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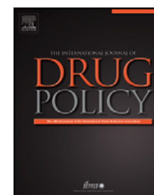

Research paper

Evaluation of an overdose prevention and response training programme for injection drug users in the Skid Row area of Los Angeles, CA

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ABSTRACT

Background: Fatal opioid overdose is a significant cause of mortality among injection drug users (IDUs).
Methods: We evaluated an overdose prevention and response training programme for IDUs run by a community-based organisation in Los Angeles, CA. During a 1-h training session participants learned skills to prevent, recognise, and respond to opioid overdoses, including: calling for emergency services, performing rescue breathing, and administering an intramuscular injection of naloxone (an opioid antagonist). Between September 2006 and January 2008, 93 IDUs were trained. Of those, 66 (71%) enrolled in the evaluation study and 47 participants (71%) completed an interview at baseline and 3-month follow-up.
Results: Twenty-one percent of participants were female, 42% were white, 29% African American, and 18% Latino. Most were homeless or lived in temporary accommodation (73%). We found significant increases in knowledge about overdose, in particular about the use of naloxone. Twenty-two participants responded to 35 overdoses during the follow-up period. Twenty-six overdose victims recovered, four died, and the outcome of five cases was unknown. Response techniques included: staying with the victim (85%), administering naloxone (80%), providing rescue breathing (66%), and calling emergency services (60%). The average number of appropriate response techniques used by participants increased significantly from baseline to follow-up ($p < 0.05$). Half (53%) of programme participants reported decreased drug use at follow-up.
Conclusion: Overdose prevention and response training programmes may be associated with improved overdose response behaviour, with few adverse consequences and some unforeseen benefits, such as reductions in personal drug use.

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Introduction

Fatal opioid overdose is a significant cause of premature mortality. The U.S. Centers for Disease Control and Prevention reported that in 2005, 33,541 persons died of drug-induced causes in the United States (Kung, Hoyert, Xu, & Murphy, 2008). In 2003, opioids were responsible for more drug-related deaths than any other drug as reported by the U.S. Drug Abuse Warning Network (DAWN) (SAMHSA Office of Applied Studies, 2005). Heroin or metabolites specific to heroin were reported in over a third of opioid-related overdose deaths, though prescription opioids such as methadone, hydrocodone, and oxycodone, also contributed significantly (SAMHSA Office of Applied Studies, 2005; Zacny et al., 2003).

Intravenous administration of opioids significantly elevates the risk of overdose (Sporer, 1999). Studies among IDUs in the U.S. and elsewhere have found rates of witnessed drug overdose ranging from 54% to 92% (Galea et al., 2006; Pollini et al., 2006; Seal et al., 2003; Strang et al., 1999), and rates of non-fatal overdoses experienced by IDUs ranging from 40% to 68% (Galea et al., 2006; Kerr et al., 2007; Pollini et al., 2006; Strang et al., 1999). Opioid overdose results in mortality by depressing respiration in the overdose victim, ultimately leading to hypoxia and death (White & Irvine, 1999). However, as this can takes between 1 and 3 h, there is time for medical intervention (Sporer, 1999).

IDUs have demonstrated a willingness to be trained to respond to opioid overdoses among their peers (Seal et al., 2003; Strang et al., 1999; Strang, Best, Man, Noble, & Gossop, 2000), and preliminary evaluations suggest training programmes can increase knowledge and response skills, potentially saving lives (Green, Heimer, & Grau, 2008). Training programmes have been implemented in the U.S. in New York (Galea et al., 2006; Piper et al., 2007), Chicago (Maxwell,

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Bigg, Stanczykiewicz, & Carlberg-Racich, 2006), New Mexico (New Mexico Department of Health, 2008), Baltimore (Tobin, Sherman, Beilenson, Welsh, & Latkin, 2008), and San Francisco (Seal et al., 2005). These programmes include training in the recognition of opioid overdose and appropriate response techniques, including rescue breathing and the administration of naloxone, an opioid antagonist routinely used in clinical and pre-clinical settings to reverse potentially fatal opioid overdoses (Baca & Grant, 2005; Julien, 2005). Some side effects associated with naloxone administration have been reported, but these are relatively rare (Sporer, 1999, 2003) and have been debated (Hsu, Rao, & Nelson, 1997). Naloxone has no psychoactive properties or pharmacologic activity in the absence of opioids. In the U.S., naloxone is available by prescription only (Burris, Norland, & Edlin, 2001).

Homelessness is associated with an elevated risk of overdose among IDUs (Kerr et al., 2007). The Skid Row area of Los Angeles, CA has the highest concentration of homeless persons in the city (over 5000 individuals on any given night), 30% of whom report drug use (Los Angeles Homeless Services Authority, 2007). While drug overdose was the sixth leading cause of premature death in all of Los Angeles County, it was the fourth leading cause in the area where Skid Row is located (Los Angeles County Department of Public Health, 2006). Homeless individuals face additional challenges in storing prescription medications such as naloxone, making those living on the streets at increased risk of fatal opioid overdose. Here we report on the evaluation of an overdose prevention and response training programme, implemented in September of 2006 for IDUs in the Skid Row area of Los Angeles.

