operator in the participant pool was contacted via email for recruitment. Operators who responded to our email were considered recruited; subsequent snowball sampling with the same recruitment email was used to increase sample size.[45] Upon recruitment, participants provided informed consent and were informed that no personally identifiable information would be made publicly available.

Participants in this study were compensated with a $20 gift card upon completion of interviews. This study was determined to be exempt from review by the University of Washington's Human Subjects Division as it was deemed minimal risk.

Data Collection:

This study used semi-structured interviews (approximately 40 minutes) of transit operators (one interview per operator) asking about experiences with passenger drug use, the impacts they have experienced from passenger drug, risk perceptions related to secondhand exposure to drug use, existing workplace guidance and supports related to passenger drug use, and workplace needs. Interviews were guided by an interview guide (SDC #1, http://links.lww.com/JOM/C500), part of which was developed using the NIOSH hierarchy of controls[42,44] as a framework. Given the semi-structured nature of interviews in this study, the interview guide provided flexibility for the interviewer to follow up on responses provided by the interviewee at the interviewer's discretion. Interviews were conducted over Zoom, and were recorded and transcribed with the consent of the interviewee.

Data Analysis:

Interview transcripts were downloaded from Zoom, and data were cleaned for transcribing errors. Data collected from interview transcripts were analyzed thematically. Data were analyzed using an inductive strategy based in a constructionist paradigm (i.e., that participant experiences,

events, meanings, and realities are based on societal factors),[46] using previously described methods of conceptual qualitative research.[47,48] Analysis began inductively for initial code development, using a starting codebook that incorporated the hierarchy of controls[44] and outrage factors[31] as an initial framework. Interview transcripts were examined for trends in risk perceptions, impacts due to passenger drug use incidents on transit vehicles, supports pertaining to passenger drug use, and needs of transit operators.

Transcripts were split-coded by two independent coders. Initially, 20% of transcripts (n=4) were independently co-coded by the two coders, and codes were compared. Differences in coding were identified and resolved via open discussion between the coders[49]; independent coding of co-coded transcripts yielded 95% agreement between coders, and differences were always due to one coder missing a code for an excerpt, rather than the coders applying different codes to an excerpt. Then, the remaining transcripts (n=15) were divided between the two coders and coded independently. Coders subsequently discussed any areas of confusion in independently coded transcripts to ensure accurate application of the codebook, which resulted in 100% code agreement between coders after discussion. All discussions between coders throughout this process allowed for refinement of code definitions, which were memorialized into the codebook. Dedoose qualitative data analysis software[50] was used to maintain organization of this codebook and its codes, allowing for easier sorting of codes and its corresponding data. Upon completion of coding of all interview transcripts, the two coders collaboratively developed key themes by synthesizing individual codes into broader thematic concepts, by examining frequently applied codes and frequently co-occurring codes, and connections between codes.

Results

Study Participants:

Table 1 summarizes work characteristics of the interviewed operators. Of the 19 interviewees, 13 (68.4%) worked in King County, WA; 3 (15.8%) worked in Snohomish County, WA; and 3 (15.8%) worked in Portland, OR. The majority of interviewed operators were solely coach drivers (73.7%). Eight operators (42.1%) were employed for 5 to 9 years, which was the most prevalent length of employment among interviewees. No demographic information was collected from interviewees to preserve confidentiality.

Table 2 summarizes key themes that emerged across interviews. Themes were categorized by research aims and are explored here, with the inclusion of quotes from interviewees to provide richer descriptions of their experiences.

Describe characteristics of the job:

Job satisfaction:

Overall, transit operators reported satisfaction with their job, with many operators saying that they "*like their job*" or they "*enjoy their work.*" For many transit operators, a primary appeal of the job was that they were in a position of service where they could help their community. Some operators gave other reasons for enjoying their work, such as the pay and benefits, or positive passenger interactions. Despite overall job satisfaction, the majority of operators still identified aspects of their work that they disliked. Many operators said that negative interactions with passengers were one of the downsides of their work, with one operator describing, "*I have personally been assaulted, been spit at, had stuff thrown at me.*" Some operators also identified their employer as a dislike about their job, with operators describing that they felt replaceable, and that agencies "*pretend that nothing's wrong in their system*", or that the priority is to "*keep*

service rolling." A few operators mentioned fear of punitive retaliation from management if they reported work-related incidents and concerns.

