

Calling emergency medical services during drug overdose: an examination of individual, social and setting correlates

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ABSTRACT

Aims The purpose of this study was to examine individual, social and setting correlates of calling the emergency number, 911, during an overdose.

Design Cross-sectional survey.

Methods A sample of 397 current or former drug users in Baltimore, MD, USA who reported having ever witnessed an overdose.

Findings Participants reported calling an ambulance in 23% of the overdose cases. Results from multivariate logistic regression indicate that having ever overdosed and having four or more bystanders present independently decreased the likelihood of calling 911. Having ever witnessed a fatal overdose and having any female bystanders present increased the likelihood of calling 911. There was a significant interaction between fear of arrest and prior exposure to the police. Setting of the overdose (public versus private) was not associated with calling 911 after controlling for other factors.

Conclusions These findings suggest that in addition to personal characteristics of witnesses, social factors influence calling 911. Intervention at the social level may be a viable means to increase bystander helping behaviors.

KEYWORDS Bystander responses, diffusion of responsibility, overdose, social factors.

INTRODUCTION

Many opiate users report witnessing drug overdoses. Darke & Ross (1997) found that 85% of an Australian sample of injection drug users had witnessed a drug overdose in their life-time. Similarly, 97% of a London methadone treatment sample (Strang *et al.* 2000) and 73% of a street-recruited sample of injectors under 30 years old in San Francisco reported witnessing overdoses (Davidson *et al.* 2002). Previous studies indicate that drug users can competently identify signs and symptoms of overdose, particularly in later stages where the victim's breathing has severely decreased or the victim has lost consciousness (McGregor *et al.* 1998; Bennett & Higgins 1999; Powis *et al.* 1999). Death from heroin overdose is often not sudden, indicating a critical opportunity to intervene and prevent death (Zador *et al.* 1996).

Although most overdose occurs in the presence of other people (Powis *et al.* 1999; Darke & Hall 2003), bystander response is often delayed and not medically appropriate (Darke & Hall 2003). Common witness responses include: slapping the person, trying to walk them around, placing ice on them, injecting them with saline or other drugs and placing them in cold showers (Darke *et al.* 1996; McGregor *et al.* 1998). Because victims of drug overdose may be experiencing respiratory or cardiac failure, calling emergency medical services in a timely manner is critical. Rates of calling the paramedics vary. One study from London reports that 44% of witnesses interviewed called for an ambulance at some time during the overdose (Strang *et al.* 2000). According to a review of medical examiner files from Australia, in only 21% of fatal overdoses did witnesses call for medical assistance (Darke *et al.* 2000). Rates of calling the paramedics

may vary due to local policies towards drug users or sample differences.

Fear of police involvement and subsequent arrest are the most common reasons described in the literature for low rates of telephoning the emergency medical system during drug overdose (McGregor *et al.* 1998; Centers for Disease Control & Prevention 2000b; Davidson *et al.* 2003). In the United States, dialing 911 on any telephone activates the emergency medical system. Ethnographic interviews with heroin users in Multnomah County, Washington, USA reveal an aversion to contacting police and paramedics (Centers for Disease Control & Prevention 2000a). These drug users reported a preference to leave the victim in a public place rather than call 911. In an Australian sample of drug users who were delayed or prevented from calling an ambulance by others present, 80% identified fear of arrest as the reason (McGregor *et al.* 1998). Few studies have reported the prevalence of police presence during overdoses or the arrest rates during these events.

Lack of access to a telephone and victim regaining consciousness are other reasons for not seeking medical assistance (Davidson *et al.* 2002). Results from one survey conducted in Dorset, UK revealed that 71% of drug users thought that the emergency services should have been sought during the most recent overdose that they witnessed (Bennett & Higgins 1999). However, the ambulance was actually called in only 53% of times. Understanding how calling 911 varies by situation and bystander characteristics may be important for addressing barriers to activating emergency medical services.

