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Prevalence and Correlates of Opiate Overdose among Young Injection Drug Users in a Large U.S. City

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1. Introduction

As in many developed countries, overdose is the single leading cause of death among injection drug users in the U.S. Over half the deaths of heroin injection drug users (IDUs) are attributed to opiate overdose, (Sporer, 1999) far exceeding the proportion of deaths due to HIV/AIDS (Tyndall et al., 2001;Brettle, 1997;Prins et al., 1997;Frischer et al., 1993;Klatt, et al., 1990). From 1995 to 2002, Baltimore consistently ranked among the top four metropolitan areas in prevalence of heroin-related emergency department drug episodes per 100,000 population (SAMHSA, 2003). In 2000, opiate overdose deaths exceeded homicides in Baltimore (Shane, 2000) and Baltimore had the highest-rates of heroin-related mortality in the U.S., with 15.8 cases per 100,000 population in 2002 (Substance Abuse and Mental Health Services Administration, 2003).

In addition to the burden of overdose mortality, IDUs suffer a high prevalence of non-fatal heroin overdoses. Studies show the proportion of heroin IDUs reporting at least one non-fatal overdose in their lifetime was 48% in SF (Seal et al., 2001), 41% in Baltimore (Tobin and Latkin, 2003), 68% in Sydney, Australia (Darke et al., 1996), and 38% in London (Powis et al., 1999). Non-fatal opiate overdose is associated with numerous deleterious health outcomes, including pulmonary edema, pneumonia, cardiac arrhythmia, and cognitive impairment. These morbidities occur in a relatively small proportion of opiate overdose cases, ranging from 5-10% (Sterrett et al., 2003;Warner-Smith et al., 2001).

A number of studies have identified risk factors associated with fatal and nonfatal opiate overdoses, the most common of which is the concurrent use of heroin and other central nervous system depressants, such as alcohol or benzodiazepines (Mann et al., 2004;Coffin et al., 2003;Warner et al., 2001;Sporer, 1999;Dark and Zador, 1996). Additionally, opiate overdose often results from a voluntary or involuntary lapse in heroin use, such as those associated with drug treatment (Davoli et al., 1993) and incarceration (Darke, et al., 2000;Seaman, 1998). Men

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are more than twice as likely to die from opiate overdose as women and African Americans have a higher opiate overdose mortality rate than Whites (Galea et al., 2003;Lehder et al., 2002).

Studies conducted in both the U.S. and Australia have shown that over 70% of IDUs have witnessed an opiate overdose (Davidson et al., 2002;Seal et al., 2001;McGregor et al., 1998;Darke and Ross, 1996). In studies exploring responses to opiate overdoses, witnesses reported that ambulances were reportedly called in 10% to 56% of events (Warner-Smith et al., 2001;Darke et al., 1996). The primary reason cited for not calling emergency medical assistance was fear of police involvement and potential arrest (Sherman et al., 2002;Darke et al., 1996).

The majority of opiate overdoses occur among long-term, drug-dependent heroin users, while less than 20% occur among novice or recreational heroin users (Darke and Zador, 1996;Powis et al., 1999;Sporer, 1999). A handful of studies have documented the infrequency of overdose among NIDUs (Darke et al., 2004;Darke et al., 2000;Swift et al., 1999;Carpenter et al., 1998), but few have examined the prevalence of witnessing overdose among this population.

Although young drug users have a lower probability compared to older IDUs of experiencing opiate overdoses, a large study of IDUs under 30 years old in San Francisco reported 45% of the sample had ever overdosed and 22% had overdosed in the past year (Davidson et al., 2002). Seventy-three percent of the participants in that study had witnessed at least one opiate overdose.

The current study assesses the prevalence and correlates of witnessing and experiencing non-fatal opiate overdose among of a large sample of young, newly initiated IDUs and non-injection drug users (NIDUs) in a large U.S. city. We also explore the circumstances of the last experienced overdose for the participants (n=90) who reported ever having overdosed. Learning more about the prevalence and correlates of opiate overdose may inform prevention efforts targeting this important subpopulation of drug users.

2. Materials and Methods

2.1 Participants

Young drug users were recruited into the Risk Evaluation and Assessment of Community Health III (REACH III) cohort between October 1999 and August 2002. REACH III examined factors associated with injection and non-injection drug use, as well as infectious diseases among recently initiated young drug users. Eligibility criteria for all participants were: being aged 15-30 years old upon enrollment; and having initiated injection or non-injection use of heroin, crack, and/or cocaine within the previous five years. NIDUs were eligible if they reported using either heroin, crack and/or cocaine two days in the previous week and IDUs were eligible if they had injected at least once in the month prior to study entry. Injection status was verified by the presence of injection stigmata and by a series of injection drug-related questions. Questionnaires were administered and a blood draw occurred at six- and twelve-month follow up.