Transit operators are responsible for the safety and well-being of passengers:

Throughout interviews, nearly all operators said that being a transit operator involves a lot more than operating a vehicle. Several interviewees said that they are ultimately responsible for the safety of their passengers and assessing the risks posed by hazards on and outside their vehicle, with one operator describing: "*sensing what's going to happen in front of you and we're keeping an eye out on those individuals who will just step out in front of traffic… just make sure that you're going to keep everybody safe. And that's my first priority, is to make sure everyone's safe.*" When asked about instances of passenger violence or drug use on vehicles, one operator said that he did not feel that he should be solely responsible for evaluating risk, describing, "*I would have liked to see supervisors, instead of telling me to fill out a report, to actually come down and assess the situation.*" This also highlights the lack of existing support for operators, and that having someone physically show up to provide support could improve operators' experiences, especially considering that operators are in a potentially physically vulnerable position regarding these passenger interactions.

Operators' protectiveness over the safety and well-being of their passengers was also evident in their descriptions of feeling care and compassion for their passengers, especially for those who are following rules, with one operator calling for enforcement of the law: "*because you got to protect the other passengers too.*" When asked about passenger drug use, another operator described, "*If other passengers are exposed, then I obviously am going to immediately say something,*" later saying, "*I say something because I see other passengers feel uncomfortable when they see it.*" Some operators said they go out of their way to try to care for their passengers,

with one operator describing, "*I would put their food up on the dash to keep it warm or to cook it… the less fortunate who didn't get hot meals, they were kind and didn't cause me any problems. I would offer them to do that.*"

Characterize transit operators' experiences with passenger drug use incidents:

Agencies do not care about operators:

Throughout interviews, the vast majority of operators said that agencies prioritize continuing service over operator safety and well-being. Most operators feel a lack of empathy from management and feel that management does not treat their health impacts due to drug exposures as real. As a result, operators feel invalidated, disrespected, and intentionally misled. When asked about seeking help from management, one operator described, "*They discipline us to suspend us, bully us into just driving the bus and not caring if anybody was being assaulted or if anybody was in trouble.*" Furthermore, many operators experienced not receiving support from their employers, who prioritized passengers over operators, even when those passengers used drugs while riding transit vehicles.

Frequency of observed drug use:

When asked how often they observed passengers using drugs on their vehicle, interviewee responses varied. Ten operators said they have daily experiences with passenger drug use, some of which were multiple times a day, while eight operators said they rarely or never observe passenger drug use. Three operators said that the frequency of observed drug use has changed, either due to switching routes or declining drug use rates. One operator described the differences in the frequency of drug use on transit vehicles based on the location: "*I'm no longer in Seattle, I'm on Vashon Island now… I've been here a year now and I have not encountered it once. In Seattle, I would venture to say daily.*"

Many interviewees also said that they are not always able to observe drug use incidents occurring. One operator described, "*I don't recall explicitly seeing people using drugs on my bus; but that's not to say that they don't. The problem is you're trying to navigate the bus and taking your eyes off the road to watch what passengers are doing is a precarious exercise.*" Another operator described that "*if it's not active use, you're seeing paraphernalia*", suggesting that there is evidence of drug use even if the actual incident goes unnoticed.

Seniority protects operators from drug use incidents:

The majority of operators highlighted the role of seniority in protecting against potential incident-related impacts and improving well-being, as senior operators have more choice in their routes, thereby allowing them to avoid routes and times when passenger drug use is more likely to occur. When talking about passengers using drugs on her vehicle, one senior operator, who had been employed for eight years, described, "*I'm so extremely blessed and grateful that I don't have to pick routes where I see it every day because I don't think I would stay a bus driver.*" In contrast, an operator who had only been employed for 1 year described, "*I worked the late shift because I'm low seniority, so I'm out till two o'clock in the morning… And at some point, the only people on your train are the houseless and the addicted*."