Methods

The Homeless Health Care Los Angeles Center for Harm Reduction (HHCLA-HRC) is a community-based organisation that provides services to IDUs including syringe exchange, medical care and referrals to drug detoxification programmes. Criteria for attending the HHCLA-HRC are (1) being a current IDU, and (2) being at least 18 years old. Clients are not required to be resident in the Skid Row area, but most live, attend services, and buy and/or use drugs in the area. In September 2006, HHCLA-HRC staff offered an overdose prevention and response training programme to all clients. Participants were recruited via street outreach, distribution of advertising leaflets, and one-on-one recruitment within the HRC.

The overdose prevention and response training programme

Training sessions were conducted individually or in small groups (two to six people) by two trainers. Both were educated in overdose prevention and response training through local overdose prevention efforts and a “Train the Trainer” seminar conducted by the Harm Reduction Coalition. Training sessions were offered 4 days a week, depending on staff availability, on a drop-in basis. The 1-h session covered: (1) mechanisms of opioid overdose, (2) strategies for the prevention of opioid overdose, (3) recognition of opioid overdose, and (4) recommended response techniques. The full curriculum is available from the authors. Appropriate response techniques followed the S.C.A.R.E. M.E. strategy developed by the Chicago Recovery Alliance (www.anypositivechange.org): Stimulation, Call for help, check Airway, Rescue breathing, Evaluation, Muscular injection of naloxone, Evaluation and support (including staying with the victim until medical help arrives and placing the victim in the recovery position).

The trainers presented the information using slides and discussion was encouraged throughout. A hands-on demonstration and practice session followed the presentation. Participants were encouraged to discuss what they had learned with friends, family, or using buddies, and the trainers suggested that they also send those individuals in to be trained, however, no educational tools were provided for the purpose of training others.

Upon demonstrating knowledge and skills in the four topic areas, each participant met one-on-one with the programme physician, who documented the encounter and provided two doses of naloxone in 1 ml (4 mg/ml naloxone), pre-filled, single-dose syringes. A prescription label affixed to the box was dated and signed by the physician. Participants also received a kit containing latex gloves, alcohol swabs, a rescue breathing mask, and a small card describing the response technique. There was no limit on the number of doses that participants could receive, nor on the number of times they could return for refills.

The evaluation study

Study recruitment was conducted from September 2006 to January 2008. All participants were asked to participate in the evaluation study, although participation in the training was not contingent upon study enrolment. The University of Southern California Institutional Review Board approved study procedures. The study aimed to assess whether training participants: (1) increased their knowledge about naloxone and overdose risks/symptoms, (2) improved their attitudes to overdose response and the summoning of emergency assistance, (3) increased the frequency with which they engaged in recommended overdose response techniques, and (4) decreased the frequency with which they engaged in non-recommended overdose response techniques.

Those who agreed to enroll in the study provided written informed consent and completed a short baseline interview. Participants returned 3 months later to complete a follow-up interview. When possible, participants were contacted via email, phone, and/or letter to remind them of their follow-up visit. The Los Angeles County Sheriff’s inmate locater database, which is publicly available via the Internet, was checked when a participant did not return for follow-up interview. If participants were incarcerated at time of interview and for the majority of the 1-month period thereafter, they were considered “unavailable”.

Those who returned to obtain a refill of naloxone during the follow-up period completed an incident report documenting the circumstances necessitating the refill, including loss, theft, confiscation, or use. If the naloxone was used to respond to an overdose, detailed information was collected about the incident. Participants received a $5 food voucher for completing the baseline assessment, and $20 and a $5 food voucher for completing the follow-up assessment.

Measures

Trained interviewers administered the surveys in private offices at the HHCLA-HRC. Demographic information including age, ethnicity, housing status, drug use behaviour, and enrollment in drug treatment were collected at baseline and 3-month follow-up. There was also a series of questions about most recent overdose experienced and witnessed in the past 3 months, including about the signs of overdose, techniques used to respond, outcome (i.e., survived or not), and negative consequences associated with the overdose. Knowledge was assessed at both baseline and 3-month follow-up using six questions, similar to those used in other evaluations (Tobin et al., 2008). These asked about risk factors for overdose, symptoms used to recognise overdose, and appropriate use of naloxone (Table 2). Attitudes towards responding to overdoses (i.e., likelihood of administering naloxone, calling emergency services, and teaching someone else to respond to an overdose) were assessed on a five-point Likert-type scale with response choices ranging from “definitely not likely” to “very likely”. At follow-up, participants

