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Changes in overdose knowledge and attitudes in an incarcerated sample of people living with HIV

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Abstract

Purpose—The purpose of this paper is to present evaluation results. People exiting incarceration who use opioids are at an elevated risk for overdose following release. People living with HIV (PLWH) who use drugs are also at increased overdose risk. Overdose education and naloxone distribution (OEND) is an effective community-based intervention, but few OEND programs have been evaluated in a correctional setting and none have specifically targeted PLWH.

Design/methodology/approach—An OEND pilot program was implemented in the Philadelphia jail from December 2017 to June 2019. OEND was provided through an HIV case management program and naloxone given at release. Participants ($n = 68$) were assessed for changes in overdose knowledge and beliefs in their ability to respond to an overdose from baseline to one month later while still incarcerated. Other demographic variables were assessed via publicly available records and case manager chart abstraction.

Findings—A total of 120 incarcerated PLWH were OEND trained; 68 (56.7%) were still incarcerated one month later and received post-tests. The 68-person sample was predominantly male (79.4%) and Black (64.7%). One-fifth reported heroin use, a third reported cocaine use and nearly 2/3 reported use of any illegal drug on date of arrest. Among these 68, overdose knowledge and overdose attitudes improved significantly ($p = 0.002$ and $p < 0.001$, respectively).

Originality/value—OEND in correctional settings is feasible and knowledge and overdose attitudes improved significantly from baseline. OEND programs should be implemented within the general population of incarcerated people but, as with PLWH, can be extended to other vulnerable populations within correctional settings, such as persons with mental health conditions and a history of homelessness.

Keywords

Correctional health care; Incarceration; Reentry; Overdose; Naloxone; Overdose education; Overdose knowledge

Introduction

The USA is in the grips of a decades-long and dynamic overdose crisis. Between 1999 and 2017, over 700,000 people died of a drug overdose, and approximately 130 deaths are attributed to opioids daily (Centers for Disease Control and Prevention, 2019). Certain demographics of the population represent high-risk groups for a fatal overdose. Researchers found that overdose deaths in Washington were 129 times higher among recently incarcerated people in the first two weeks after release from state prison than among other state residents (Binswanger et al., 2007). Other studies have noted elevated risk of overdose death for people leaving jail (Alex et al., 2017; Lim et al., 2012; Pizzicato et al., 2018). In Philadelphia, people released from jail had nearly 37 times the risk of an overdose death within two weeks of release from jail compared to other Philadelphia residents (Pizzicato et al., 2018).

As one response to increasing opioid overdoses among people who use drugs, community-based programs have been training laypeople since 1996 on how to recognize and respond to a witnessed overdose (Wheeler et al., 2015). This overdose education and naloxone distribution (OEND) training includes distributing naloxone, an overdose reversal medication that temporarily reverses the effect of an opioid overdose (Sporer, 1999). Evaluations of OEND programs have consistently shown they lower rates of fatal overdose (Clark et al., 2014; Walley et al., 2013).

Researchers have increasingly brought attention to the importance of bringing OEND interventions to correctional settings (Brinkley-Rubinstein et al., 2017; Fairbairn et al., 2017; Joudrey et al., 2019). Many corrections-based OEND programs now exist in the USA but remain largely unevaluated in terms of how they affect trainees. Offering naloxone distribution to all people being released from prison in Scotland resulted in a 36% reduction in overdose deaths in the first month out of prison (Bird et al., 2016). Among OEND trainees at the San Francisco County Jail, nearly a third reported reversing an overdose after release (Wenger et al., 2019). Simulation exercises used with participants trained while incarcerated in Rhode Island showed that many trainees properly responded to a witnessed overdose but remained nervous about calling 911 (Kobayashi et al., 2017). While some studies have evaluated knowledge after OEND training, they either did not include a pre-test (Kobayashi et al., 2017) or included a post-test that only assessed knowledge immediately after training (Pettersson and Madah-Amiri, 2017). Overall, little is known about how OEND programs

may change participant perceptions of overdose risk, their ability to recognize an overdose in someone else, or how equipped they would feel to respond to a witnessed overdose.