Targeted sampling methods (Carlson, et al. 2003; Watters and Biernacki, 1989) were used to recruit potential participants. Recruitment areas were identified through ethnographic observations and previous research with this target population. Experienced street outreach workers approached people on the street in targeted neighborhoods, attended community meetings, and posted study flyers. In addition to the study clinic, a van was used as a mobile study center. This study van parked regularly in targeted neighborhoods to recruit and screen potential participants.

2.2 Data Collection

All eligible participants were invited to join the study if they provided written informed consent. Participants underwent an interviewer-administered baseline survey, provided locator information for follow-up visits, had their blood drawn, and were given pre-test HIV and Hepatitis C virus (HCV) counseling. They were compensated \$20 for the completion of each assessment. They returned two weeks after their baseline visit for test results, post-test counseling and \$10 compensation which was provided regardless of whether they chose to get results. The study was approved by the Committee on Human Research at the Johns Hopkins Bloomberg School of Public Health and a Federal certificate of confidentiality was obtained to protect collected data.

An “opiate overdose addendum” was added in February, 2001 due to our developing interest in overdose experiences among the target population. As a result, data in the current study are derived from the overdose addendums collected at baseline and both follow-up periods (N=309).

2.3 Measurement

The baseline and follow-up questionnaires contained information on a wide variety of sociodemographic characteristics, drug use patterns, and sexual behaviours. The current study utilizes data from both the baseline survey as well as the behavioral survey administered at the time that the overdose addendum was administered: either at baseline or either follow-up visit. Demographic and drug utilization variables were derived from information collected at the latest visit at which witnessing and/or experiencing overdoses were reported. Demographic variables included in this analysis were: gender (reported at baseline); ethnicity (reported at baseline), age at time of survey; educational attainment (reported at baseline); recent (in the past six months) homelessness; and recent (in the past six months) incarceration. Recent (in the past six months) drug use patterns were ascertained. The median and interquartile range (IQR) was reported for all continuous variables, except duration of injection career which was categorized into four groups based on quartiles.

There were two outcomes of interest for the current analysis. Witnessing overdose was assessed by asking “Have you ever seen someone overdose?” Non-fatal opiate overdose was assessed by asking “Have you ever had a drug overdose?” The subset of participants who reported having experienced an overdose (n=90) were asked specific questions regarding the last time they overdosed on heroin including: what substances they had used; who was present; and what actions were taken.

2.4 Statistical Analysis

The same methods were used to analyze each of the two dependent variables. Chi-square tests were used to assess statistical significance of dichotomous data, whereas Wilcoxon rank-sum tests were used to analyze continuous covariates because they were not normally distributed. All variables having a p-value ≤ 0.10 in the bivariate logistic models and some variables which had been shown in prior research to be associated with the dependent variables were considered as potential risk factors in initial multivariate logistic regression models. Potential interactions among all of the main effects in the final model were assessed. Adjusted odds ratios (AORs) and corresponding 95% confidence intervals (CIs) are reported. The goodness-of-fit of logistic models was evaluated by likelihood ratio test, Akaike's information criterion, and Schwartz criterion. Multicollinearity and influence statistics were also examined. Bar charts were used to display characteristics of the last overdose, including: drug used; who was present; and what actions were taken.

3. Results

Participants (N=309) were 56% male, 38% African American, and had a median age of 29 years old (IQR=25.9, 32.6). Only 45% of participants reported having completed high school, 18% reported having been homeless in the past six months, and 41% reported having been incarcerated in the past six months. “Ever” having injected drugs was reported by 82% of the sample, with 53% of those participants reporting daily injection. The majority of the IDUs injected heroin, and 28.4% reported primarily injecting alone. IDUs (n=251) reported having injecting drugs a median of 7.0 years (IQR= 5.6, 8.0). Drugs reportedly used in the past six months include: sniffing heroin (27%); using other opiates (10%); smoking crack (27.2%); and drinking alcohol (35%).

