BRIEF REPORT

Community-Based Response to Fentanyl Overdose Outbreak, San Francisco, 2015

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Abstract This report documents a successful intervention by a community-based naloxone distribution program in San Francisco. The program and its partner organizations, working with participants who use drugs, first identified the appearance of illicitly made fentanyl and increased outreach and naloxone distribution. Distribution of naloxone and reported use of naloxone to reverse opioid-involved overdoses increased significantly while the number of opioid-involved and fentanyl-involved overdose deaths did not. Community-based programs that provide training and naloxone to people who use drugs can serve as an early warning system for

overdose risk and adaptively respond to the rapidly changing overdose risk environment.

Keywords Fentanyl · Naloxone · Opioid overdose · People who use drugs · Community-based response

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The US opioid epidemic is not improving [1, 2]. In recent years, illicitly made fentanyl and its analogs have emerged as major causes of opioid-related morbidity and mortality and further challenged public health efforts to respond to this epidemic [3]. Community-based opioid overdose education and naloxone distribution programs (OENDPs) are a critical component of efforts to reduce opioid-related mortality [4]. These programs provide training and distribute naloxone, an opioid reversal medication, to lay persons, principally people who use drugs (PWUD).

San Francisco's community-based OENDP, the Drug Overdose Prevention and Education (DOPE) Project of the Harm Reduction Coalition, has been working with partner organizations to distribute naloxone to lay persons since 2003. In 2014 and 2015, the DOPE project, collaborating with the San Francisco Department of Public Health (SFDPH), worked with ten community-based organizations and government agencies¹ to distribute naloxone to PWUD and their friends and family

¹ In 2014–15, the ten community partners of the DOPE project included five syringe service programs, San Francisco County Jail, three programs serving individuals who were homeless, and a local study that recruited and actively followed individuals who inject drugs.

in San Francisco. The DOPE Project provides technical support and resources to community partners, including purchasing and distributing naloxone and ancillary materials², providing overdose prevention training, and coordinating all San Francisco's lay naloxone distribution. Partner organizations provide naloxone kits to individuals and submit monthly program reports to the DOPE Project. Reports include demographic information on newly trained participants provided with naloxone, dates and reasons for naloxone refills, and interview data³ on reported overdose reversals. DOPE Project partners provide services, including naloxone distribution, to PWUD under the principles of harm reduction [5], which prioritize non-judgmental and non-coercive provision of services, ensuring PWUD have a real voice in the creation and operation of programs designed to serve them, and empowerment of PWUD as the primary agents of reducing the harms related to their drug use. These principles can facilitate the development of trusting and cooperative relationships between program staff and participants [6, 7].

Lay naloxone distribution data, including dates of new participant registrations/refills and dates/locations of overdose reversals, were obtained from the DOPE Project. Opioid-involved overdose deaths were derived from the California Electronic Death Reporting System (CA-EDRS). Emergency Medical Service (EMS) incidents involving naloxone administration were obtained from the San Francisco Fire Department, which is responsible for 85–90% of EMS incidents in San Francisco. Opioid-involved overdose deaths were defined as those that included acute toxicity from an opioid as the immediate or underlying cause of death on the death certificate, as determined by the San Francisco Office of the Chief Medical Examiner (OCME) and

reported to CA-EDRS; fentanyl-involved overdose deaths included acute toxicity from fentanyl as a cause of death. Homicides and suicides were excluded. Opioid overdose reversals, overdose deaths, and EMS incidents involving naloxone were geocoded. In-hospital deaths were geocoded to the decedent's residence if in San Francisco and excluded if the residence address was unknown or outside San Francisco. Due to the concentration of reversals in one neighborhood ("Civic Center") in June–September 2015, geocoded events were categorized as either "in Civic Center" or not. An event was defined as occurring in the Civic Center if the event fell inside or within 50 m of the "Civic Center/Downtown" neighborhood, as defined by the San Francisco Planning Department.⁴ In order to examine DOPE project activities, overdose deaths, and EMS incidents involving naloxone during June–September 2015, the proportion of annual events occurring during June–September in the entire city and in the Civic Center neighborhood was calculated for 2014 and 2015 and compared between years using Chi-squared tests or Fisher's exact tests when expected cell sizes were < 5.0.