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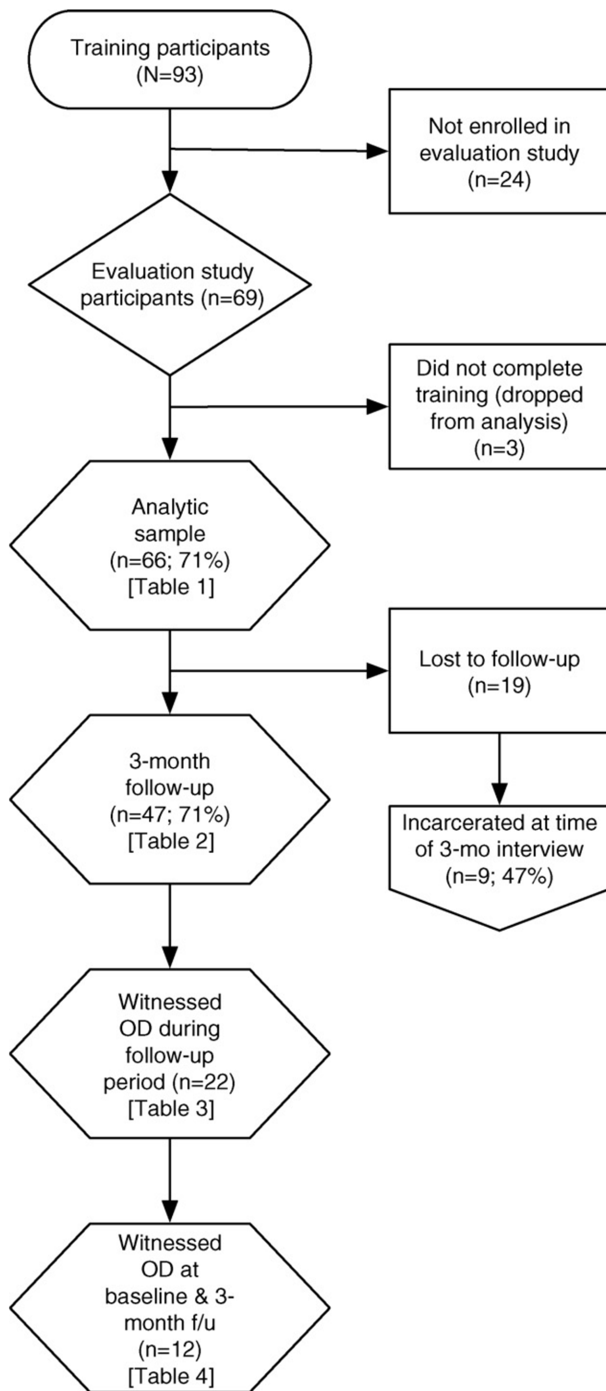

Fig. 1. Flow diagram of evaluation study participation.

were asked whether they still had the naloxone given at the training and, if not, what had happened to it.

Analysis

Univariate statistics were calculated for all variables of interest. Attrition analysis was conducted using Chi-square tests or Fischer's Exact test when expected cell frequencies were less than five. To examine changes in knowledge and attitudes (aims 1 and 2) we included all those individuals who completed both a baseline and 3-month follow-up survey. A single knowledge index was created, representing the percent of correct answers. As the psychometric properties of this index were poor (Cronbach's alpha = 0.39), we also report the score on each individual item. Changes in knowledge and attitudes from baseline to follow-up were calculated using paired Student's *t*-test for means, Wilcoxon Signed Rank test for medians, and McNemar's test for paired proportions.

We described the total number of overdose responses reported using data from the 3-month follow-up surveys and incident reports, including symptoms used to recognise overdose, response behaviour, and outcome. To investigate changes in overdose response behaviour (aims 3 and 4), we restricted the follow-up data set to those who reported responding to an overdose at baseline and at follow-up. Because of the small sample size, we collapsed outcome variables into two summary measures representing the average number of recommended and non-recommended response techniques employed at each event. We compared the summary measure using paired Student's *t*-tests for means and Wilcoxon Signed Rank tests for medians. The proportion of witnessed overdoses to which participants responded was compared using McNemar's test. All analyses were conducted using SAS 9.1.3.

Results

Ninety-three IDUs were trained between September 2006 and January 2008. Of those, 69 (74%) enrolled in the evaluation study (Fig. 1). No data were collected from those who refused to enroll, although anecdotal accounts suggest that common reasons for refusal were lack of time and not wanting to return for follow-

Table 1
Demographic characteristics of study participants and experience with drug overdoses in 3 months prior to training (n = 66).

	n	%
Age		
Mean (S.D.)	45.8 (9.1)	
Median (IQR)	46.5(41–52)	
Age of first injection		
Mean (S.D.)	21.5 (9.1)	
Median (IQR)	19.5 (15–26)	
Female	14	21.1
Ethnicity		
White	28	42.4
African American	19	28.8
Latino	12	18.2
Mixed ethnicity	4	6.1
American Indian	2	3.0
Asian	1	1.5
Housing status: living in		
The street or in a car	29	43.9
My own house	12	18.2
Hotel/motel/SRO	10	15.2
Shelter	9	13.6
Someone else's house	4	6.1
Other	2	3.0
Drugs used (past 30 days)[a]		
Heroin	58	96.7
Crack cocaine	23	38.3
Alcohol	12	20.0
Benzodiazapines	7	11.7
Other opiates	6	10.0
Powder cocaine	3	5.0
Methadone (non-prescribed)	3	5.0
Methamphetamine	2	3.3
Number of participants who *experienced* OD in 3 months prior to training	10	15.2
Total number of ODs experienced	24	
Number of participants who *witnessed* OD in 3 months prior to training	32	48.5
Total number of ODs witnessed	148	

[a] Drug categories are not mutually exclusive.