One operator, who is also involved in advocating for operator safety, described the impact of seniority:

"*[Low seniority drivers] are driving these routes through the middle of the night that have real challenges with people that are just riding around on their bus doing drugs or doing alcohol… So unfortunately, the guy at the low end who is just coming in, he's going to get exposed to all of this chaos. And a lot of them don't survive. I tell you, they quit within three months or even three weeks.*"

Varying opinions on the value of reporting:

When asked whether they report passenger drug use incidents on their vehicle, interviewees had varying opinions on the value of reporting incidents. Many operators would previously report incidents diligently per guidelines, but eventually "*stopped bothering because there was no point – nothing was going to happen.*" One operator described her experience with the ineffectiveness of reporting incidents:

"*In the beginning I filled out everything - security incidents, safety incidents. Any kind of incident I could fill out, I was filling them all out and reporting them. But get this – every single one of them that I filled out I never got an answer, never got any kind of an answer, never got my paper back… Never got a single response… We're all sick and tired of filling out papers when nothing gets done.*"

Reporting incidents also seemed to be a hassle for operators, with some noting that the reports take too long and the online system is slow, making it particularly burdensome to do after the end of an eight-hour shift.

Despite these concerns, about half of interviewees still said they report incidents. One operator described going out of his way to find incidents and report them:

"*More than once, I found lots of remnants from drug use syringes… One day, there would be anywhere from 10 to 30 people, partying and sleeping on… And I intentionally took that work for six months after the shift every day. I would go in, I'd get on the computer, and I'd write two to three reports on what was happening out there.*"

Investigate risk perceptions and impacts associated with drug use incidents:

Perceived severity and susceptibility of drug exposures:

Nearly all interviewees expressed both perceived severity and perceived susceptibility related to drug use incidents. An operator said that "*every time [there is a drug use incident] is dangerous*" and that even for operators who experience fewer incidents, they "*ratchet up in severity.*" Many operators expressed concern over the effects that these exposures have on the health of riders. One operator said:

"*If you look at the studies of the residue from methamphetamines, that stuff stays on there for a long time. It's not the easiest thing to get rid of. So, there's always those concerns of having to go to the back or anywhere and touch anything on the bus. Most of us don't even want to leave the driver compartment because we're afraid of touching something.*"

Controllability, process, and age of victims:

Outrage factors were themes of interest. Among the most common outrage factors discussed by interviewees was controllability, with nearly half of operators describing "*the feeling that you are trapped*" and feeling like a "*hostage having to breathe it in.*" One operator described, "*It would make me mad because I knew that there's nothing I could do.*"

Process was another outrage factor discussed by some interviewees, in particular that management does not acknowledge passenger drug use as a problem, and therefore does not intervene to stop/prevent it. An operator said:

"*I would like management chiefs, superintendents, the general managers – take it more serious than what they did… They're sitting in their offices and not boots on the ground, and they have no idea what we're going through. They hear it, but they don't know for sure, and they didn't do anything. It would have been nice to have some support. For them to protect this.*"

Several operators also called for operator involvement in company conversations and decision-making regarding passenger drug use.

The age of passengers who may be exposed to secondhand drug residue was mentioned repeatedly throughout interviews, highlighting again how operators feel protective of their passengers. Many operators said there is potential for vulnerable populations such as children and the elderly to be exposed to secondhand drug residue. One operator described an overdose incident she witnessed in which a man with children overdosed and was resuscitated, expressing concern for the well-being of the children.

Physical and mental health impacts:

Almost all interviewees reported physical and mental health impacts attributed to passenger drug use. Physical health impacts were primarily short-term effects, directly after a passenger drug use incident, such as shortness of breath, feeling sick, headaches, and dizziness. In some incidents, operators described requiring medical attention and time off work due to these short-term effects. Some operators also reported experiencing long-term physical health effects which they said were related to passenger drug uses, such as high blood pressure due to the stress of handling these incidents, long-term respiratory difficulties, and trouble sleeping.