Beginning in June 2015, PWUD reported to the DOPE Project's partner organizations a new, white powder being sold as "heroin" and referred to as "China White." PWUD reported several distinct effects of the white powder that corresponded to documented effects of fentanyl: (1) an immediate and strong high that tapered quickly, requiring more frequent use than the black tar heroin usually sold in San Francisco; [8]; (2) rapid onset of overdose-involved respiratory depression; and (3) multiple doses of naloxone were required to resuscitate people who overdosed. During June–September 2015, DOPE Project partners noted concurrent increases in new participant registrations, naloxone refill requests, and reported overdose reversals. In July 2015, recognizing the increases in demand for and use of naloxone and participant reports of suspected fentanyl overdoses, DOPE Project partners began alerting participants about the spike in overdoses both verbally and by posting warning flyers. DOPE Project partners increased street outreach, conducting daily outreach in the Civic Center to engage PWUD and provide naloxone kits to those who did not have them. The Civic Center was initially targeted because program staff

² The community partners of the Dope Project provide "naloxone kits" to trained individuals. The kit includes educational materials on identifying and managing an opioid overdose, a prescription card, and two doses of naloxone. In 2014–2015, the DOPE Project provided three types of naloxone: 0.4 milligram (mg)/0.4 milliliter (ml) auto-injector, 0.4 mg/1-ml vials and syringes for intramuscular injection, and the off-label 2 mg/2 ml adapted for intranasal administration with mucosal atomizer devices.

³ When previously trained participants return to a DOPE Project site for a refill of naloxone, staff conducted a brief interview. If naloxone was used in a suspected overdose, staff record information about where and when the overdose occurred, to whom naloxone was administered (e.g. "spouse", "friend", "stranger"), known drugs involved in the overdose, and whether participants used other response strategies covered in DOPE Project training (sternum rub, call 911, and rescue breathing).

⁴ San Francisco Planning Department. Neighborhood Groups Map. 2017 [accessed 2017 July 15]; Available from: <http://sf-planning.org/neighborhood-groups-map>.

Fig. 1 Naloxone reversals reported to the DOPE Project by month, San Francisco 2014–2015 * †. *The number of DOPE Project naloxone overdose reversals includes all reversal reports collected by all ten DOPE Project naloxone distribution partners in the City and County of San Francisco, 2014 (326) and 2015 (504).

†Compared with 2014, DOPE Project reported overdose reversals in calendar year 2015 increased by 55% (from 326 to 504). During June–September, there were larger increases from 2014 to 2015 in reported overdose reversals (113%; from 113 to 241) ($p < 0.001$). *DOPE Drug Overdose Prevention and Education*

recognized an upsurge of participant reports of overdoses in the neighborhood in the preceding weeks and months, a pattern that was confirmed in early August when data for the month of July were compiled across sites and examined. In August 2015, a sample of the white powder was tested with mass spectrometry and contained fentanyl and no other psychoactive substance. Subsequently, in the same month, the DOPE Project and SFDPH produced and circulated a health alert among substance use treatment providers and health care clinics (see [Supplemental Figure](#)).

Compared with 2014, DOPE Project new registrations in calendar year 2015 increased by 10% (from 1023 to 1123), naloxone refills by 45% (from 1189 to 1727), and reported overdose reversals by 55% (from 326 to 504) (Fig. 1 and Table 1). Comparing June–September in 2015 to the same months in 2014, there were larger increases in new registrations (55% from 319 to 495), naloxone refills (89% from 377 to 714), and reported overdose reversals (113% from 113 to 241) (all $p < 0.001$) relative to the full-year comparisons; that is, a significantly larger proportion of events occurred in June–September in 2015, compared to 2014. There was no significant change from 2014 to 2015 in the proportion of opioid-involved overdose deaths (Fig. 2),

fentanyl-involved overdose deaths, or EMS incidents involving naloxone administration occurring in June–September (all $p > 0.05$).

In the Civic Center neighborhood, reported overdose reversals in June–September 2015 increased 54% (from 186 to 287) ($p < 0.001$) compared with June–September 2014, with no significant changes observed for opioid-involved overdose deaths, fentanyl-involved overdose deaths, or EMS incidents involving naloxone administration (all $p > 0.05$).