Results of two series of bivariate analyses examining correlates of experienced and witnessed overdoses are displayed in Table 1. Twenty-nine percent reported having ever experienced an overdose, having experienced a median of 2.0 (IQR= 1.0, 3.0) overdoses in their lifetime. There were a number of differences between participants who reported ever having an overdose compared to those who did not. In comparing the two groups, those who reported ever having overdosed were significantly: less likely to be African American; more likely to report recent homelessness; more likely to report being an IDU; more likely to report recently having been in drug treatment; more likely to report having ever witnessed an overdose; and reported a significantly longer median duration of heroin, cocaine, and/or crack use. Among IDUs, a significantly higher percentage of those who reported having witnessed an overdose, compared to those who had not, reported primarily injecting heroin only and injecting daily.

Fifty-seven percent reported having ever witnessed an overdose, with a median of 3.0 (IQR= 2.0, 5.0) witnessed overdoses. In bivariate analyses, there were a number of statistically significant differences in demographic variables and drug use characteristics between those who had and had not witnessed an overdose. Participants who reported ever having witnessed an overdose compared to those who did not were significantly younger, less likely to be African American, and more likely to report being an IDU. In comparing IDUs who had and had not witnessed an overdose, there were several differences. A significantly lower percentage of those who reported having witnessed an overdose reported “always” injecting by themselves and a significantly higher percentage reported having experienced an overdose.

The results from the multivariate logistic regression model examining correlates of ever having experienced as well as every have witnessed an opiate overdose are displayed in Table 2. Having ever experienced an overdose was independently associated with being White (AOR=3.2; 95% CI: 1.6, 6.4) recent homelessness (AOR=2.9; 95% CI: 1.5, 5.7); and length of injection-- injecting 5.6-6.9 years compared to less than 5.6 years (AOR= 4.0; 95% CI: 1.8-8.9); injecting 7.0-7.9 years compared to less than 5.6 years (AOR=2.5; 95% CI: 1.03-6.1); injecting 8.0 or more years compared to less than 5.6 years (AOR=4.7; 95% CI: 2.2-10.2). Having witnessed an overdose was independently associated with being White (AOR=2.4; 95% CI: 1.4, 4.1) and 8.0 or more years of injecting drugs compared to less than 5.6 years (AOR=2.2; 95% CI: 1.2, 4.0).

We ascertained [data not shown] what drugs were used, who was present, and what response occurred during participants' most recent opiate overdose (n=90). The most common drugs reported to have been used in combination with heroin at the time of participants' last overdose were cocaine (23.5%), alcohol (13.1%), and benzodiazepines (7.1%). Only 16.5% of participants reported being alone when they last overdosed. During the majority of last overdose events when others were present, 911 was called and the paramedics attended 58.8% of these events and of these, the police attended 43.7% of the time. No arrests were reported during any overdose event. A range of overdose revival methods were administered by

bystanders and paramedics. The three most commonly reported revival methods performed by bystanders were: keeping the participant awake through either physical stimulation or talking to them (46.7%); administering cardio-pulmonary resuscitation (CPR) (31.7%); and performing rescue breathing (19.4%). The three most commonly reported techniques that to have been performed by paramedics were: administering naloxone (50%); taking the participant to the hospital (26.4%); and administering CPR (13.1%).

4. Discussion

This study documents the high prevalence of witnessing and experiencing opiate overdoses among young, newly initiated injection and noninjection drug users in a large U.S. city. The prevalence of experiencing and witnessing overdoses is higher than those reported previously among a similar population of young, urban IDUs (Ochoa et al., 2005; Davidson et al., 2002). Given the relatively short length of the current sample's injection drug use careers, we would have expected a lower prevalence. This is among the first studies to document the prevalence and correlates of witnessing overdose among NIDUs, underscoring the importance of including them in overdose prevention efforts. The study also documented a number of positive responses that occurred at participants' last overdose, including the paramedics being called over half of the time and CPR administration by nonmedical bystanders close to a third of the time. These behaviors provide a solid foundation for overdose prevention efforts that have begun since this study was conducted.

Being White and having a longer drug use career were independently associated with both having ever witnessed and experienced an opiate overdose. Prior research has found that Whites have higher prevalence of nonfatal opiate overdose compared to African Americans, but comparatively, African Americans experience more fatal opiate overdoses (Galea et al., 2003; Lehder et al., 2002). These and other differences in drug use trajectories (Sherman et al., 2005; Des Jarlais et al., 2002; Fuller et al., 2001) point to the need of culturally sensitive interventions, including overdose prevention efforts.