HIV case management programs for incarcerated persons are potentially important opportunities to implement OEND programs. Pragmatically, OEND programs are considered more sustainable and successful when added to existing incarceration programs (Wenger et al., 2019). More importantly, people living with HIV (PLWH) are at high risk for fatal overdose. Compared to people who do not have HIV who use drugs, PLWH who use drugs have 74% greater risk of overdose (Green et al., 2012). Because 1 in 7 PLWH leaves a correctional system each year (Spaulding et al., 2009) and experience higher reincarceration rates than those not living with HIV (Fu et al., 2013), incarcerated PLWH who use drugs represent a group with exceptionally elevated overdose risk upon release from prison or jail. Despite this heightened risk of overdose, we know of no OEND interventions that specifically attempt to reach this high-risk group within a high risk group.

A corrections-based OEND training program has potential to decrease overdose deaths after people are released from incarceration if the program is effective in changing trainee knowledge about overdoses and attitudes toward managing an overdose. We hypothesized that both knowledge and attitudes about overdose would improve from baseline to follow-up.

Methods

Intervention setting

The corrections-based OEND intervention and accompanying evaluation were made possible through a collaboration between the Philadelphia Department of Prisons (PDP), the county jail; Action Wellness, a community-based organization that provides HIV-related case management inside PDP; Prevention Point Philadelphia, the leading OEND program in the city; and Drexel University.

The intervention was implemented during an external decarceration initiative funded by the John D. and Catherine T. MacArthur Foundation (“Safety and Justice Challenge”, 2020). PDP, which is comprised of five individual jail facilities, had an average daily population of 6,620 and average length of stay of 98 days when the intervention began in December 2017 and an average daily population of 4,861 and average length of stay of 69 days when the intervention ended in June 2019 (First Judicial District of Pennsylvania, 2019). The OEND training was conducted one-on-one with participants in each of the five facilities.

Eligibility and recruitment

Newly incarcerated individuals who reported being HIV positive or those who received a positive HIV test result at PDP were referred by PDP to Action Wellness for case management services. A case manager conducted screening and assessed interest in receiving OEND training. Inclusion criteria included: HIV-positive, over the age of 18, did not know their release date or had a release date within the next 10 months, and spoke English. Ten months was chosen based on the study timeline and study design plans to follow-up with participants after their release from PDP. The intervention was offered

to any eligible persons regardless of history of substance use. The principal investigator (PI) or an employee/volunteer of Action Wellness met with each interested individual to explain study procedures, collect consent, conduct OEND training and administer study instruments. Anyone who declined to participate in the research was offered the training nonetheless, which was provided by the PI. The decision on whether to participate had no bearing on their legal and incarceration status, nor their ability to receive services from Action Wellness. After the training, the PI alerted administrative staff at PDP so that the participant's medication record could be flagged to receive naloxone at release.

Overdose education and naloxone distribution training and data collection

OEND trainings lasted approximately 15min and, using a standard format (Wenger et al., 2019), covered overdose risks, signs of an opioid overdose and recommended actions to take during a witnessed overdose. Simulations of overdose response were not feasible, though rescue breathing barrier masks and an educational model of intranasal naloxone were permitted for training purposes. A pre-test assessing overdose knowledge and attitudes was issued to all enrolled participants prior to training. Participants who were still incarcerated one month later were given a post-test.

Compensation

Participants were given two doses of naloxone at release by the jail pharmacy. After release, they received a bag when visiting Action Wellness offices to store the naloxone that also contained a breathing mask, latex gloves, two transportation tokens and a \$5 gift card. If a participant was released without naloxone (e.g. those who were released from court or were not flagged properly in the jail pharmacy system to receive naloxone at discharge), they received it at Action Wellness or the PI post-release. Participants were not provided monetary compensation while in jail, only afterwards.

All Action Wellness staff who participated in consent and data collection activities were provided with human subjects training developed specifically for community research partners (Calzo et al., 2016). Study materials and procedures were approved by the City of Philadelphia Department of Public Health Institutional Review Board and the Drexel University Institutional Review Board. All data were protected by a Federal Certificate of Confidentiality.