Table 2
Changes in knowledge, attitudes, and behaviour from baseline to 3-month follow-up ($n = 47$).

	Baseline	3-Month follow-up	Test statistic[a]	*p*-Value
Overall knowledge mean (S.D.)	76.5 (15.4)	91.5 (9.6)	$t = 6.94$	<0.0001
Overall knowledge median (IQR)	77.8 (66.7–88.9)	88.9 (88.9–100.0)	$S = 334.50$	<0.0001
Knowledge items (% correct)				
Drinking alcohol when using opiates increases your risk of overdose	78.7	91.5	$\chi^2 = 3.00$	0.15
Slamming your drugs increases your risk of overdose	89.4	97.9	$\chi^2 = 2.67$	0.22
Using drugs after getting out of detox or jail/prison increases your risk of overdose	87.2	100.0	–	
You are at greatest risk of dying from an overdose if you are alone when you inject	100.0	100.0	–	
Change in the colour of someone's lips/nails is a sign of heroin overdose	85.1	97.9	$\chi^2 = 4.50$	0.07
Heroin overdose causes your heartbeat to speed up (False)	85.1	78.7	$\chi^2 = 1.29$	0.45
After a person has been revived with naloxone, they can fall back into an overdose	48.9	89.4	$\chi^2 = 19.00$	<0.0001
The effect of naloxone lasts for 24 h (False)	31.9	70.2	$\chi^2 = 12.46$	0.03
Naloxone works for a heroin overdose (not cocaine or both)	83.0	97.9	$\chi^2 = 5.44$	0.04
Attitude items				
Worried about getting arrested for calling emergency services	15 (32%)	16 (34%)	$\chi^2 = 0.11$	0.99
Likelihood you will give someone a shot of naloxone if they overdosed near you (median, range 1–5)	5	5	$S = 21.5$	0.27
Likelihood you will call emergency services if you are with someone who overdosed (median, range 1–5)	5	5	$S = 3.5$	0.90
Likelihood of teaching someone to respond to an overdose in the next 3 months (median, range 1–5)	4.5	3.5	$S = -76.5$	0.03
Behaviour items				
Trained someone to respond to an overdose since training	–	19 (40.4%)		
Change in drug use since training				
Increased	–	6 (12.8%)		
Decreased	–	25 (53.2%)		
No change	–	16 (34.0%)		
Currently enrolled in drug treatment	10 (22.7%)	16 (36.4%)	$\chi^2 = 4.5$	0.07

[a] t = Paired Student's t-test; S = Wilcoxon Signed Rank test; χ^2 = McNemar's test.

up interview. Of those who enrolled, three did not complete the training and were dropped from subsequent analysis, yielding an analytic sample of 66. Demographic characteristics are described in Table 1. Twenty-one percent of participants were female, 42% were White, 29% African American, 18% Latino and 11% were other or mixed ethnicity. Most were homeless and reported living predominantly in the street (44%), temporary housing such as hotels (15%), or shelters (14%). Ninety-seven percent reported using heroin, and of those 98% said their preferred mode of administration was injection. Use of other drugs such as crack, alcohol, benzodiazepines, and other opiates was also common. Programme participants were similar to the larger population of HHCLA-HRC clients in gender and ethnicity (all $ps > 0.05$), but were significantly more likely to be homeless ($p = 0.002$).

Of the 66 training participants, 10 (15%) reported experiencing an overdose in 3 months prior to the training. The median number experienced before training was one (interquartile range; IQR: 1-1) however, one individual reported overdosing 15 times. Thirty-two participants (49%) reported witnessing an overdose in 3 months prior to training. In 29 cases (91%), the victim recovered or was taken to the hospital. In the remainder (3; 9%), victims were already dead or died at the scene. These 32 participants reported witnessing a total of 148 overdoses; the median witnessed by an individual was two (IQR: 1–4). While most reported witnessing between one and six overdoses in the previous 3 months, 1 individual witnessed 37 and another witnessed 50 overdoses. These participants may have been exposed to multiple overdoses due to their heavy drug and street involvement.

Forty-seven participants (71%) completed the 3-month follow-up assessment. Those lost to follow-up were similar to the retained group in age ($p = 0.99$), gender ($p = 0.98$), homelessness ($p = 0.12$), ethnicity (white vs. non-white, $p = 0.55$), current drug treatment enrollment ($p = 0.09$), and experience of overdose in the past 3 months ($p = 0.71$). Nine participants (47%) were incarcerated at follow-up.

While overall baseline knowledge was high (Table 2), scores on the overall knowledge index increased significantly from baseline to follow-up (mean score increased from 77% to 91% and median increased from 78% to 89%, $ps < 0.0001$). A statistically significant increase was observed for three items about the appropriate use and effects of naloxone. No significant changes were observed in items about risk factors for overdose or overdose symptoms.

No significant changes were observed in attitudes about overdose response, including likelihood of administering naloxone, likelihood of calling emergency services, or worry about arrest after calling emergency services (all $ps > 0.05$). At 3-month follow-up, the likelihood that participants would train someone else in overdose response decreased significantly ($p = 0.03$). At the same time, 19 (40%) participants reported that they had already trained someone in the interim 3 months. Having trained someone in overdose response was significantly associated with increased intention to train someone at follow-up, controlling for baseline intention ($\beta = 0.42$, $p < 0.01$).

