



Naloxone Distribution and Cardiopulmonary Resuscitation Training for Injection Drug Users to Prevent Heroin Overdose Death: A Pilot Intervention Study

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ABSTRACT *Fatal heroin overdose has become a leading cause of death among injection drug users (IDUs). Several recent feasibility studies have concluded that naloxone distribution programs for heroin injectors should be implemented to decrease heroin overdose deaths, but there have been no prospective trials of such programs in North America. This pilot study was undertaken to investigate the safety and feasibility of training injection drug using partners to perform cardiopulmonary resuscitation (CPR) and administer naloxone in the event of heroin overdose. During May and June 2001, 24 IDUs (12 pairs of injection partners) were recruited from street settings in San Francisco. Participants took part in 8-hour training in heroin overdose prevention, CPR, and the use of naloxone. Following the intervention, participants were prospectively followed for 6 months to determine the number and outcomes of witnessed heroin overdoses, outcomes of participant interventions, and changes in participants' knowledge of overdose and drug use behavior. Study participants witnessed 20 heroin overdose events during 6 months follow-up. They performed CPR in 16 (80%) events, administered naloxone in 15 (75%) and did one or the other in 19 (95%). All overdose victims survived. Knowledge about heroin overdose management increased, whereas heroin use decreased. IDUs can be trained to respond to heroin overdose emergencies by performing CPR and administering naloxone. Future research is needed to evaluate the effectiveness of this peer intervention to prevent fatal heroin overdose.*

KEYWORDS *Heroin, Heroin-related deaths, Injection drug use, Overdose, Prevention.*

INTRODUCTION

Dramatic increases in the incidence of fatal opiate overdose have shadowed burgeoning heroin epidemics in several countries.^{1,2} In the United States, each year, more injection drug users (IDUs) die from heroin overdose than from any other cause, including AIDS, hepatitis, or homicide.³ In fact, heroin overdose was the single

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largest cause of accidental death in San Francisco, California from 1997 to 2000.⁴ Many of these deaths are preventable because heroin overdose can be readily reversed through the timely injection of naloxone, a legal, unscheduled opiate antagonist routinely used by emergency medical personnel to quickly and safely reverse opiate overdose.⁵ Peers witness most overdoses,⁶ but deaths occur because drug users are hesitant to summon emergency medical services for fear of police involvement^{7,8} and their attempts at resuscitation are often unsuccessful.^{8,9}

Naloxone effectively reverses opiate overdose. Naloxone precipitates acute withdrawal symptoms in opiate-dependent persons, but has no effect on nonopiate users; serious adverse effects are rare and naloxone has no abuse potential.⁹ Several feasibility studies have concluded that if injection heroin users were provided naloxone and resuscitation training, including training in CPR and rescue breathing, they might be able to intervene to prevent heroin overdose fatalities in their peers.^{8,10,11} Recently, through both underground and government-sponsored programs, naloxone has been made available to drug users in Germany, Italy,^{12,13} and in the United States, in Baltimore, Maryland, Chicago, Illinois¹⁴ and Rio Arriba County, New Mexico.¹⁵ There have been no formal evaluations of these programs however, and thus their effectiveness has not been established.^{14,16,17}

Although naloxone is not routinely prescribed to laypersons in the United States, naloxone distribution programs are being planned or considered in the United States—in other localities including New York City, New Haven, Connecticut, and several counties in Northern California. These programs have encountered political barriers, however, owing to concerns that naloxone will be viewed by drug users as a “safety net,” thus enabling more drug use, increasing the number of overdoses, and decreasing the use of emergency services.¹⁸ Moreover, while the legality of prescribing naloxone to laypersons for use in others who overdose has been called into question by politicians and physicians alike, a recent legal analysis provides justification for the prescription of naloxone.⁵ To date, there have been no prospective trials of naloxone distribution in North America to investigate these specific concerns. In collaboration with the San Francisco Department of Public Health, the Urban Health Study at the University of California, San Francisco developed and implemented a pilot overdose prevention and management program to train heroin injectors to perform cardiopulmonary resuscitation (CPR) and administer naloxone to injection partners in the event of a heroin overdose emergency. Participants were followed for 6 months to investigate the safety and feasibility of this intervention.