Instruments

To assess opioid overdose knowledge we modified the Opioid Overdose Knowledge Scale (OOKS) (Williams et al., 2013). The original scale had 45 questions assessing overdose risk, signs, action and naloxone use for a range of 0–45 points. The original OOKS has strong internal consistency ($\alpha = 0.83$) and test-retest reliability (0.90) (Williams et al., 2013). To accommodate time restrictions for data collection, the scale was shortened to 31 questions assessing the same domains and modified to account for provision of intranasal as opposed to injectable naloxone. The modified OOKS (mOOKS) had a possible range of scores from 0–31 points (with 0–5 points possible for “risk”, 0–6 points possible for “signs”, 0–8 points

possible for “action” and 0–12 points possible for “naloxone use”); higher scores indicated greater knowledge.

To assess attitudes about responding to a witnessed opioid overdose we modified the Opioid Overdose Attitudes Scale (OOAS) (Williams et al., 2013). The original OOAS contained 28 questions, each using a five-point Likert scale ranging from “completely agree” to “completely disagree” on perceived competence to assist in a witnessed opioid overdose, concerns about responding to an opioid overdose and readiness to assist an opioid overdose victim. Possible scores on the original OOAS ranged from 28 to 140 points. The original OOAS also had excellent internal reliability ($\alpha = 0.90$) and test-retest reliability (0.82) (Williams et al., 2013). The modified OOAS (mOOAS) was shortened to 10 questions assessing the same domains with some wording changes to account for the route of naloxone administration, to adjust the literacy level of the study population and country context (e.g. “straight away” versus “right away”). The mOOAS had a possible range of scores from 10 to 50 points (3–15 points possible for “competence”, 3–15 points possible for “concern” and 4–20 points possible for “readiness”), with a higher score indicating a greater inclination to assist an overdose victim. Expert opinion was elicited from Prevention Point Philadelphia and Action Wellness to retain questions most vital to construct validity.

Other measures

Demographic information was primarily gathered through a chart review of participants who were current or former clients at Action Wellness. These variables included age, race/ethnicity, gender identity, education, sexual orientation, hepatitis C status, mental health diagnoses, whether participants used drugs on the date of arrest, year of HIV diagnosis, whether HIV diagnosis had progressed to an AIDS diagnosis, HIV risk factors, HIV diagnosis setting, housing at time of arrest and housing expected upon release from jail. Data for some variables (e.g. date of birth, race/ethnicity, HIV-related variables) existed for each participant who had ever been an Action Wellness client while others (e.g. drugs used on date of arrest, housing status) were only recorded for current Action Wellness clients. Lifetime arrests in Philadelphia County were measured by entering each participant name and date of birth into government websites. The release date was recorded by entering each participant’s name in the “inmate locator” section of the City of Philadelphia’s website multiple times each week. Dates of release were verified through publicly available online resources. For the subset of the sample released during the study, the PI calculated length of stay as release date minus date of arrest.

While each participant met with an Action Wellness case manager inside PDP, not all went on to access services as some declined case management services, but accepted OEND. Therefore, participants were categorized for research purpose in the following categories: active Action Wellness clients, former Action Wellness clients, or never Action Wellness clients (Table 1). “Active” clients received services during their incarceration, “former” clients had received services in the past, but declined jail-based services, and “never” clients had never received services and declined to receive services, but requested to enroll in the study. The status of clients dictated what information the PI was able to collect about participants which is reflected in Table 1.