Helping behavior occurs within a social context, yet few studies of overdose witness behavior have included measures of social influence when examining bystander responses. The Diffusion of Responsibility model is one framework of examining helping behavior during an emergency (Darley & Latane 1968) and suggests that the presence of other people influences emergency helping behavior in two ways: defining the situation and taking responsibility to act. Individuals commonly rely on cues from people present to aid their interpretation of the event. Compared to being alone, an individual in the presence of passive or non-reacting observers is less likely to define an event as an emergency. The presence of other people also directly influences an individual's decision about their personal responsibility to help. When alone, the responsibility to help is completely assigned to one person. Indeed, Darley & Latane's (1968) experiments demonstrated consistently that as the number of bystanders increase, the likelihood of anyone intervening decreases. In the present study, we use their model as a framework to examine the role of other bystanders on an individual's likelihood of calling emergency medical services (i.e. calling 911) during a drug overdose.

It is unclear from the literature whether men or women are more likely to engage in helping behavior (Wilson & Kahn 1975). A review of gender differences and helping behaviors (Eagly & Crowley 1986) reports that stereotypical social roles of men and women prescribe the type of help given during emergencies. Furthermore, results of this meta-analysis indicate that men are more likely to help female victims compared to male victims, while women are equally likely to help either gender. Thus, the gender of the bystander and overdose victim was examined in the present study, in addition to other social variables. We hypothesized that gender of the victim would modify the effects of bystander gender on calling 911.

In addition to social factors, other contextual factors have seldom been considered in previous studies of overdose bystander behavior. These contextual factors can include setting and location of the overdose, availability of a telephone to call emergency services, availability of naloxone (a medication that reverses opiate overdose) to drug users and local police and Emergency Medical System (EMS) policies towards drug users (Burris *et al.* 2004; Hembree *et al.* in press).

The aim of this study is to examine the independent influence of individual, social and setting correlates on calling 911 during witnessed drug overdose. We considered participant demographics, previous witnessing experience, previous overdose experience, perceived risk of arrest and the participant's use of drugs during the overdose as individual factors. Social variables were the number of other bystanders present, the gender of those bystanders, gender of the victim and relationship between the victim and the bystander. Location of the witnessed overdose was included as a behavioral setting factor.

METHODS

Study participants

Data for this study came from the fourth wave of follow-up of the SHIELD (Self-Help in Eliminating Life Threatening Diseases) HIV Prevention study, an experimental HIV prevention intervention. Details of this study are described elsewhere (Latkin *et al.* 2003). In brief, participants were recruited using street-based outreach, advertisements and word of mouth. Inclusion criteria were: (1) being aged 18 years old or older, (2) having daily contact with drug users and (3) willingness to conduct HIV prevention outreach.

From July 2002 to June 2003, 568 participants completed a survey for the fourth wave of follow-up. The present study reports on a sample of 397 participants (70%), surveyed during the fourth wave, who reported

having ever witnessed an overdose. All participants provided written informed consent for the follow-up survey and were interviewed face to face by a trained interviewer. Participants were paid \$25.00 for completing the interview. This research was approved by the Johns Hopkins Bloomberg School of Public Health Committee on Human Research.

The majority of the participants in the sample were male (62%), African American (92%) and currently unemployed (73%). The mean age was 45 (SD = 7). Fifty-five per cent reported having 12 or more years of education. Less than one-quarter reported being homeless (15%) or incarcerated (17%) in the past 6 months. Twenty-five per cent were HIV positive. Approximately three-quarters (73%) reported having ever injected drugs (heroin, cocaine or speedball), and 64% of the sample were active drug users (injected, snorted or smoked drugs in the past 6 months).

Over one-third of the entire sample (37%) reported having ever overdosed (mean number of times = 3; SD = 3) and among those who ever injected 48% reported having ever overdosed. Of those who had ever overdosed, the majority was not alone during their most recent overdose (79%) and the paramedics were called for them 58% of the time.