METHODS

Study Participants

During May and June 2001, 487 IDUs participating in the Urban Health Study, a semiannual cross-sectional serosurveillance study of injection drug users (IDUs), were recruited from street settings in San Francisco and screened for enrollment. IDUs were eligible if they injected heroin at least twice a week, reported one or more heroin overdoses in the past 5 years, and could enroll together with an eligible injection partner who met the same criteria. The study was approved by the University of California, San Francisco Committee on Human Research, and each participant provided written informed consent.

The Overdose Prevention and Management Program

Twenty-four eligible, consenting IDUs enrolled in the study in pairs and underwent overdose prevention and management training in July and August 2001. The overdose prevention and management program was modeled after existing community-based naloxone distribution programs in Chicago and San Francisco¹⁹ and consisted of four 2-hour interactive training sessions facilitated by experienced counselors. Sessions were held at convenient community-based field sites, and participants were reimbursed for their time at each session. Before beginning the training sessions, study staff met with local police to describe the program and to apprise them that participants would be carrying naloxone and using it in the event of an overdose. Moreover, police were educated about users' reluctance to call 911 for an overdose because of the perception that arrests were made in conjunction with these emergency overdose calls.

In Session 1 of the program, participants acknowledged the impact of heroin overdose on their lives by describing past experiences with heroin overdose including the loss of friends and family. Subsequently, participants were trained to recognize a life-threatening heroin overdose, defined as being unresponsive, with or without cyanosis, and/or as having slowed, shallow or absent respirations. Overdose prevention strategies were reviewed which included not using alcohol or sedatives together with heroin, not injecting alone, and starting with smaller doses after a period of abstinence or when using heroin from an unfamiliar source. Session 2 was hands-on; participants learned to perform rescue breathing and CPR and practiced emergency overdose resuscitation with their injection partners. (Fig. 1)

Accessing emergency medical services (calling 911) after using naloxone for an overdose was the focus of Session 3. Staff reviewed the importance of definitive medical help to manage any complications of the overdose, including the victim's withdrawal symptoms, after receiving naloxone. Participants listed barriers to calling 911 for an overdose including lack of access to a telephone and fear of police arrest. Participants role-played calling 911 in such a way as to elicit a rapid medical response without necessarily triggering police involvement. In Session 4, participants learned to safely and appropriately administer naloxone using the contents of the naloxone kit (see below). Participants were instructed to inject one 0.4 mg dose of naloxone intramuscularly and repeat in 5 minutes if the victim remained unresponsive. Finally, they developed and rehearsed individualized rescue plans to be used by their partner in the event the other overdosed.

The Naloxone Kit

Under the auspices of the San Francisco Department of Public Health, study physicians dispensed a labeled naloxone kit to each participant contingent on successful completion of the training program. Each kit included two 0.4 mg prefilled injection cartridges of naloxone with two injection devices, gloves, a rescue breathing mask, and detailed instructions all packaged inside a plastic case that also contained a safe compartment for used needles (Fitpacks, ASP Harm Reduction Systems, Australia). (Fig. 2) We chose to use 0.4 mg prefilled, single-dose, injection devices to minimize the likelihood of severe opiate withdrawal reactions from larger doses, eliminate the need to draw up the medication during an emergency, assure the availability of a sterile needle and injection device when it was needed, and reduce the likelihood of infectious disease transmission through a nonsterile syringe or multi-dose vial.²⁰ Participants were given a written prescription for naloxone in case they needed additional evidence that they were carrying a legally prescribed drug.



FIGURE 1. Participants practicing naloxone injection with their injection partner during the overdose prevention and management program.

Data Collection and Statistical Methods

Participants were interviewed monthly for 6 months. Data were collected on overdose-related knowledge, overdoses witnessed or experienced by study participants, and drug and alcohol use. Knowledge was assessed by asking participants to name identifying features of heroin overdose, risk factors for overdose, and overdose prevention and management strategies.

Participants were asked to contact study staff as soon as possible after witnessing or experiencing an overdose. Participants were interviewed in-depth after each overdose they witnessed or experienced, usually within 24–48 hours. Overdose events, including specific details, were confirmed by interviewing one or two witnesses.