Data analysis

Quantitative analysis included descriptive statistics, including measures of central tendency and dispersion for variables of interest. To assess changes in overdose knowledge and overdose attitudes we compared scores on the mOOKS and the mOOAS pre-test and post-test using a paired t-test. Literature measuring changes in opioid overdose knowledge and attitudes has infrequently assessed whether changes differed according to demographics. Jones et al. (2014) found no significant changes in knowledge based on age, a history of heroin use, education, overdose history or intervention setting while age and gender were associated with greater changes in overdose knowledge in a study by Dietze et al. (2018) (Dietze et al., 2018; Jones et al., 2014). Based on a review of the literature and for conceptual purposes, we assessed whether the following were potential confounders: age (dichotomized as ages 40 and under and 41 and over), gender (cisgender male as reference category), race/ethnicity (Black non-Latino as reference category), education (less than high school education as the reference category), number of mental health diagnoses and no reported drug use on date of arrest. After conducting the paired t-test, each potential confounding variable was used in separate linear regression models with changes in score (calculated as the score on post-test minus the score on pre-test) on the mOOKS as the dependent variable. Linear regression models were again generated for each potential confounder with changes in the mOOAS as the dependent variable. Statistical significance assumed an alpha level of 0.05. Normality of the residuals from the linear regression analyses was tested and confirmed by visual inspection of histograms, and all statistical analyses were conducted in IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA).

Results

Between December 2017 and June 2019, PLWH ($n = 120$) were trained and given a pre-test. Of these, 68 (57%) were still incarcerated one month later and were given a post-test. The mean age was 41 years and predominantly cisgender male (79.4%) and non-white (64.7% non-Latino Black, 23.5% Latino and 1.5% “other” [non-Latino biracial]) and nearly a third of the sample identified as not heterosexual (Table 1). The median number of years since HIV diagnosis was 7.0, although nearly 15% of the sample self-reported an HIV diagnosis within the past year. A total of 40% of the sample received their HIV diagnosis in a correctional setting and nearly a third of the sample had a history of injection drug use. One quarter had received a hepatitis C diagnosis and nearly 84% had at least one mental health diagnosis, with nearly two-thirds having received two or more mental health diagnoses in their lifetime. The median number of lifetime arrests in Philadelphia was 12. A total of 44 of the 68 participants were released before the end of the study period; among these participants, their median length of stay was 144 days. Although participants were not asked at enrollment about their drug use, chart review showed that nearly half reported using an illegal drug (excluding cannabis) on the date of arrest. Nearly one-quarter had used heroin on the date of arrest and over one-third had used cocaine. Almost one-fifth of the sample was homeless and one-third expected to be homeless at the time of release from jail or did not know where they would live. One person died of an opioid overdose 11 days after his release from PDP. To test whether the sample of study participants still incarcerated and

able to take the post-test was statistically different from those who were released prior to post-test, the sample in this analysis was compared to the sample released from PDP before post-test data could be collected. Beyond most recent length of incarceration, only using any drug on the date of arrest was significantly different between the sample used in this analysis and the sample lost to follow up (63.2% versus 44.2%, respectively, $p = 0.016$).

Overall, scores on the mOOKS improved from an average of 22.3 to 26.2 and on the mOOAS from an average score of 8.1 to 11.4. In the paired t-test (Table 2), participants had significantly improved knowledge about opioid overdose, as indicated by the change in scores on the mOOKS ($p = 0.002$) and significantly more confident attitudes about responding to an opioid overdose, as indicated by the change in scores on the mOOAS ($p < 0.000$). Within the mOOKS subscales, participants were better able to identify opioid overdose risks, signs, correct actions to take during a witnessed overdose, and naloxone use. Within the mOOAS subscales, participants reported greater confidence to assist an overdose victim and fewer concerns about responding. Only one subscale, “readiness”, was not significantly changed, with a mean score of 18.1 out of 20 possible points on both pre- and post-tests.

When considering the bivariate assessments of potential confounders and their impact on changes in overdose knowledge and attitudes separately (Table 3), only reported drug use on date of arrest was significantly associated with changes in opioid overdose knowledge ($\beta = 2.62$, $p = 0.006$), but marginally significant for changes in opioid overdose attitudes ($\beta = 2.19$, $p = 0.068$). Specifically, those who reported no drug use on date of arrest had greater improvement in their scores from pre-test to post-test compared to participants who reported any illegal drug use, and scores also improved for this group to a lesser extent on the mOOAS. Younger age was marginally significant for increased changes in opioid overdose attitudes ($\beta = -1.78$, $p = 0.073$). A full model of change in mOOKS score containing all possible confounders was compared to a reduced model including no drug use on date of arrest and age, compared to a simple model including only no drug use on date of arrest. Using Akaike information criterion, we determined that the simple model was the best fit.