More than half of interviewees said they had experienced long-term mental health outcomes. Stress, related to repeatedly experiencing passenger drug use aboard vehicles, was the most common. Some operators described work-related anxiety due to concern over dealing with drug use incidents; for a few operators, this anxiety was severe enough to warrant anti-anxiety medication prescriptions. One operator described his mental health and needing to take time off, "*I thought several times this isn't the job for me. I can't do this mental stress anymore. I have taken FMLA [Family and Medical Leave Act] for anxiety and stress and it was hard.*" Another

operator described that he "*would wake up dreading going to work*" and that he "*became a recluse.*"

Emotional impacts:

The majority of interviewees said they had emotional impacts related to passenger drug use. Short-term effects included anger and frustration that these incidents are occurring. One operator said he felt "*perturbed*", and "*mad because [he] knew there was nothing [he] could do*". In the long term, several operators described feeling hypervigilant, mentally distraught, less empathetic, and more negative towards society. One operator said, "*I used to love working for the bus and streetcar and [then] it was demoralizing… It cost me years and years of peace and tranquility.*" Another operator described, "*I started not liking myself because I was losing that compassion and empathy and it was changing me.*"

Explore existing supports and unfulfilled needs pertaining to drug use incidents on transit:

Operators take safety into their own hands:

Many interviewees described taking safety into their own hands to protect themselves from secondhand exposure to drugs, because of the lack of support from management and the inadequacy of existing supports (such as increases in the number of available security personnel). Some operators have opted to buy their own personal protective equipment (PPE) such as respirators; however, one operator who purchased a P100 respirator described being told by management that she was "*not allowed to wear that respirator.*"

A light rail operator said, "*I bring a roll of masking tape and I literally tape off my air vents,*" in an effort to reduce her inhalation exposure to drugs.

One operator described multiple ways in which she protects herself:

"*I have figured out that I am the only one that's going to take care of me in these situations… I mean, there isn't immediate help, so what I have learned is to take care of myself. I carry an N95 mask on me close by, within reach so I can just pop it on, and I found that that actually seems to help… I've also gotten to the point where I don't really care what the control center says. If I need to take care of myself, if I need to stop, if I need to get off the train – I'm going to do it. So I've gotten pretty bold about protecting myself because I know that there really isn't anybody else that's going to. I'm sort of out there on my own… Another way I protect myself is blocking off the area directly behind my cab. I carry these chains that we can use to block it off. I'll use caution tape if I have to. And I do that to protect myself, at least from that real close contact.*"

Many operators have sought professional mental healthcare services to help them deal with the impacts of repeatedly observing drug use incidents. While some peer-to-peer counselling services exist within transit agencies, operators reported these services to be ineffective and inefficient, noting a lack of adequate staffing.

Call for engineering controls:

Across interviewees, there was a resounding call for engineering controls. Several coach operators repeatedly mentioned the need for a physical barrier to protect them from passengers. Per operators, there has been "*talks about putting in a shield*" or "*implementing safety doors.*" Other coach operators described their preference for a completely enclosed operator cabin. There was also a call for better ventilation controls, primarily among light rail operators, who are already in a completely enclosed operator cabin. One operator described the ventilation in light rail vehicles:

"*One of the designs of the trains is all the positive air pressure that comes into the car vents itself out through the [operator] cabin. So there are louvers that shut to minimize the amount of*

air that comes from the cabin, but they don't work on the Japanese trains… With the Japanese trains, you had to literally turn the air conditioning system off which meant the train would get really cold and you'd get complaints."

Discussion

This study is the first to qualitatively characterize transit operators' experiences with passenger drug use and its impacts on operator health and well-being. Operators told us they experience drug use incidents frequently on their vehicles, and these exposures can result in a range of impacts, including physical health symptoms, mental health effects, and emotional impacts. The shared experience of these impacts in our interviewees highlights the need for intervention, not only to promote the occupational health and well-being of this worker group, but also to reduce turnover due to these perceived impacts and ensure that transit systems can continue to provide effective service to communities.

A novel finding of this study was that operators with seniority are able to select routes and regions with lower perceived risk of exposure, leaving newer operators at disproportionately higher risk of experiencing passenger drug use incidents. Interviewed operators indicated that newer operators are also less likely to advocate for themselves for fear of being fired, potentially contributing to higher rates of turnover among newer transit operators, which was also reported by interviewees. Therefore, newer operators may particularly benefit from targeted supports and interventions to reduce passenger drug use on higher-risk routes. This could potentially be accomplished by management interviewing senior operators to identify high-risk routes (i.e., those with frequent operator exposures). Deploying trained security on these routes to accompany operators can deter drug use, and offering enhanced training to new operators can

help them deal with the stressor of passenger drug use and reduce adverse mental health outcomes.