At follow-up, participants were asked about changes in their drug use since the training. The majority (53%) reported that their drug use had decreased. In support of this observation, an increased proportion reported enrollment in drug treatment, from 23% to 36% ($p = 0.07$).

During the follow-up period, 22 individuals reported responding to a total of 35 overdoses (Table 3). Most of the victims were strangers (40%), associates/acquaintances (31%), and friends (17%). One participant provided data about her own overdose, during which her friend injected her with her own naloxone. Another provided information about the use of his naloxone by a friend to rescue

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a third party. Nine individuals reported responding to more than one overdose. Those who responded to multiple overdoses were similar to those who responded to one or fewer in terms of age, gender, and homelessness status (all *ps* > 0.10). The greatest number of overdoses any one person responded to during the follow-up period was four. Multiple responders most frequently responded to overdoses experienced by strangers (64%), associates/acquaintances (27%), and friends (7%). Due to the limitations of small cell sizes, these proportions were not assessed for statistical significance.

Participants reported observing a variety of symptoms, most frequently non-responsiveness (57%), abnormal or no breathing (54%), and change in colour of lips/nails (51%). Finding the victim collapsed (29%) or in a "nod" (14%) were also common. A large proportion (49%) reported other signs of overdose (e.g., being told that the victim had overdosed by others, finding the victim with a needle in his/her arm, or seeing the victim's eyes rolled back in his/her head).

Techniques used to respond to overdoses were categorised into recommended and non-recommended methods, according to the S.C.A.R.E. M.E. technique taught in the training. Recommended responses included stimulation using the sternum rub (26%), calling emergency services (60%), rescue breathing (66%), administering a muscular injection of naloxone (80%), and staying with the victim until help arrives (85%). Among the 21 individuals who reported calling emergency services, 67% said that the police responded to the call and 14% said that someone was arrested at the scene.

Non-recommended responses included doing nothing to help (9%), hitting, slapping or shaking the victim (33%), and using ice or cold water for revival (11%). Twenty percent reported some other non-recommended response technique (e.g., walking the person around, trying to stand him/her up, or shouting at him/her). No participants reported injecting the victim with cocaine or other stimulants, milk, or salt water. Approximately half reported using only recommended techniques, while half reported using both recommended and non-recommended techniques.

In 26 (74%) cases, the victim recovered at the scene and/or was taken to hospital. In four (11%) cases, the victim was already dead by the time the participant arrived or died at the scene, and in five cases (14%) the outcome was unknown. Negative consequences associated with the witnessed overdoses included the victim getting angry (14%), vomiting (3%), and someone getting arrested (9%). In no account did the victims experience a seizure. Other negative consequences reported included being harassed by police.

Six refills were provided to replace naloxone that was lost or stolen, four to replace naloxone confiscated by the police, and four for some other reason.

Table 4 presents changes in response behaviour reported by the 12 participants who described witnessing an overdose both at the baseline and 3-month follow-up. At both time points, participants reported responding to a similar proportion of overdoses they witnessed. The mean number of recommended response techniques employed increased significantly from 2 to 3.3 ($p = 0.01$). At 3-month follow-up, more participants used the sternum rub to stimulate the victim, provided rescue breathing, administered naloxone, and stayed until help arrived. The mean number of non-recommended responses decreased from 0.9 to 0.7, though this difference was not statistically significant. At 3-month follow-up, fewer participants did nothing to help, and fewer used ice or cold water to stimulate the victim.

Table 3
Characteristics of 35 overdoses witnessed during follow-up period, as reported by 22 individuals.

	n	%
Relationship to victim		
Stranger	14	40.0
Associate/acquaintance	11	31.4
Friend	6	17.1
Self	1	2.9
Sex partner	1	2.9
Dealer	1	2.9
Other	1	2.9
Signs used to recognise overdose[a]		
Non-responsive	20	57.1
Abnormal or no breathing	19	54.3
Lips/fingers turned blue	18	51.4
Collapsed	10	28.5
He/she was in a 'nod'	5	14.3
Other[b]	17	48.6
Response to overdose[a]		
Appropriate responses		
Stimulated by sternum rub	9	25.7
Called emergency services ($n = 34$)	21	60.0
Police responded	14	66.7
Someone got arrested at the scene	3	14.3
Rescue breathing/CPR	23	65.7
Muscular injection of naloxone	28	80.0
Stayed with victim ($n = 34$)	29	85.3
Inappropriate responses		
Did nothing	3	8.6
Stimulated by hitting/slapping/shaking	12	34.3
Rubbed with ice/put in shower/bath/water	4	11.4
Injected with milk or salt water	0	–
Injected with cocaine	0	–
Other	7	20.0
Outcome		
Victim recovered and/or was taken to hospital	26	74.3
Victim died	4	11.4
Don't know	5	14.3
Negative consequences associated with overdose ($n = 34$)[a]		
Victim got angry	5	14.7
Someone got arrested	3	8.8
Victim vomited	1	2.9
Victim had a seizure	0	–
Other[c]	7	20.6

[a] Response choices were not mutually exclusive.
[b] e.g., "eyes rolled back in head", "others told me he had overdosed", "saw the needle in his arm".
[c] e.g., "police harassment".