Discussion

In this study, incarcerated PLWH inside PDP received OEND training through HIV case management and were given naloxone as they were released from the facility and from Action Wellness as needed. Data show that participant knowledge and feelings of confidence to manage an overdose increased from pre-test to post-test, indicating greater competence and confidence in the event of responding to future overdoses.

The intervention increased participant knowledge of opioid overdose risks, signs, and appropriate actions to help overdose victims. Participants felt better equipped to respond to a witnessed overdose one month after training. This outcome in the special setting of a jail is consistent with other evaluations of community-based programs (Clark et al., 2014) as well as the only other corrections-based evaluation of changes in opioid overdose knowledge we are aware of (Pettersen and Madah-Amiri, 2017). Knowledge about opioid overdose improved for each subscale in the mOOKS and scores increased for all but one

subscale in the mOOAS, “readiness”. Notably, participants scored nearly the maximum number of points on the readiness subscale at baseline, suggesting a ceiling effect. The readiness subscale measures motivation and desires to help an overdose victim, indicating that participants previously wanted to help overdose victims but had not been felt equipped to do so. The success of this OEND pilot demonstrates that an effective community-based intervention to decrease overdose deaths can be adapted for a correctional setting and reach a population at exceptionally high risk of an opioid overdose. This is the first opioid overdose intervention program we are aware of that was targeted at people with HIV. Over 15% of the sample had received an HIV diagnosis in the past year, primarily while in PDP. An HIV diagnosis in prison or jail presents an opportunity to provide information about overdose to those with a history of drug use. We conclude that HIV case managers should address any overdose risks with their clients as part of the case management process.

Of note, a quarter of the sample (16 participants, data not shown) reported non-opioid drug use on the date of arrest including: cocaine, methamphetamine, benzodiazepines or PCP. Because use of drugs like crack cocaine often happens in areas with other drug use (such as opioids) (Friedman et al., 2019), harm reduction programs should consider extending outreach efforts to include training people who use drugs other than opioids as potential “first responders” likely to witness an opioid overdose. Qualitative research indicates that people who use stimulants with a recent history of incarceration are likely to witness an overdose after their release (Reed et al., 2021). However, this same subpopulation may now be at risk of an overdose themselves. The presence of fentanyl in the drug supply in locations like Philadelphia and elsewhere (Ciccarone, 2017; City of Philadelphia, 2019) provides additional urgency to reach networks of people who use non-opioid drugs. Fentanyl, a potent opioid increasingly found in opioid overdose deaths, has become more pervasive in the drug market and reports exist of fentanyl contamination of other drugs, including crack cocaine and benzodiazepines (Arens et al., 2016; Gladden et al., 2016; Khatri et al., 2018; Klar et al., 2016). Outreach efforts to include people who use stimulants and other non-opioid drugs may reach a different population of people who use drugs than those who have traditionally been reached by OEND. These same programs should extend efforts to distribute fentanyl test strips, which can easily be used to test drugs for the presence of fentanyl, alongside naloxone. Recent research indicates that formerly incarcerated people who use stimulants would like to use fentanyl test strips (Reed et al., 2021). Further, programs should consider expanding outreach to include dealers, as these relationships are sometimes protective against overdose and may be one of the first contacts people have after release from prison or jail (Binswanger et al., 2012; Carroll et al., 2020). Finally, fentanyl test strips should be considered for distribution to people alongside naloxone during release.

