



Prevalence and disparities in opioid overdose response training among people who inject drugs, San Francisco

Naloxone training among injectors in San Francisco

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ABSTRACT

Background: Expanding naloxone training stands to reduce opioid-related overdose deaths. The current study assessed the prevalence of overdose response training and use of naloxone among people who inject drugs (PWID).

Methods: Data were from a survey of PWID in San Francisco in 2018, recruited by respondent-driven sampling (RDS). Eligibility criteria were age over 18 years, injected non-prescribed drugs in the last year, San Francisco residence, and referral by another participant. Interviews collected demographic characteristics and injection-related behavior.

Results: The sample (N = 458) was majority male (67.5%) and over 45.5 years. Over three-fourths (76.0%) injected primarily opioids. Overall, 62.9% received overdose response training and 68.8% owned a naloxone kit. A majority (77.9%) had witnessed an overdose in the past year, of whom 55.8% used naloxone the last time they witnessed an overdose. Receiving overdose response training was significantly lower among persons of non-white race/ethnicity compared to whites (adjusted odds ratio [AOR] 0.43, 95% CI 0.27, 0.69) and higher among those who owned naloxone (AOR 6.29, 95% confidence interval [CI] 3.95, 10.02) and used syringe exchange programs (AOR 3.51, 95% CI 1.41, 8.79).

Conclusion: While the majority of PWID have had overdose response training, gaps and disparities persist in promotion of naloxone use.

Introduction

Opioid overdose continues to be the leading cause of drug-related death worldwide, accounting for two-thirds of deaths attributed to drug-use disorder. The World Health Organization estimated that in 2016, 27 million people suffered from opioid use disorders and more than 100,000 people died from opioid overdose worldwide.¹ Although heroin-related overdose deaths continue to rise, there has been an alarming increase in overdose deaths from synthetic derivatives of opioid, such as fentanyl, an analgesic that is 50 to 100 times more potent than morphine.² To combat the crisis, many countries have enacted legislation to permit prescription-free methods of providing overdose reversal medication and has prioritized improving access to drug treatment and recovery services.

An overdose occurs when a person has excessive stimulation in the opiate pathway, leading to respiratory failure. This process can be

interrupted by the introduction of naloxone, an opioid receptor antagonist that prevents and reverses an opiate-induced overdose.³ Health authorities consider naloxone access a top priority for responding to the opioid crisis. Opioid overdose education and community naloxone distribution programs have been implemented in many countries including the United States, Britain, and Germany, providing training to improve knowledge and overdose response actions among substance users at risk of an opioid overdose.⁴ Data suggest decreases in opioid overdose death rates in communities that have implemented overdose education and naloxone distribution programs.⁵

One of the largest single city naloxone distribution programs in the world is The DOPE Project, located in San Francisco, California. The DOPE Project manages the distribution of naloxone to people in San Francisco by collaborating with programs that provide services directly to people who use drugs, including all San Francisco syringe access programs, jail health services, and other community-based health

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Table 1

Characteristics of people who inject drugs surveyed in San Francisco and history of overdose response training, 2018 (n = 458)