Discussion

Over the course of this 16-month programme, 66 individuals were trained in techniques for responding to opioid overdoses and data were collected on 35 overdoses they witnessed post-training. The proportion of victims who died at the scene was similar before (9%) and after (11%) the training. However, important changes in knowledge, attitudes, and response behaviour were observed. Baseline knowledge about overdose risks and symptoms was generally high. This has been observed in other studies (e.g., Strang et al., 2008) and may reflect ongoing risk reduction education and outreach among IDUs prior to the introduction of naloxone. Despite high baseline knowledge, participants demonstrated significant increases in knowledge at follow-up, driven largely by increases in knowledge about naloxone. Training participants also significantly increased the number of recommended techniques used in overdose response and slightly decreased the number of non-recommended techniques, though this decrease was not statistically significant.

Importantly, 40% of the overdose victims were strangers. The frequency of assisting strangers may be characteristic of this

Table 4
Changes in behaviour in response to witnessed overdoses among participants who reported witnessing overdose at both baseline and 3-month follow-up ($n = 12$).

	Baseline	3-Month follow-up	Test statistic[a]	p-Value
Proportion of witnessed overdoses responded to in past 3 months ($n = 10$)	0.66	0.75	$S = 4$	0.58

	n (%)		Test statistic[a]	p-Value
	Baseline	3-Month follow-up		
Behaviour in response to most recently witnessed overdose				
Recommended responses[b]				
Mean (S.D.)	2.0 (1.0)	3.3 (1.1)	$t = 3.0$	0.01
Median (IQR)	2.0 (1.0–3.0)	4.0 (2.5–4.0)	$S = 25.5$	0.02
Stimulate with sternum rub	1 (8.3%)	3 (25.%)		
Call emergency services	8 (66.7%)	8 (66.7%)		
Rescue breathing	6 (50.0%)	9 (75.0%)		
Naloxone injection	0	8 (66.7%)		
Stayed with victim	9 (75.0%)	11 (91.7%)		
Non-recommended responses[b]				
Mean (S.D.)	0.9 (0.7)	0.7 (0.8)	$t = -0.9$	0.39
Median (IQR)	1.0 (0.5–1.0)	0.5 (0.0–1.0)	$S = -6.0$	0.56
Nothing	3 (25.0%)	1 (8.3%)		
Hit/slapped/shook	4 (33.3%)	5 (41.7%)		
Injected with salt or milk	0	0		
Injected with cocaine	0	0		
Ice/cold water	4 (33.3%)	2 (16.7%)		

[a] S = Wilcoxon Signed Rank test; t = Paired Student's t-test.
[b] Response choices were dichotomous [yes/no].

largely homeless population, where overdoses are more likely to be observed by others. In a sample with a lower prevalence of homelessness, the most frequently reported relationship was friend or drug partner (Tobin, Davey, & Latkin, 2005). Some participants discussed their training with other IDUs so that in the event of an overdose they could be summoned to the scene. This phenomenon may represent the acquisition of new forms of "street capital" (Bourdieu, 1986). IDUs who are trained in overdose response may integrate new response techniques into their behavioural repertoire, leading to changes in social roles. Others have observed that overdose response training extends the natural caretaking and helping roles that some IDUs assume within their social networks (Sherman et al., 2008). This may be particularly relevant among those who reported responding to multiple overdoses, and those who trained others in overdose response.

Some have found that the frequency of calling emergency services decreases after participants have undergone this type of training (Tobin et al., 2008), while others have observed an increase (Galea et al., 2006). We found no change before and after the training in the frequency of calling emergency services. Medical follow-up is recommended for overdose victims treated with naloxone and there is a possibility that victims may not be revived using the techniques learned in a training. However, there are very real and serious consequences resulting from police response to emergency services calls—in this study police responded to two-thirds of the calls and three people were arrested at the scene. The high prevalence of police response and arrest may reflect the increase in policing in the Skid Row area coinciding with the implementation of the programme (Blasi et al., 2007). The threat of arrest and incarceration is an important barrier to calling emergency services (Davidson, Ochoa, Hahn, Evans, & Moss, 2002), though this fear may be moderated by a history of actual contact with police (Tobin et al., 2005). To address the public health implications of the barriers to summoning medical assistance, both individual- and policy-level interventions are needed, such as "Good Samaritan" legislation that protects from prosecution the individual who calls emergency services (New Mexico Department of Health, 2007). In the meantime, it is critical that programmes emphasise the need for medical follow-up and that participants are trained to observe for the possibility of relapse and to discourage the victim from using more opioids if they choose not to summon emergency medical response.

Our results differ from others (e.g., Tobin et al., 2008) who report no incidences of loss, theft or confiscation of naloxone. Four of our sample had their naloxone confiscated by police and six reported it lost or stolen. In an environment characterised by significant amounts of homelessness, where IDUs are increasingly subject to police surveillance and arrest, the ability of IDUs to hold on to their naloxone long enough to use it is a challenge to the success of this type of programme. More effort is needed to educate street-level law enforcement officers about the life-saving potential of this type of programme. The loss or theft of naloxone may have been made more likely by high rates of homelessness observed in this sample. For homeless individuals, challenges related to the safe storage of naloxone need to be addressed.