This pilot likely reached a previously untrained group of people who are prone to witnessing future opioid overdoses. This is important because, while the training provides education about one’s own risk for overdose, the primary focus is how to respond to a witnessed overdose. The areas most impacted by mass incarceration also experience disproportionate overdose rates: over a third of fatal opioid overdoses in 2018 occurred in the top five ZIP codes of residence for incarcerated Philadelphia residents during that time (R. Domer-Shank, personal communication, February 13, 2020; City of Philadelphia,

2019). An evaluation of an OEND program for visitors at Rikers Island in New York City found that nearly half of reported overdose reversals post-training were administered to strangers (Huxley-Reicher et al., 2018). Providing training to incarcerated people may not just reduce overdose deaths among this population, but in their home communities. With limited exceptions (e.g. France, Scotland), naloxone is not widely available to people exiting incarceration and initiatives such as this can be used to expand access in correctional settings nationally and internationally (Jamin et al., 2021).

Participants in this sample experienced a high burden of mental health diagnoses. This was expected since nearly half of incarcerated people have co-occurring substance use and mental health disorders (Peters et al., 2015). Previous research has found an association between mental illness and overdose (Pizzicato et al., 2018; Webster, 2017). Additionally, 17.6% of participants were homeless when they were arrested and a third either expected to be homeless or did not know where they would live after release. Incarceration is a predictor of unstable housing and homelessness is associated with greater odds of an opioid overdose death (Herbert et al., 2015; Wagner et al., 2015). The ability of this program to reach these groups indicates that corrections-based OEND programs can reach other groups of people at elevated risk for overdose who are otherwise particularly difficult to reach.

Participants in this sample were also overwhelmingly people of color. In June 2019, approximately the mid-point of this study, 68.2% of PDP residents were Black, 19.4% were Latino, and 11.0% were white (First Judicial District of Pennsylvania, 2019). This is similar to the racial composition of study participants. However, Philadelphia's population is 44.1% Black, 35.8% white, and 13.6% Latino (United States Census Bureau, 2010). This is concerning, especially as overdose deaths among Black and Latino people continue to rise in Philadelphia (Farley, 2020). These racial disparities may be further exacerbated due to greater numbers of people of color being released from PDP at heightened risk of an overdose.

Our analysis to assess for variables that may influence the extent to which participants improved their opioid overdose knowledge or attitudes found that people who reported no drug use on date of arrest had greater improvement at post-test from their pre-test scores compared to people who reported any drug use on the day of arrest. This may be due to previous experience with overdose or exposure to overdose response techniques among those with a history of drug use. This may indicate that people who use drugs are ideal partners in overdose education and may be best equipped to deliver the intervention to those who are less informed. The overall goal of this analysis was to assess whether OEND training was associated with changes in overdose knowledge and attitudes and not to explore the mechanism through which they changed. Other sociodemographic variables were not significantly associated with outcomes. This may indicate that diverse groups respond similarly to OEND and standardized training may be effective among most groups of people. However, the lack of statistical significance with measured outcomes could be due to the small sample size or the racial and gender homogeneity of the sample. A future analysis with a larger sample size should assess possible predictors of changes in overdose knowledge and attitudes. This may have implications for structuring future trainings, especially when they are given one-on-one. For example, when training people

who do not use drugs and have no overdose risk, content should focus on recognizing and responding to a witnessed overdose. When training those who use drugs that could be contaminated by fentanyl, trainers should spend additional time discussing how opioids operate in the body and how to mitigate one's own risk of overdose. Finally, trainings with people who use opioids should emphasize ways in which they can lower their own risk of overdose.

Limitations

Findings from this study should be interpreted considering several limitations. This study was not a randomized control trial, did not have a control group and the sample was modest in size. To decrease a threat to internal validity, no post-test was given to participants immediately after training; however, this limited our ability to know if and to what extent changes from baseline to follow-up deteriorated during the one-month follow-up period. Due to restrictions in data collection directly from incarcerated participants, we were limited to reviewing case notes from Action Wellness for all demographic variables. Case notes did not include previous experience with overdose, receipt of previous overdose training, and a comprehensive drug history. The number of lifetime arrests noted is an undercount as they only included arrests in Philadelphia County and only included index arrests (as opposed to also including arrests for violation of parole or probation). Much of the data collected through chart review was self-reported by participants and thus subject to social desirability and recall bias. We do not have information on how many people responded to an overdose after their release from jail, nor do we have information on changes in opioid overdose knowledge and attitudes among participants who were released from jail before 30 days. In terms of measuring outcomes, we modified existing, validated scales. This intervention was implemented during the decarceration initiative, which reflected a larger shift in the incarceration structure in Philadelphia. This decarceration may have had an unmeasured impact on research participants. Finally, participants in this sample were self-identified or recently tested as HIV-positive and it is unknown how these participants differed from PLWH who did not disclose their status to jail staff. The small sample size and HIV status of incarcerated people in a large, urban jail may further limit the generalizability of results to all incarcerated people.