FIGURE 2. The naloxone kit.

To further verify the overdose event, when possible, records were obtained from San Francisco Emergency Medical Services, local hospital emergency departments, and the medical examiner. We excluded one death reported by a participant because it could not be confirmed by witnesses, paramedics, police, or hospital, or medical examiner records.

Frequencies were calculated for categorical variables and medians with interquartile ranges (IQR) were calculated for continuous variables. Questions testing knowledge of overdose prevention and management were scored, and the scores were dichotomized and compared with baseline using a McNemar's Q test. Number of overdoses, drug use frequency, and entry into drug treatment were compared at baseline and during 6 months of follow-up by using Wilcoxon signed-rank test for ordinal outcomes and a McNemar's Q test for dichotomous outcomes.²¹

RESULTS

Twelve pairs of injection partners ($n=24$ IDUs) enrolled and all completed the overdose prevention and management program. Of the participants, 33% were female, 46% African American, 54% white and 54% homeless. The median age was 41 years (IQR=34–49 years), and the median duration of injection drug use was 22 years (IQR=11–28 years). There were no statistically significant demographic differences between the 24 participants in the Overdose prevention and management program and the other 463 participants in the Urban Health Study.

From August 2001 through January 2002, participants reported witnessing 20 heroin overdoses. (Table 1) In three (15%) cases, the victim was the participant's study partner, in 12 (60%), an acquaintance, and in five (25%), a stranger. Study participants described the overdose victim as unresponsive in 87% of cases, cyanotic in 70%, and not breathing in 57%; in all 20 cases, the victim was described as cyanotic or not breathing. Participants intervened in all 20 heroin overdose events. They performed CPR and rescue breathing in 16 (80%) overdose events, administered naloxone in 15 (75%), and did one or the other in 19 (95%). Emergency medical services were called by participants in two cases and by other witnesses in four cases. In one of these cases, a participant reported being harassed by police, but was not arrested. Reasons cited for not summoning emergency services were fear of police involvement and possible arrest in 10 (50%) cases, no nearby phone in five (25%), and a perceived lack of need in five (25%). All 20 overdose victims survived.

After 6 months of follow-up, participants' knowledge of heroin overdose prevention and management had increased. (Table 2) The frequency of heroin injection decreased ($P=.003$). The number of heroin overdoses experienced by participants was similar in the 6 months before and after the intervention (5 vs. 3, $P=0.83$). Fourteen study participants entered drug treatment during the 6 months of follow-up. No arrests occurred and no participants were prosecuted for using naloxone prescribed for them for another overdose victim.

DISCUSSION

This pilot trial is the first in North America to prospectively evaluate a program of naloxone distribution to IDUs to prevent heroin overdose death. After an 8-hour training, our study participants' knowledge of heroin overdose prevention and management increased, and they reported successful resuscitations during 20 heroin overdose events. All victims were reported to have been unresponsive, cyanotic, or not breathing, but all survived. These findings suggest that IDUs can be trained to respond to heroin overdose by using CPR and naloxone, as others have reported.^{12,19} Moreover, we found no evidence of increases in drug use or heroin overdose in study participants. These data corroborate the findings of several feasibility studies recommending the prescription and distribution of naloxone to drug users to prevent fatal heroin overdose.^{8,10,22}

TABLE 1. Interventions performed by study participants in response to witnessed heroin overdose events

| Interventions performed | Number of overdose events (N = 20) |
|--------------------------------------|------------------------------------|
| Naloxone used | fifteen |
| With CPR only | 6 |
| With CPR and 911 call | 3 |
| With rescue breathing only | 3 |
| Without other intervention | 3 |
| Naloxone not used | five |
| CPR only | 2 |
| CPR and 911 call | 2 |
| Victim taken to emergency department | 1 |
| 911 call only | 0 |