Discussion

The USA is in the midst of an expanding opioid overdose epidemic.⁵ [1, 2] Since 2013, fentanyl and its analogs (e.g., carfentanil) have become a major contributor in this epidemic, particularly east of the Mississippi River [3]. Dramatic increases in illicit fentanyl have contributed to a rapidly changing overdose risk environment, in which

⁵ Drug overdoses accounted for 52,404 deaths in the USA in 2015, 33,091 (63%) involving an opioid. The overdose death rate from synthetic opioids other than methadone, which includes fentanyl and its analogs, increased by 72% from 2014 to 2015 [2].

Table 1 Time/date and location characteristics of DOPE Project activities, opioid-involved and fentanyl-involved overdose deaths, and emergency medical services activity, San Francisco, 2014–2015 * † § ¶ ** †† §§ ¶¶

Time/date comparison						<i>p</i> value	Time/date and location comparison						<i>p</i> value
Total for year		Event occurred June–September		Event occurred in other months			Total with valid location data for YEAR	Event occurred June–September and in Civic Center Area		Event occurred in other months or areas			
<i>n</i>		<i>n</i>	(%)	<i>n</i>	(%)			<i>n</i>		<i>n</i>	(%)	<i>n</i>	
DOPE Project naloxone distribution and use													
New registrations													
2014	1023	319	(31.2)	704	(68.8)	< 0.001							
2015	1123	495	(44.1)	628	(55.9)								
Naloxone refills													
2014	1189	377	(31.7)	812	(68.3)	< 0.001							
2015	1727	714	(41.3)	1013	(58.7)								
Naloxone reversals													
2014	326	113	(34.7)	213	(65.3)	< 0.001	294	53	(18.0)	241	(82.0)	< 0.001	
2015	504	241	(47.8)	263	(52.2)		389	123	(31.6)	266	(68.4)		
Opioid overdose deaths													
Opioid-involved overdose deaths													
2014	126	42	(33.3)	84	(66.7)	0.456	124	16	(12.9)	108	(87.1)	0.169	
2015	101	29	(28.7)	72	(71.3)		97	7	(7.2)	90	(92.8)		
Fentanyl-involved overdose deaths													
2014	8	3	(37.5)	5	(62.5)	0.262	8	1	(12.5)	7	(87.5)	1.000	
2015	11	1	(9.1)	10	(90.9)		11	1	(9.1)	10	(90.9)		
Emergency medical services (EMS) activity													
EMS incidents involving naloxone													
2014	480	178	(37.1)	302	(62.9)	0.469	479	52	(10.9)	427	(89.1)	0.350	
2015	533	186	(34.9)	347	(65.1)		533	68	(12.8)	465	(87.2)		

*Naloxone distribution data were obtained from the DOPE Project and include all new participant registrations with initial naloxone distributions, naloxone refills, and reported naloxone overdose reversals collected by all DOPE Project naloxone distribution partners in the City and County of San Francisco, 2014–2015

† Location data were not available for new registrations and naloxone refills

§ Opioid-involved overdose death data were obtained from the California Electronic Death Reporting System (CA-EDRS). Opioid-involved deaths were identified as those that included acute toxicity from an opioid as the immediate or underlying cause of death on the death certificate, as determined by the San Francisco Office of the Chief Medical Examiner (OCME) and reported to CA-EDRS. Homicides and suicides were excluded

¶ Fentanyl-involved overdose deaths include opioid-involved overdose deaths for which acute toxicity from fentanyl was listed as an immediate or underlying cause of death, as determined by the San Francisco Office of the Chief Medical Examiner (OCME) and reported to CA-EDRS

**Emergency Medical Services (EMS) data was obtained from the San Francisco Fire Department (SFFD) and includes all SFFD EMS ambulance incidents that involved the administration of naloxone in the City and County of San Francisco, 2014–2015

†† *p* values were calculated from Chi-squared tests, except for the time/date and location comparison for opioid-involved overdose deaths and both comparisons for fentanyl-involved overdose deaths, for which *p* values were calculated from Fisher's exact tests due to small cell sizes

§§ 82.3% of naloxone overdose reversals, 97.4% of opioid-involved overdose deaths, 100% of fentanyl-involved overdose deaths, and 99.9% of EMS incidents involving the administration of naloxone included valid location data and are included in the spatial and temporal comparison