We found a median of two experienced overdoses in a sample with a relatively short injection and drug use career – a disturbing finding. The prevalence of overdose among longer-term drug users is well documented, given the innate increase in exposure over time (Ochoa et al., 2005; Davidson et al., 2002; McGregor et al., 1998; Gossop et al., 1996). Our study is similar to previous literature that found a dearth of overdose experience among NIDUs (Darke et al., 2004; Darke et al., 2000; Swift et al., 1999; Carpenter et al., 1998), but 41% of NIDUs in our sample had witnessed an overdose. NIDUs not only use drugs with IDUs, but a sizable proportion will transition to injection drug use (Sherman et al., 2005; Crofts et al., 1996; van Ameijden et al., 1994). The high prevalence of witnessing overdose among NIDUs underscores the importance of including them in overdose education and prevention efforts. To meet this aim, overdose prevention should occur at a range of programs that reaches this population, such as treatment programs, correctional institutions, and broader HIV prevention efforts. Most often overdose prevention is initiated by and occurs primarily at needle exchange programs. This is vital but not sufficient in reaching of the spectrum of IDUs, NIDUs, and non drug users who are affected by overdose.

A large percentage of the current sample of IDUs always injected alone and close to one-fifth of participants reported being alone at their last overdose. Being alone while overdosing is a risk for having a fatal overdose, as having other individuals present within two to three hours of an opiate overdose is a prerequisite for intervention (Sporer 2003; Sporer 2001; Darke and Zador, 1996). The risk of fatal overdose from solitary injection was documented by Davison and colleagues (Davidson et al., 2003), who found that in 68% of fatal overdoses in San Francisco, the victim was reportedly alone. Overdose prevention messages need to underscore

the importance of injecting while others are present. This need for “others” in overdose prevention causes a public health dilemma – as injecting with others is a significant risk factor for receptive and distributive syringe sharing. This dilemma points to the need for ensuring that risk reduction messages regarding overdose should also include messages about the dangers of syringe sharing.

Our exploration of specific circumstances of and responses at the last overdose can inform overdose prevention efforts. Our results indicate that non-medical personnel present, in this case young drug users, during overdose events often performed appropriate overdose responses such as keeping participants awake through stimulation, administering CPR, performing rescue breathing, and taking participants to the hospital. This documents the wealth of knowledge and experience even among this relatively young sample and the feasibility of peer interventions. Emergency medical personnel was called roughly two-thirds of the time, with police attending less than half of these events – with no arrests reported. Fear of arrest is the single most common barrier to calling 911 for emergency personnel (Seal et al., 2003; Sherman et al., 2002; Warner-Smith et al., 2001; Darke et al., 1996). As a result, other studies have documented that emergency personnel are only called in half or fewer overdose events (Powis et al, 1999; Dark et al., 1996). Although we are encouraged that no arrests were reported, fear of arrest most probably contributed to the 40% of the time that emergency personnel were not contacted. When 911 was called, the most common response was the administration of naloxone. At the time of the study, naloxone was not available to IDUs and has only recently become available to them a Baltimore City Health Department program.

The study's results must be interpreted with caution due to several potential limitations of the study design. Nonrandom sampling could result in the under-representation of certain subgroups in the sample. To address this concern, recruitment efforts were spread over a geographic range of neighborhoods. The main variables of interest were behavioral variables based on self-report, creating the potential for recall bias or an underestimation of high-risk behaviors in order to provide more socially desirable responses. In an attempt to reduce these biases, interviewers were extensively trained. Regarding the outcomes of interest, we would be concerned with under- rather than over-reporting because answering affirmatively to these questions mandated a series of additional questions, lengthening the time of the interview. Our estimates of both outcomes were slightly higher than those previously reported in similar samples, leaving us to believe that even if there was an under-reporting of these events, the prevalence is still high and results are instructive.

In light of these limitations, the current study adds to our understanding of the correlates and points of intervention in reducing the occurrence of fatal and nonfatal opiate overdose. IDUs and NIDUs' exposure to overdose was remarkably high given their short drug use careers. The study points to a number of intervention efforts that are needed, whether in combination with existing services such as needle and syringe exchanges or through the development of targeted overdose prevention, which is slowly growing throughout the country. Understanding the specific factors associated with witnessing and experiencing overdose will only better inform our prevention efforts that ultimately aim to reduce this preventable cause of morbidity and mortality.