Concerns that the distribution of naloxone provides a "safety net", encouraging continued or escalating drug use have been noted (Sporer & Kral, 2007). Our findings and others (Seal et al., 2005) suggest the opposite—53% of our participants reported that their drug use decreased at follow-up, and we observed a marginally significant increase in the proportion reporting current enrollment in drug treatment. Similar to the provision of syringe exchange services, this type of programme may serve as a gateway for underserved individuals to take advantage of other services such as drug treatment. Individuals trained in overdose response and, more specifically, those involved in successful 'rescues' may also experience increased self-worth that may translate into other positive health behaviours such as reductions in drug use or increased participation in drug treatment and/or other services such as HIV/HCV testing (e.g., Maxwell et al., 2006).

Limitations of this study should be noted. The design was observational and lacked a control condition; therefore, it is impossible to attribute outcome changes solely to the programme. Furthermore, the study design is vulnerable to internal validity threats, including: (1) the effects of unique historical events that may

have influenced behaviour or attitudes, (2) selection bias in programme participants and/or those who chose to enroll in the evaluation study, (3) testing effects (e.g., improvement in knowledge scores due solely to the learning effect of taking multiple knowledge quizzes over time), and (4) maturation (though the short follow-up period may limit the effect of maturation). All data are based on self-report and are therefore subject to recall bias and socially desirable reporting. As information about witnessed and observed overdoses were obtained only from those individuals who returned for their follow-up visits or completed an incident report, the number of overdoses witnessed and experienced by study participants is likely underestimated, and there is likely some selection bias in those who returned. Participants in this study were ethnically diverse, but were mostly homeless, limiting our ability to generalise to non-homeless populations. Given the precariousness of chronic homelessness and the high rates of incarceration during the follow-up period, the 71% follow-up rate was higher than expected and comparable to others (Strang et al., 2008), though a larger completion rate would have been desirable. However, our findings are strengthened by the fact that those lost to follow-up did not differ significantly from those who were retained. Finally, while the current study provides some preliminary evidence for changes in knowledge and behaviour over the 3-month follow-up period, future experimental studies with longer follow-up periods will be required to determine whether these changes are associated with the programme and are sustainable over time.

Conclusions

We have provided preliminary evidence for the feasibility and efficacy of a relatively low-threshold overdose prevention and response training programme for IDUs. Participants in this programme reported 26 successful overdose reversals, along with increases in knowledge and changes in behaviour. Findings from several quasi-experimental evaluation studies of overdose prevention and response training programmes among IDUs show their ability to change behaviour and reverse potentially fatal opioid overdoses. These programmes come at relatively low cost to the organisation (i.e., staff time and naloxone) compared to the enormous benefit of lives saved. This study contributes to a growing literature suggesting that overdose prevention and response training programmes for IDUs may be associated with changes in knowledge and overdose response behaviour, with few negative consequences and the possibility of unforeseen benefits such as reductions in drug use or increased engagement with drug treatment.

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References

Baca, C. T., & Grant, K. J. (2005). Take-home naloxone to reduce heroin death. *Addiction*, *100*(12), 1823–1831.

Blasi, G., & & the UCLA School of Law Fact Investigation Clinic. (2007). *Policing our way out of homelessness? The first year of the Safer Cities Initiative on Skid Row*. Los Angeles, CA: UCLA School of Law.

Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.), *Handbook of theory and research for the sociology of education*. New York: Greenwood Press.

Burris, S., Norland, J., & Edlin, B. R. (2001). Legal aspects of providing naloxone to heroin users in the United States. *International Journal of Drug Policy*, *12*(3), 237–248.

Davidson, P. J., Ochoa, K. C., Hahn, J. A., Evans, J. L., & Moss, A. R. (2002). Witnessing heroin-related overdoses: The experiences of young injectors in San Francisco. *Addiction*, *97*(12), 1511–1516.

Galea, S., Worthington, N., Piper, T. M., Nandi, V. V., Curtis, M., & Rosenthal, D. M. (2006). Provision of naloxone to injection drug users as an overdose prevention strategy: Early evidence from a pilot study in New York City. *Addictive Behaviors*, *31*(5), 907–912.

Green, T. C., Heimer, R., & Grau, L. E. (2008). Distinguishing signs of opioid overdose and indication for naloxone: An evaluation of six overdose training and naloxone distribution programs in the United States. *Addiction*, *103*(6), 979–989.

Hsu, W., Rao, R. B., & Nelson, L. S. (1997). Naloxone hazards overstated. *Journal of Toxicology. Clinical Toxicology*, *35*(2), 215–217.

Julien, R. M. (2005). *A primer of drug action* (10th ed.). New York: Worth Publishers.

Kerr, T., Fairbairn, N., Tyndall, M., Marsh, D., Li, K., Montaner, J., et al. (2007). Predictors of non-fatal overdose among a cohort of polysubstance-using injection drug users. *Drug and Alcohol Dependence*, *87*(1), 39–45.