Characteristics	Trained in overdose response N (%)	Not trained N (%)	Bivariate p-value	Adjusted odds ratio* (95% CI)	Adjusted p-value
Overall	288 (62.9)	170 (37.1)	–	–	–
Sex:			0.119		
Male	184 (60.1)	122 (39.9)		0.63 (0.39, 1.02)	0.059
Female	93 (67.9)	44 (32.1)		Ref: Female, transgender	
Transgender	7 (70.0)	3 (30.0)			
Race/ethnicity (multiple responses):					
Native American/Alaskan Native	52 (71.2)	21 (28.8)	0.089	Combined non-white vs. white categories:	<0.001
Asian/Pacific Islander	16 (48.5)	17 (51.5)	0.076	0.43 (0.27, 0.69)	
Black/African American	60 (50.0)	60 (50.0)	0.001	Ref	
Latinx	42 (60.9)	27 (39.1)	0.707		
White	214 (69.3)	95 (30.7)	<0.001		
Age in years (mean)	44.4	47.2	<0.001	–	–
Highest education level:			0.216		
Less than high school	14 (73.7)	5 (26.3)		–	–
High school diploma or GED	170 (64.6)	93 (35.4)			
More than high school	104 (59.1)	72 (40.9)			
Homeless in the last 12 months:			0.078		
Yes	257 (64.4)	142 (35.6)		–	–
No	31 (52.5)	28 (47.5)			
Ever experienced overdose:			0.016		
Yes	159 (68.2)	74 (31.8)		–	–
No	129 (57.3)	96 (42.7)			
Witnessed overdose in last 12 months:			0.008		
Yes	234 (65.9)	121 (34.1)		–	–
No	52 (51.5)	49 (48.5)			
Used naloxone last time witnessed overdose (only asked if witnessed overdose):			<0.001	–	–
Yes	157 (79.3)	41 (20.7)			
No	76 (48.7)	80 (51.3)			
Currently own naloxone:			<0.001		
Yes	244 (77.5)	71 (22.5)		6.29 (3.95, 10.02)	<0.001
No	44 (30.8)	99 (69.2)		Ref	
Drug most frequently inject, last 12 months:					
Any opioid	187 (67.5)	90 (32.5)	0.011	–	–
Methamphetamine	46 (42.2)	63 (57.8)	<0.001		
Received syringes and needles from an exchange program, last 12 months:			<0.001		
Yes	279 (66.6)	140 (33.4)		3.51 (1.41, 8.79)	0.007
No	8 (25.0)	24 (75.0)		Ref	
Frequency of drug injection:			0.023		
More than once a day	206 (67.5)	99 (32.5)		–	–
Once a day	31 (57.4)	23 (42.6)			
More than once a week	29 (54.7)	24 (45.3)			
Once a week or less	22 (47.8)	24 (52.2)			

*Adjusted for other variables in the model. Subgroups may not add up to totals due to missing data.

programs. Individuals can be trained to administer naloxone and obtain naloxone kits from training sites spread around the city. Over 13,000 people in San Francisco have received overdose reversal training, and an average of 1,500 overdose reversals are reported each year.⁶ However, despite efforts to increase naloxone access and overdose training, the opioid overdose death rate in San Francisco has reached 2.23 times the national average, 2.57 times the local rate of vehicular death, and 1.94 times the citywide homicide rate.⁷ The rate of fentanyl-involved overdose deaths has increased since 2013, in parallel with increases in fentanyl-laced drugs.⁸

Among PWID, the chance of witnessing overdose is high. The provision of naloxone and overdose prevention counseling to peers therefore stands to greatly reduce overdose fatalities. The purpose of the current study was to identify gaps and disparities of overdose prevention training among different populations of PWID in our city.

Methods

Data originate from the US Center for Disease Control and Prevention's National HIV Behavioral Surveillance (NHBS).⁹ NHBS consists of a series of cross-sectional surveys that rotate every three years through populations at high risk of HIV acquisition, including

men who have sex with men, low-income heterosexuals, and PWID. NHBS data characterize trends in HIV prevalence and risk-related behaviors over time, and to assess the reach of HIV prevention programs. The PWID cycle of NHBS uses respondent-driven sampling (RDS), a long-chain peer referral recruitment mechanism that approximates representative samples of hard-to-reach populations.¹⁰ Recruitment begins with the selection of initial participants known as “seeds” who are chosen to reflect the PWID population's diversity across different social networks (e.g., by age, race, drug of choice, language, neighborhood, and use of harm reduction services). Initial seeds are referred by service providers, with additional seeds referrals from PWID with specific requests for persons to fill the above network characteristics. A total of 9 seeds were chosen to initiate recruitment for the present survey. After completing study procedures, seeds are instructed to distribute referral coupons to recruit up to five eligible PWID from their social circles. These recruits in turn recruit other eligible PWID to the study until the sample size is achieved. Coupon recipients presenting to the study site are screened for eligibility, provide informed consent, and participate in a structured interview. To be eligible, participants must have a referral from another participant, be 18 years or older, reside in San Francisco, and report injecting illicit drugs in the past 12 months. Monetary incentives were \$25 for completion of the interview, \$25 for HIV testing,

\$25 for hepatitis C testing, and \$10 for each successfully recruited peer.