One person in this study died of an opioid overdose soon after release from PDP. His score on the mOOKS improved from 23 to 27 points at follow-up and his score on the mOOAS increased slightly from 37 to 38. While the purpose of the study was not to measure overdose risk, his death after receiving OEND underscores the fact that increased knowledge and improved attitudes are a necessary but not sufficient condition to change behavior; in this case to prevent overdose, a multifactorial phenomenon (Bettinghaus, 1986; Webster, 2017).

Conclusion

In this study we report on results from OEND training provided to incarcerated people via HIV case management programs. Brief overdose trainings added to existing services received by people who are at an elevated risk of overdose are feasible in correctional

settings and participants indicate greater opioid knowledge and more favorable attitudes about their ability to respond to a witnessed overdose. Our results contribute to the growing evidence that OEND trainings are desired by, and effective in, incarcerated populations, especially those who have compounded risk of overdose such as a positive HIV status, mental health disorders, and homelessness after release from jail.

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Table 1Characteristics of incarcerated PLWH participating in overdose training ($n = 68$), december 2017-June 2019

	<i>N</i> (%)
Age (mean, SD ^a)	41 (10.8)
Race/Ethnicity	
Non-Hispanic/Latino Black	44 (64.7)
Hispanic/Latino	16 (23.5)
Non-Hispanic/Latino white	7 (10.3)
Non-Hispanic/Latino other ^b	1 (1.5)
Gender Identity	
Cisgender man	54 (79.4)
Cisgender woman	12 (17.6)
Transgender woman	2(2.9)
Education	
Less than high school	23 (33.8)
High school diploma/GED	32 (47.1)
Some college or more	13 (19.1)
Sexual Orientation	
Straight/heterosexual	46 (67.6)
Bisexual	13 (19.1)
Gay	5 (7.4)
Lesbian	1 (1.5)
Queer	1 (1.5)
Refuse to answer	2 (2.9)
Status with Action Wellness	
Active client	58 (85.3)
Former/inactive client	6 (8.8)
Never client	4 (5.9)
Hepatitis C Statuse	
Yes	17 (25.0)
No	41 (60.3)
Mental Health Diagnoses ^f	
Depression	42 (61.8)
Anxiety	34 (50.0)
Schizophrenia	16 (23.5)
PTSD ^c	26 (38.2)
Bipolar disorder	22 (32.4)
Median number of diagnoses (median, IQR ^d)	3 (1,4)
Number of diagnoses	
0	11 (16.2)
1	8 (11.8)

	<i>N</i> (%)
2	10 (14.7)
3	16 (23.5)
4 or more	16 (23.5)
Number of Lifetime Arrests in Philadelphia (median, IQR)	12 (7, 22)
Arrest Charge Category at Time of Enrollment	
Drug	23 (33.8)
Violent	21 (30.9)
Property	17 (25.0)
Public order	7 (10.3)
Length of Stay, days (median, IQR) ^g	144 (77, 270)
Drugs Used on Date of Arrest ^f	
Any drug	43 (63.2)
Any drug, excluding cannabis	32 (47.1)
Cannabis	25 (36.8)
Cocaine (powder/crack)	24 (35.3)
Heroin	15 (22.1)
Benzodiazepines	3 (4.4)
Methamphetamine	3 (4.4)
Prescription opioids	1 (1.5)
PCP ⁱ	1 (1.5)
Synthetic cannabinoid “K2”	1 (1.5)
No drug use on date of arrest	15 (22.1)
Number of years since HIV diagnosis ^e	
<1 year	10 (14.7)
1–5 years	19 (27.9)
6–10 years	10 (14.7)
>10 years	24 (35.3)
Missing/Unknown	5 (7.4)
Number of years since diagnosis (median, IQR)	7 (2, 19)
Progression to AIDS diagnosis ^e	
Yes	13 (19.1)
No	48 (70.6)
HIV transmission risk ^f	
Heterosexual contact	55 (80.9)
Injection drug use	21 (30.9)
MSM	19 (27.9)
Transfusion	2 (2.9)
Setting of HIV diagnosis	
Correctional setting	27 (39.7)
Community	25 (36.8)
Homeless at time of arrest	12(17.6)