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Table 1
Demographics and drug use patterns among REACH III participants, by witnessing or experiencing overdose (N=309)

	Experienced overdose		Witnessed overdose		P value
	Yes	No	Yes	No	
Age (years), median (IQR)	28.7 (26.0, 31.5)	29.1 (25.9, 33.0)	28.0 (24.8, 32.0)	30.3 (26.5, 33.2)	0.0038
Male (%)	51 (56.7)	122 (65.7)	100 (57.1)	73 (54.5)	0.64
African American (%)	16 (18.0)	99 (45.4)	48 (27.6)	67 (50.4)	<0.0001
High school or above (%)	40 (44.9)	96 (44.4)	79 (45.9)	57 (42.9)	0.59
Homeless (%) *	27 (31.8)	27 (12.7)	30 (18.0)	24 (18.5)	0.91
Incarceration (%) *	43 (48.9)	78 (37.1)	71 (42.0)	50 (38.8)	0.57
Licit employment (%) *	54 (60.0)	149 (68.0)	117 (66.9)	86 (64.2)	0.62
Alcohol drinking (%) *	24 (28.6)	79 (37.6)	59 (34.7)	44 (35.5)	0.89
Snorting or sniffing heroin (%) *	17 (19.8)	65 (30.5)	41 (24.1)	41 (31.8)	0.14
Sniffing or snorting cocaine (%) *	6 (7.1)	14 (6.6)	11 (6.5)	9 (7.1)	0.84
Crack smoking (%) *	26 (28.9)	58 (26.5)	51 (29.1)	33 (24.6)	0.38
Using tranquilizers/barbiturates (%) *	5 (6.2)	7 (3.5)	9 (5.5)	3 (2.5)	0.21
Using other opiates (%) *	8 (9.9)	10 (5.1)	11 (6.9)	7 (5.9)	0.73
Duration (years) of heroin, cocaine, and/or crack use, median (IQR)	9.0 (7.0, 12.0)	8.0 (6.0, 11.0)	8.0 (6.0, 11.0)	8.0 (6.0, 12.0)	0.69
Injection drug use (%) *	73 (83.0)	119 (56.7)	117 (69.2)	75 (58.1)	0.048
Injecting any drug daily (%) *	50 (68.5)	82 (68.9)	80 (68.4)	52 (69.3)	0.89
Always injection alone (%) *	16 (22.9)	33 (29.0)	24 (21.4)	25 (34.7)	0.047
Ever injecting heroin solely (%) *	70 (79.6)	112 (54.1)	113 (68.1)	69 (53.5)	0.011
Ever injecting heroin and cocaine together (%) *	41 (48.2)	60 (29.9)	62 (38.0)	39 (31.7)	0.27
Duration (years) of injection, median (IQR)	7.1 (6.0, 8.5)	6.7 (5.4, 8.0)	7.0 (5.7, 8.5)	6.5 (5.5, 8.0)	0.15
Expense (\$) of the last injection, median (IQR)	20.0 (10.0, 40.0)	20.0 (10.0, 35.0)	20.0 (10.0, 40.0)	20.0 (10.0, 35.0)	0.53
Drug treatment (%) *	48 (53.3)	86 (40.8)	81 (47.1)	53 (41.1)	0.30
Ever experiencing overdose (%)	---	---	75 (42.9)	15 (11.2)	<0.0001
Times of experiencing overdose, median (IQR)	---	---	2.0 (1.0, 3.0)	2.0 (1.0, 3.0)	0.28
Ever witnessing overdose (%)	75 (83.3)	100 (45.7)	---	---	---
Times of witnessing overdose, median (IQR)	3.0 (2.0, 4.0)	3.0 (1.0, 5.0)	---	---	---

* In the past 6 months

Table 2

Multivariate logistic regression models[†] for ever having witnessed or experienced an opiate overdose (N=309), Baltimore, MD

	<i>Adjusted OR for having experienced overdose (95% CI)</i>	<i>Adjusted OR for having witnessed overdose (95% CI)</i>
White vs. African American	3.2 (1.6, 6.4)	2.4 (1.4, 4.1)
Homeless in the past 6 months vs. not	2.9 (1.5, 5.7)	---
Duration of injection career		
Less than 5.6 years*	1.00	1.00
5.6-6.9 years	4.0 (1.8, 8.9)	1.3 (0.7, 2.6)
7.0~7.9 years	2.5 (1.03, 6.1)	1.2 (0.6, 2.5)
8.0 years or above	4.7 (2.2,10.2)	2.2 (1.2, 4.0)

[†]Controlling for age

* Including "never" injected drugs