Interviewed operators said that employers do not acknowledge the impact that drug use incidents have on operators, despite their frequent occurrence on transit vehicles in the Pacific Northwest. Operators told us this results in their feeling invalidated and disrespected by their management. Operators said they are less likely to report safety incidents occurring on their vehicle when they do not believe that they will receive timely help. It is possible that this lack of reporting leads to a cyclical issue: as employers receive fewer reports, they intervene less, contributing to increased operator frustration; future research should investigate this potential issue further. Operators told us that lack of support is one reason they feel they must handle incidents on their own, putting their personal safety at risk. Future research should aim to identify evidence-based workplace supports that would most benefit transit operators.

Interviewed operators told us about how they perceive the risk of exposure to secondhand drugs, and our thematic analysis found common outrage factors shared across interviewees. As risk perceptions can affect health, specifically mental health,[30] it is important to intervene on factors contributing to risk perceptions. Outrage over process (how trustworthy and fair employer decision-making seems to the worker, and whether decisions address worker concerns) can be reduced if management actively aims to address operator safety concerns regarding passenger drug use, and includes operators in decision-making regarding operator safety. Research has shown that promoting employee participation in workplace safety committees and inclusion in the safety process can be effective to improve occupational health and safety.[51] Thematic analysis of interviews also found operators experience outrage over controllability. Facilitating resources that operators can access to protect themselves from exposure (e.g., company-provided

PPE, timely responses from supportive security to remove drug users from vehicles) can help operators feel like they have agency to prevent or reduce their exposure.

This study is also the first to assess the acceptability of existing supports provided to transit operators in the context of passenger drug use. While some supports such as increased security exist, operators reported that they still have unfulfilled needs, leading operators to take steps to protect themselves. Within the hierarchy of controls,[44] eliminating a hazard is the most effective method of hazard control and should therefore be prioritized; public health in the United States has also long supported smoke-free workplaces.[52] However, most operators reported using PPE (i.e., respirators) or administrative controls (e.g., security) to protect themselves from exposure to passenger drug use, which are less effective hazard controls per the hierarchy of controls.[44] Engineering controls, such as the enclosed driver cabin or improved ventilation that transit operators identified in these interviews, are considered more effective hazard controls.[44] In particular, engineering controls such as an enclosed driver cabin may also change the way operators interact with passengers, thereby reducing both negative and positive passenger interactions passenger interactions; future research should evaluate how these changes can impact job satisfaction. If passenger drug use on transit vehicles cannot be fully eliminated, then implementing engineering controls, which would need to be properly evaluated for effectiveness and acceptability, could help reduce transit operators' secondhand exposure to passenger drug use. The implementation of such engineering controls could also have impacts on mental health, as research has also shown that when employers are perceived to be responsive to worker health and safety concerns, workers experience reduced adverse mental health outcomes associated with workplace safety climate.[53] However, engineering controls would not protect passengers, and would not reduce the mental health and emotional impacts associated with witnessing drug

use incidents. Further research should investigate the implementation of hazard controls in transit systems, and evaluate which specific methods of control are most effective in reducing operators' exposure to passenger drug use and its impacts. Pre- and post-intervention evaluations of interventions using experimental or longitudinal study designs should aim to assess levels of potential secondhand exposure to drug residue among both operators and passengers, as well as the impacts of observing these incidents among operators.

Limitations

Qualitative research is inherently prone to subjectivity[54]; it is not possible to separate interpretive work from the researcher doing the work. However, we mitigated our bias by using strategies to improve credibility and transferability.[55] Reflexivity (i.e., acknowledging personal biases)[55] helped us improve the credibility of this work.[56] Additionally, by using multiple coders, we reduced the likelihood that the perspectives of one researcher clouded the experiences of interviewees. Due to its small sample size and unequal representation from the three union locals, the findings of this study may be difficult to generalize to a larger population. Recruitment may have also not adequately sampled operators who do not have strong feelings on drug use, as it is possible that operators with stronger feelings on the issue may have been more likely to volunteer to participate. In addition, the recent emergence of fentanyl as a commonly misused drug,[2,57] in conjunction with its higher prevalence in Western United States, may mean that the rest of the American population may not have previously experienced these types of issues. Furthermore, while our interviews followed a semi-structured approach that allowed for detailed accounts from interviewees, it is still limited in its ability to capture all nuances regarding operators' experiences with passenger drug use due to time and length constraints. To preserve anonymity with our small sample size, we were also unable to investigate demographic