	<i>N</i> (%)
Homelessness expected at release or “doesn’t know”	23 (33.8)

Notes:

^aSD = standard deviation

^b“other” is non-Latino biracial

^cIQR = Interquartile range

^dPTSD=post-traumatic stress disorder

^ePercentages will not add to 100% due to missing data

^fThese categories are not mutually exclusive, thus will not add to 100%

^gData is from participants incarcerated at least one month. Median number of days does not include 24 participants (35.3%) who were still incarcerated at conclusion of study

ⁱphenylcyclohexyl piperidine

Table 2Changes in overdose knowledge and overdose attitudes among study participants ($n = 68$)

	<i>Baseline, mean (SD)</i>	<i>1-month follow-up, mean (std)</i>	<i>t*</i>	<i>p-value</i>
Overall opioid overdose knowledge mean ^a	23.3 (3.3)	26.2 (3.0)	6.96	0.002
Overdose risk subscale	4.5 (0.9)	4.7 (0.7)	2.28	0.026
Overdose signs subscale	4.2 (1.3)	4.6 (0.9)	2.67	0.010
Overdose actions subscale	6.6 (1.0)	7.2 (1.1)	4.21	<0.000
Naloxone subscale	8.1 (2.0)	9.8 (1.7)	5.97	<0.000
Overall opioid overdose attitudes mean ^a	35.9 (4.2)	40.7 (4.5)	9.53	<0.000
Competence subscale	8.1 (2.6)	11.4 (1.8)	11.74	<0.000
Concern subscale	9.7 (2.0)	11.2 (2.2)	5.04	<0.000
Readiness	18.1 (2.0)	18.1 (2.0)	-0.13	0.901

Notes:

^a Knowledge and attitudes assessed using the mOOKS (Modified Opioid Overdose Knowledge Scale and mOOAS (Modified Opioid Overdose Attitudes Scale), respectively SD = standard deviation

* t = Paired Student's t-test

Table 3Bivariate assessments of changes in overdose knowledge and overdose attitudes via linear regressions ($n = 68$)

Outcome	Change in mOOKS ^a score β (SE)	Change in mOOAS ¹ score β (SE)
Age (under/over 40)	-0.474 (0.85)	-1.78 (0.98)
Gender identity		
Cisgender man	Ref	Ref
Other ^b	-0.16 (1.05)	1.50 (1.22)
Race/Ethnicity		
Non-Latino/Hispanic Black	Ref	Ref
Other ^c	0.10 (0.89)	1.27 (1.04)
Education		
Less than high school graduate	Ref	Ref
High school diploma/GED	-0.32 (0.96)	1.12 (1.12)
Some college or more	0.93 (1.22)	2.22 (1.41)
Number of mental health diagnoses	-0.26 (0.27)	-0.12 (0.33)
No drug use on date of arrest	2.62 (0.91)	2.19 (1.18)

Notes:

^a knowledge and attitudes assessed using the mOOKS (modified opioid overdose knowledge scale and mOOAS (modified opioid overdose attitudes scale), respectively

^b Category includes cisgender woman and transgender woman

^c Category includes Hispanic/Latino, Non-Hispanic/Latino white, Non-Hispanic/Latino other Bold font indicates statistical significance, $p < 0.05$, SE = standard error