Trained staff conducted face-to-face interviews recording responses on a tablet that directly entered the data. Structured interviews included demographic characteristics and injection-related risk and preventive behaviors. The present analysis focusses on receiving overdose training among different populations of PWID. The outcome variable was asked as: "Have you ever taken part in a training about how to help someone survive an overdose from heroin, fentanyl, or opioid pain killers? The measure of use of naloxone was "People react in different ways when they see someone overdose. Which of the following describe what you did the last time you saw someone overdose on heroin, fentanyl, or painkillers? You may choose more than one option." A response card offered several options including use of naloxone. Bivariate differences were assessed using the chi-square or t-test. Multivariate logistic regression analysis was used to identify independent associations with receiving training including variables with $p < 0.2$ as candidate predictors and retaining those with $p < 0.1$ in the final model.

Results

The sample ($n = 458$) was majority male (67.5%), had a high school education or less (61.6%), and white (57.4%). The mean age was 45.5 years. Over four-fifths (87.1%) had experienced homelessness in the last 12 months, including living on the street, in a shelter, in a single-room occupancy hotel, or in a car.

Overall, 62.9% reported that they had received training in overdose response and 68.8% currently owned a naloxone kit. Overdose response training did not differ significantly by sex, education level, or housing status (Table 1). Receipt of training varied by race/ethnicity, with white (69.3%) and Native American (71.2%) PWID more likely to have received training compared to Black/African American (50.0%), Asian/Pacific Islander (48.5%), and Latinx (60.9%) participants. PWID who were trained were younger than those who had not received training (mean 44.4 vs. 47.2 years, respectively, $p < 0.001$).

In bivariate comparisons of injection-related variables, PWID who had experienced an overdose themselves (reported by 50.8% of respondents) were more likely to report overdose response training than those who had not experienced an overdose (68.2% vs. 57.3%, $p = 0.016$). Those who had witnessed overdose in the last 12 months (reported by 77.9% of respondents) were also more likely to report receiving overdose response training compared to those who had not witnessed an overdose (65.9% vs. 51.5%, $p = 0.009$). Among those witnessing an overdose in the last 12 months, 55.8% said they had administered naloxone the last time they witnessed an overdose. We found no differences in witnessing overdose by race/ethnicity; however, whites were more likely than non-whites to report a history of overdosing themselves (57.6% vs. 35.5%, respectively, $p < 0.001$). While those using naloxone were significantly more likely to have been trained to use it (79.3% vs. 48.7%, $p < 0.001$), over one in five (20.7%) who had administered naloxone had not received training. Significantly more persons who currently owned naloxone had been trained on how to use it compared to those who did not (77.5% vs. 30.8%, $p < 0.001$); however, 22.5% of those owning naloxone reported they had not received training on how to use it. Overdose response training was significantly higher among persons who used opioids as their most frequently injected drug and among those who had received clean syringes and needles from an exchange program in the last year. An increasing likelihood of receiving overdose response training was found with increasing frequency of injection.

In multivariate analysis, independent associations with receiving overdose response training were owning naloxone (adjusted odds ratio [AOR] 6.29, 95% confidence interval [CI] 3.95, 10.02) and receiving clean syringes and needles from an exchange program (AOR 3.51, 95% CI 1.41, 8.79). Persons of non-white race/ethnicities were significantly less likely to receive training than whites (AOR 0.43, 95% CI 0.27, 0.69). A borderline association ($p = 0.059$) was noted for men being less

likely to receive training compared to women or transgender persons (AOR 0.63, 95% CI 0.39, 1.02).