impacts on perceptions about drug use. Despite these limitations, by using rich, thick descriptions (i.e., detailed descriptions of interviewee experiences),[58] transferability is promoted, as readers are provided with adequate contextual information to consider for themselves how this work may be transferable to other situations or settings.[55,56,58] This work is likely impacted by the healthy worker effect,[59] and therefore may underestimate the severity of experiences of newer transit operators. This study relies on self-report, and impacts and risks were not directly observed; future research should aim to elucidate these impacts via experimental or longitudinal study designs. As our study did not gauge experiences prior to drug use occurring on transit, we were unable to distinguish the effects of drug use incidents on well-being from the effects of other workplace stressors; future experimental or longitudinal study design may be well suited to examine these relationships. While this study elucidates operators' experiences with passenger drug use and the distress caused by potential exposure, this study does not quantify these exposures and is also unable to determine which drugs operators are more likely to be exposed to; thus, this study is unable to investigate physiological responses to these exposures.

Conclusions

Transit operators are essential in providing transportation to the communities they serve. With passenger drug use on transit putting operators at risk of secondhand exposures, it is important to investigate the impacts of these exposures, and identify unfulfilled needs of operators regarding these passenger drug use incidents. Interviewees told us that these incidents result in physical health, mental health, and emotional impacts on transit operators. Furthermore, operators told us they feel unsupported by management and that existing supports are inadequate, and called for the implementation of engineering controls. Describing these perceived impacts and unfulfilled needs can help inform future research to evaluate interventions that address these concerns and

improve the work experience of transit operators, ultimately ensuring that operators can continue providing safe and reliable service to their communities.

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Table 1: Work characteristics of interviewed transit operators (n=19)

		n (%)
Union Affiliation	Seattle	13 (68.4%)
	Portland	3 (15.8%)
	Lynnwood	3 (15.8%)
Vehicle type	All coaches (40ft and 60ft coaches)	12 (63.2%)
	40ft coach only	2 (10.5%)
	Light rail or streetcar only	2 (10.5%)
	Coaches and light rail/streetcar	3 (15.8%)
Length of employment	<5 years	2 (10.5%)
	5-9 years	8 (42.1%)
	10-14 years	2 (10.5%)
	15-19 years	2 (10.5%)
	>20 years	5 (26.3%)

Table 2: Key themes from interviews of transit operators (n=19), categorized by research aims

Research aims	Key themes identified	Interpretation and recommendations
Describe characteristics of job	1. Job satisfaction 2. Transit operators are responsible for the safety and well-being of passengers	Overall, operators are satisfied with their jobs. Many operators feel a sense of responsibility for their passengers and communities.
Characterize transit operators' experiences with passenger drug use incidents	1. Agencies do not care about operators 2. Frequency of observed drug use 3. Seniority protects operators from drug use incidents 4. Varying opinions on the value of reporting	Despite transit operators reporting frequent drug use incidents, they feel unsupported and invalidated by their employers, with some operators feeling that reporting these incidents to management has become ineffective. Promoting operator participation in workplace safety[51] may help increase trust between operators and management. Future research should aim to identify evidence-based interventions that employers can adopt to protect transit operators from these incidents.
Investigate risk perceptions and impacts associated with drug use incidents	1. Perceived severity and susceptibility of drug exposures 2. Controllability, process, and age of victims 3. Physical and mental health impacts 4. Emotional impacts	Transit operators reported being impacted by drug use incidents. Risk perceptions, which can be exacerbated by outrage factors, can impact health.[30] Facilitating resources that operators can access to protect themselves can help operators feel like they have agency to reduce their exposure, which could change risk perceptions and reduce impacts.
Explore existing supports and unfulfilled needs pertaining to drug use incidents on transit	1. Operators take safety into their own hands 2. Call for engineering controls	Despite some existing supports, transit operators have unfulfilled needs. Future research should aim to evaluate potential interventions to reduce the impacts of these drug use incidents on transit operators.

Graphical Abstract