TABLE 2. Knowledge and behavior among study participants (N = 24) before and after the overdose prevention and management program

| Knowledge or behavior | At baseline N (%) | At 6 months follow-up N (%) | P-value |
|--|----------------------|--------------------------------|---------|
| Knowledge >50% correct responses | | | |
| Identifying a heroin overdose | 0 (0) | 13 (53) | <0.001 |
| Risk factors for heroin overdose | 2 (8) | 16 (68) | 0.003 |
| Heroin overdose prevention strategies | 1 (6) | 8 (32) | 0.040 |
| Correct uses of naloxone | 21 (91) | 23 (95) | 1.000 |
| Number heroin overdoses in past 6 months | | | |
| 0 | 19 (83) | 21 (88) | 0.829 |
| 1 | 3 (13) | 3 (12) | — |
| 2 | 1 (4) | 0 (0) | — |
| Heroin injections during past 30 days. | | | |
| None | 3 (13) | 7 (37) | 0.003 |
| 1–29 | 4 (17) | 7 (37) | — |
| 30–59 | 2 (8) | 3 (16) | — |
| 60–89 | 4 (17) | 2 (11) | — |
| 90+ | 11 (46) | 0 (0) | — |
| Drug treatment entry | 8 (35) | 14 (60) | 0.16 |

Despite being trained to summon emergency medical services, participants called 911 in only two of the 20 overdose events, as other studies have found, largely because of fear of police intervention.^{7,18} In fact, we found that within the 6-month follow-up period, no participant arrests occurred for possessing or using naloxone to resuscitate overdose victims. Our results indicate that more work needs to be done to ensure that drug users access emergency services when provided naloxone, yet until drug users' perceptions change, they will likely resist calling for help. Thus, at present, putting life-saving interventions such as CPR, rescue breathing, and naloxone in the hands of drug users themselves may prevent unnecessary overdose fatalities.²³ Furthermore, forging a partnership with law enforcement and implementing policies that shield drug users from police harassment, arrest, or other legal consequences of accessing emergency services may be central to the success of a naloxone distribution program.

Contrary to initial concerns about naloxone distribution, we found decreased heroin use among participants, even though the program did not advocate reduction in drug use, abstinence, or drug treatment. The training program was interactive, capitalizing on participants' prior overdose experiences and empowering them with additional knowledge and training. This may have increased self-efficacy and motivated participants to decrease drug use despite having the "safety net" of naloxone. Most of the overdose interventions occurred in nonstudy participants, confirming that IDUs are willing to intervene to resuscitate a peer in the event of overdose.^{18,24} These results suggest that limiting naloxone training and distribution to IDUs with stable injection partners may not be necessary.

This pilot study was limited by the small sample, lack of a control group, possible selection bias of motivated participants, and reliance on self-reported data. We were unable to quantify the number of lives saved because we had no way of knowing how many of the 20 reported overdose victims would have died had our trained

study participant and naloxone not been available. Controlled trials of naloxone distribution may be problematic however as withholding naloxone, considered a life-saving intervention, from one group, raises ethical concerns. The overdose events were self-reported, but were corroborated by one or more witnesses and when possible, hospital, police, emergency medical services, and medical examiner records. Self-reported data from drug users recruited outside clinical settings have been shown to have high validity.^{25,26} Future studies should evaluate overdose prevention and management training and the prescription and distribution of naloxone to larger numbers of heroin users.

Millions of dollars are spent annually to train lay people in CPR because bystander CPR can reduce mortality in sudden out-of-hospital cardiac arrest although no randomized study, to our knowledge, has ever shown a benefit from community CPR training programs.²⁷ Few of those trained attain and retain competency in the technique, most rarely if ever perform it, and most people who receive bystander CPR do not survive.^{28,29} Heroin overdose, in contrast, can be quickly, easily, safely, and effectively reversed with naloxone, a medication that costs between \$1 and \$2 per dose. In a follow-up study of 891 laypersons, 6 months after CPR training, no one had performed CPR on a real victim.³⁰ We trained 24 IDUs, and in 6 months they reported 20 resuscitations, with 100% survival and no evident adverse consequences.

In the current political climate in the United States, drug policies that deviate from “zero tolerance” are considered a political liability, and the prescription of naloxone to heroin injectors has not been widely adopted. Nevertheless, on the basis of our study results, the San Francisco Department of Public Health recently began training IDUs and distributing naloxone as part of a comprehensive overdose prevention program. Our data suggest that providing drug users training in CPR and the use of naloxone may be a safe and feasible option for preventing heroin overdose fatalities and may be helpful for other localities considering the implementation of naloxone distribution programs.

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