Discussion

Although overdose education and naloxone distribution programs are successful in providing overdose response training and materials to many PWID in San Francisco, drug overdose remains a leading cause of unintentional death citywide. Moreover, programs are leaving some groups behind. For example, we observed significantly fewer non-white persons had received overdose training compared to whites. We also noted that among those who were currently carrying naloxone, one in five had not received training on its use. Other studies have found that implementation of programs to increase access to naloxone and encourage individuals to call for assistance in overdose situations were significantly associated with reduced opioid-overdose mortality. For example, a study in 2016 found that Scotland's National Naloxone Programme was associated with a 36% reduction in the proportion of opioid-related deaths that occurred four weeks following release from prison (a period of high overdose risk).¹¹ In a follow-up study in 2019, the program distributed 8,000 naloxone kits (20 times Scotland's mean number of overdose-related deaths) by 2016, and deaths four weeks after prison release had been reduced by 50% since 2011.¹² The effectiveness of naloxone programs was further supported by a systematic review using Bradford Hill criteria, examining causation between naloxone programs and reduced opioid overdose mortality among program participants, with overdose reversals by means of naloxone programs documented in four different countries (United States, Canada, Germany, and the United Kingdom).¹³ In addition to observational studies, economic modeling found that opioid education and naloxone distribution programs are cost effective when using a standardized measure of quality-adjusted life-years (QALYs). Markov modeling studies in the United States, United Kingdom, and Russia estimated incremental cost effectiveness at \$438, £899, and \$94/QALY, respectively.^{13,14} Distribution of naloxone would decrease overdose deaths by 6.0% in the US, 6.6% in the UK, and 7.6% in Russia. Our findings suggest that closing the gaps through outreach to target populations, particularly non-white communities, and continuing to saturate naloxone supply and education on how to use it may help to further reduce overdose mortality in San Francisco.

Our study found other gaps in naloxone promotion and use. The strongest association with being trained in overdose response was accessing a syringe exchange program; further closing the training gap will have to reach beyond persons accessing such programs. More PWID who experienced an overdose or witnessed an overdose were trained in overdose prevention, suggesting personal experiences motivate seeking or accepting overdose training and lead to understanding the importance of having the medication ready at all times. PWID who did not use naloxone although they were trained on overdose response may be related to reluctance to carry or use naloxone to avoid conflicts from the police. Canada enacted the Good Samaritan Drug Overdose Act in 2017 to provide legal protection for individuals who seek help from an overdose; however, there is anecdotal evidence of individuals being stopped or arrested for carrying naloxone kits.¹⁵ Guidance and education are needed to inform PWID, police, and the public about policies that legalize the possession of naloxone and limit arrest and prosecution for carrying naloxone with other injection paraphernalia.

We recognize limitations of our study. Foremost is its representativeness. While RDS is held to approximate representative samples of hidden populations, the required assumptions are difficult to meet or prove (e.g., that participants recruit randomly from their networks, that they accurately report their network size, that they are interconnected to other social networks). We recognize that some groups may be under-represented. Nonetheless, RDS can diversify a sample aware from only included PWID who use harm reduction or other services. Other limitations affecting our data and interpretations are common to cross-

sectional surveys, including causal inference, timing of outcomes and exposures, and under-reporting of stigmatized behaviors.

Conclusion

While naloxone access, use, and training reach a majority of PWID in San Francisco as of 2018, significant disparities persist. Outreach to overlooked populations and areas, ongoing overdose prevention training, and increased avenues for naloxone distribution are needed to further reduce overdose deaths.

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Ethical approval

The study was reviewed and approved by the Institutional Review Board of the University of California San Francisco. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all individual participants included in the study.

Author contributions

All authors contributed to the concepts of the manuscript, the conduct of the study, and the writing. Kyu Kim conceived the study hypotheses, conducted the main analysis, and wrote the first draft. Hayoung Oh contributed to the analysis, interpretation, and literature review. Desmond Miller and Danielle Veloso were responsible for data collection, quality assurance, data management, and logistical oversight. Jessica Lin contributed to the overall study concept, helped secure funding, administered the grant, and provided interpretation and editing. Willi McFarland was principal investigator, leading the design of the parent study, obtaining funding, providing training and scientific oversight, guiding the concept, supervising the analysis, contributing to the interpretation and recommendations, and performing final editing

of the manuscript. All authors approved the final manuscript and could provide the original data if requested.

Declaration of competing interest

None.