¶¶ We defined naloxone overdose reversals, opioid-involved overdose deaths, and naloxone-involved EMS incidents as occurring in the Civic Center neighborhood if they were inside or within 50 m of the “Civic Center/Downtown” neighborhood as defined by the San Francisco Planning Department (see in-text footnote ¶)

Fig. 2 Opioid-involved and fentanyl-involved overdose deaths by month, San Francisco, 2014–2015 * † §. *Opioid-involved overdose death data were obtained from the California Electronic Death Reporting System (CA-EDRS). Opioid-involved deaths were identified as those that included acute toxicity from an opioid as the immediate or underlying cause of death on the death certificate, as determined by the San Francisco Office of the Chief Medical Examiner (OCME) and reported to CA-EDRS; fentanyl-involved overdose deaths included acute toxicity from fentanyl as

a cause of death. Homicides and suicides were excluded. †Opioid overdose deaths decreased by 20% from 126 in 2014 to 101 in 2015 and fentanyl-involved deaths increased by 38% from 8 in 2014 to 11 in 2015. From 2014 to 2015, there was no significant change in the proportion of events occurring in June–September for opioid-involved overdose deaths or fentanyl-involved overdose deaths. § At least 6 of the 8 fentanyl-involved overdose deaths in October–December 2015 were due to counterfeit alprazolam (Xanax®) that contained fentanyl

supply-side risk factors, such as product availability, purity, and potency, change swiftly and often quicker than public health authorities can react [3, 9, 10].

Naloxone has been provided to potential first responders (e.g., PWUD, police officers, parents, probation officers) in a variety of settings (e.g., homeless shelters, corrections, syringe service programs, schools). Beginning with the Chicago Recovery Alliance in 1999 [11], community-based OENDPs have provided overdose prevention services, including naloxone distribution, to PWUD and their families, friends, and service providers. In June 2014, there were roughly 644 OENDPs operating in 30 states and the District of Columbia [4], but this number has likely expanded given the gravity of the current epidemic. The DOPE project and community partners provide most naloxone kits to PWUD because they are more likely to be present at an overdose and administer naloxone [12, 13].

This report demonstrates how a community-based OENDP network with open communication between staff and PWUD participants can be an early warning

system for increased overdose risk. PWUD can recognize changes in the drugs sold in illicit drug markets before law enforcement and public health authorities. PWUD participants provide this information to OENDPs, which can share it with program partners and participants, expand overdose prevention services, and increase distribution of naloxone kits. That San Francisco experienced a fentanyl-involved overdose outbreak in the summer of 2015 without any significant increase in deaths suggests a PWUD-based surveillance system linked to a community-based naloxone distribution network can save lives.

This report is subject to at least five potential limitations. First, we cannot make any claims of a causal relationship between DOPE Project activity and opioid overdose mortality in San Francisco during June–September 2015; however, this report describes a community-based response to a fentanyl overdose outbreak. The data presented in this report suggest that this response may have averted an increase in opioid overdose mortality. Second, reports of overdose reversals are

unconfirmed self-reports. Third, because overdose reversals are only reported by participants who return to a distribution site for additional naloxone, the number of overdose reversals in this report is likely an underestimation. Fourth, the presence of illicitly made fentanyl in local street drug markets was extrapolated from the reports of PWUD's experiences consuming the "white powder" and the laboratory confirmation of fentanyl in one sample. Fifth, usable location data were available for only 82.3% of overdose reversals, which may affect the validity of the geographic analysis of overdose reversals in this report.

Community-based OENDPs that work with PWUD are an important response to the current opioid overdose epidemic. OENDP's ability to develop trusting relationships between staff and participants can help facilitate the early detection of market changes in illicit drugs, help track overdose locations, allow for the rapid dissemination of information about new drugs, and permit the timely expansion of access to naloxone for people at high risk of opioid overdose. In addition, collaboration of OENDPs and researchers using OENDP data can yield published research that helps understand and improve public health responses to opioid overdoses [4, 12, 13].

States affected by the opioid overdose epidemic may consider expanding community-based overdose prevention programs that serve people who use drugs. Connections to social networks of people who use drugs can enhance surveillance and facilitate naloxone distribution and may reduce opioid overdose deaths.

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Compliance with Ethical Standards

Disclaimer The authors are solely responsible for the content of this article, which does not necessarily represent the official views of the San Francisco Department of Public Health.

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