Kung, H. C., Hoyert, D. L., Xu, J. Q., & Murphy, S. L. (2008). Deaths: Final data for 2005. National vital statistics reports; vol. 56 no 10. Hyattsville, MD: National Center for Health Statistics.

Los Angeles County Department of Public Health. (2006). Mortality in Los Angeles County 2003: Leading causes of death and premature death. Retrieved May 15, 2008, from http://lapublichealth.org/wwwfiles/ph/hae/dca/LA%20County%20Mortality%20Report%202003b.pdf.

Los Angeles Homeless Services Authority. (2007). *2007 greater Los Angeles homeless count*. Los Angeles.

Maxwell, S., Bigg, D., Stanczykiewicz, K., & Carlberg-Racich, S. (2006). Prescribing naloxone to actively injecting heroin users: A program to reduce heroin overdose deaths. *Journal of Addictive Diseases*, *25*(3), 89–96.

New Mexico Department of Health. (2007). Department of health encourages people to seek medical help for overdose—NM first state in nation to pass 911 good samaritan law. Retrieved May 15, 2008, from http://www.health.state.nm.us/pdf/harmreduction.pdf.

New Mexico Department of Health. (2008). State provides nasal spray to reverse drug overdoses. Retrieved May 15, 2008, from http://www.health.state.nm.us/pdf/narcan.pdf.

Piper, T. M., Rudenstine, S., Stancliff, S., Sherman, S. G., Nandi, V. V., Clear, A., et al. (2007). Overdose prevention for injection drug users: Lessons learned from naloxone training and distribution programs in New York City. *Harm Reduction Journal*, *25*(4) doi:10.1108/1477-7517-1104-1103

Pollini, R. A., McCall, L., Mehta, S. H., Celentano, D. D., Vlahov, D., & Strathdee, S. A. (2006). Response to overdose among injection drug users. *American Journal of Preventive Medicine*, *31*(3), 261–264.

SAMHSA Office of Applied Studies. (2005). Drug abuse warning network, 2003: Area profiles of drug-related mortality. DAWN series d-27, DHHS publication no. (sma) 05-4023. Rockville, MD.

Seal, K. H., Downing, M., Kral, A. H., Singleton-Banks, S., Hammond, J. P., Lorvick, J., et al. (2003). Attitudes about prescribing take-home naloxone to injection drug users for the management of heroin overdose: A survey of street-recruited injectors in the San Francisco bay area. *Journal of Urban Health*, *80*(2), 291–301.

Seal, K. H., Thawley, R., Gee, L., Bamberger, J., Kral, A. H., Ciccarone, D., et al. (2005). Naloxone distribution and cardiopulmonary resuscitation training for injection drug users to prevent heroin overdose death: A pilot intervention study. *Journal of Urban Health*, *82*(2), 303–311.

Sherman, S., Gann, D., Scott, G., Carlberg, S., Bigg, D., & Heimer, R. (2008). A qualitative study of overdose responses among Chicago IDUs. *Harm Reduction Journal*, *5*(1), 2.

Sporer, K. A. (1999). Acute heroin overdose. *Annals of Internal Medicine*, *130*(7), 584–590.

Sporer, K. A. (2003). Strategies for preventing heroin overdose. *BMJ: British Medical Journal*, *326*(7386), 442–444.

Sporer, K. A., & Kral, A. H. (2007). Prescription naloxone: A novel approach to heroin overdose prevention. *Annals of Emergency Medicine*, *49*(2), 172–177.

Strang, J., Best, D., Man, L., Noble, A., & Gossop, M. (2000). Peer-initiated overdose resuscitation: Fellow drug users could be mobilised to implement resuscitation. *International Journal of Drug Policy*, *11*(6), 437–445.

Strang, J., Manning, V., Mayet, S., Best, D., Titherington, E., Santana, L., et al. (2008). Overdose training and take-home naloxone for opiate users: Prospective cohort study of impact on knowledge and attitudes and subsequent management of overdoses. *Addiction*, *103*, 1648–1657.

Strang, J., Powis, B., Best, D., Vingoe, L., Griffiths, P., Taylor, C., et al. (1999). Preventing opiate overdose fatalities with take-home naloxone: Pre-launch study of possible impact and acceptability. *Addiction*, *94*(2), 199–204.

Tobin, K. E., Davey, M. A., & Latkin, C. A. (2005). Calling emergency medical services during drug overdose: An examination of individual, social and setting correlates. *Addiction*, *100*(3), 397–404.

Tobin, K. E., Sherman, S. G., Beilenson, P., Welsh, C., & Latkin, C. A. (2008). Evaluation of the Staying Alive programme: Training injection drug users to properly administer naloxone and save lives. *International Journal of Drug Policy*, doi:10.1016/j.drugpo.2008.03.002

White, J. M., & Irvine, R. J. (1999). Mechanisms of fatal opioid overdose. *Addiction*, *94*(7), 961–972.

Zacny, J., Bigelow, G., Compton, P., Foley, K., Iguchi, M. Y., & Sannerud, C. (2003). Cpdd taskforce on prescrption opioid non-medical use & abuse: Position statement. *Drug and Alcohol Dependence*, *69*(3), 215–232.

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