References

- Information sheet on opioid overdose. (2018, August 21). Retrieved 11th April 2020 from https://www.who.int/substance_abuse/information-sheet/en/.
- Scholl, L., Seth, P., Kariisa, M., Wilson, N., & Baldwin, G. (2018). Drug and Opioid-Involved Overdose Deaths — United States, 2013–2017. *MMWR. Morbidity and Mortality Weekly Report*, 67(5152), <https://doi.org/10.15585/mmwr.mm675152e1>.
- Merlin, M., Ariyaprakai, N., & Arshad, F. (2015). Assessment of the safety and ease of use of the naloxone auto-injector for the reversal of opioid overdose. *Open Access Emergency Medicine*, 21. <https://doi.org/10.2147/oaem.s82133>.
- Strang, J., McDonald, R., Campbell, G., Degenhardt, L., Nielsen, S., Ritter, A., & Dale, O. (2019). Take-Home Naloxone for the Emergency Interim Management of Opioid Overdose: The Public Health Application of an Emergency Medicine. *Drugs*, 79(13), 1395–1418. <https://doi.org/10.1007/s40265-019-01154-5>.
- Tobin, K. E., Sherman, S. G., Beilenson, P., Welsh, C., & Latkin, C. A. (2009). Evaluation of the Staying Alive programme: Training injection drug users to properly administer naloxone and save lives. *International Journal of Drug Policy*, 20(2), 131–136. <https://doi.org/10.1016/j.drugpo.2008.03.002>.
- DOPE Project. Retrieved 12th September 2019 from <https://harmreduction.org/issues/overdose-prevention/tools-best-practices/naloxone-program-case-studies/dope-project/>.
- Visconti, A. J., Santos, G.-M., Lemos, N. P., Burke, C., & Coffin, P. O. (2015). Opioid Overdose Deaths in the City and County of San Francisco: Prevalence, Distribution, and Disparities. *Journal of Urban Health*, 92(4), 758–772. <https://doi.org/10.1007/s11524-015-9967-y>.
- Rowe, C., Wheeler, E., Jones, T. S., Yeh, C., & Coffin, P. O. (2018). Community-Based Response to Fentanyl Overdose Outbreak, San Francisco, 2015. *Journal of Urban Health*, 96(1), 6–11. <https://doi.org/10.1007/s11524-018-0250-x>.
- Gallagher, K. M., Sullivan, P. S., Lansky, A., & Onorato, I. M. (2007). Behavioral Surveillance among People at Risk for HIV Infection in the U.S.: The National HIV Behavioral Surveillance System. *Public Health Reports*, 122(1_suppl), 32–38. <https://doi.org/10.1177/00333549071220s106>.
- Heckathorn, D. (1997). Respondent-Driven Sampling: A New Approach to The Study of Hidden Populations. *Social Problems*, 44(2), 174–199. <https://doi.org/10.2307/3096941>.
- Bird, S. M., McCauley, A., Perry, S., & Hunter, C. (2016). Effectiveness of Scotland's National Naloxone Programme for reducing opioid-related deaths: a before (2006-10) versus after (2011-13) comparison. *Addiction*, 111(5), 883–891. <https://doi.org/10.1111/add.13265>.
- Bird, S. M., & Mcauley, A. (2019). Scotland's National Naloxone Programme. *The Lancet*, 393(10169), 316–318. [https://doi.org/10.1016/s0140-6736\(18\)33065-4](https://doi.org/10.1016/s0140-6736(18)33065-4).
- McDonald, R., & Strang, J. (2016). Are take-home naloxone programmes effective? Systematic review utilizing application of the Bradford Hill criteria. *Addiction*, 111(7), 1177–1187. <https://doi.org/10.1111/add.13326>.
- Langham, S., Wright, A., Kenworthy, J., Grieve, R., & Dunlop, W. C. (2018). Cost-Effectiveness of Take-Home Naloxone for the Prevention of Overdose Fatalities among Heroin Users in the United Kingdom. *Value in Health*, 21(4), 407–415. <https://doi.org/10.1016/j.jval.2017.07.014>.
- Moustaqim-Barrette, A., Elton-Marshall, T., Leece, P., Morissette, C., Rittenbach, K., & Buxton, J. (2019). Environmental Scan Naloxone Access and Distribution in Canada. [doi:10.14288/1.0379400](https://doi.org/10.14288/1.0379400).