Measures

Outcome: calling an ambulance (calling 911)

Participants were asked to report actions taken by them or others present during the most recent overdose they witnessed using the open-ended question, 'Once you noticed that the person was overdosing, what did you or the others do?'. The open-ended responses were recoded into separate variables that indicated 11 discreet behaviors, including calling for an ambulance (i.e. calling 911). For each action reported, participants were also asked if they or someone else performed the action. A categorical variable was created for calling 911 where 0 = no one present called and 1 = the participant reported calling. We excluded cases where others present called 911 ($n = 89$) (i.e. not the participant). By excluding the cases where another bystander called 911, we are able to focus on the influence of other bystanders on our study participant's behavior, in addition to other factors.

Individual level correlates

Demographics. Participant gender was recorded by the interviewer. Age, ethnicity, current employment status and educational attainment were self-reported.

Participants were asked whether they had been homeless or incarcerated in the past 6 months (yes or no). HIV serostatus was based on self-report, which has been shown to have good validity (Latkin & Vlahov 1998). To measure drug use history, participants were asked to report life-time use of injection drugs (i.e. cocaine, heroin and speedball) and the last time they injected or snorted any drugs or smoked crack. Variables were created to indicate use of injection drugs, snorting heroin or smoking crack in the past 6 months (yes or no).

Overdose witnessing history. Experience of witnessing overdose was assessed by asking participants how many different people they had witnessed overdosing in their life-time. Participants were also asked how many witnessed overdoses were fatal and how many times the police were present during past overdoses. Data for these variables were skewed to the right, despite performing log transformation methods. Therefore, dichotomous variables (yes versus no) were created to indicate having ever witnessed a fatal overdose and prior police presence during the witnessed overdose. To assess participant's fear of being given a drug charge during an overdose we asked, 'If the police showed up during an overdose, how likely is it that the people present will get a drug charge?'. Participants responded using a five-point Likert scale with the response categories of 'no chance of it', 'very unlikely', 'unlikely', 'likely' or 'very likely'. If the participant responded that there was no chance to an unlikely chance of arrest they were categorized as having low fear of arrest. Participants responding that the chance was likely or very likely were categorized as high fear of arrest. Participant use of substances during the most recent witnessed overdose was measured using the question, 'Were you high or using drugs or alcohol at any time during the overdose (yes or no)?'.

Personal overdose experience. Participants reported the total number of overdoses they had personally experienced. A dichotomous variable was created to indicate having ever overdosed (yes versus no).

Social level correlates. Participants reported the total number of bystanders present (excluding themselves), and gender composition of the group. Due to outliers in the data, a categorical variable for number of bystanders present was constructed where 0 = no other bystanders present, 1 = one to three other bystanders present and 2 = four or greater bystanders present. A dichotomous variable (yes versus no) indicated the presence of any female bystander (excluding the participant). Participants also reported the relationship of the victim who overdosed, which was categorized as family, friend, drug partner or acquaintance.

Setting level correlates. A dichotomous variable measuring location of overdose was created (public versus private) based on the setting described by the participant. Public locations included shooting galleries, abandoned houses and alleys. Private locations included private residences of the participant, victim or other bystanders.

Statistical analysis

All variables were examined with univariate statistics. Data were missing for 17 cases for the question about the overdose victim's gender. Bivariate associations between individual, social and setting variables and calling 911 were examined using *t*-tests, χ^2 statistics and unadjusted odds ratios. Sets of variables were entered into a logistic regression model hierarchically by category of variable: individual, social and setting. Improvement of the model with each additional set of variables was assessed using the likelihood-ratio χ^2 statistic and McFadden's R^2 statistic. All analyses were conducted using Stata version 7.0.

RESULTS

Social and setting characteristics of the most recently witnessed overdose

The majority of the overdose victims were male (74%) and most commonly a friend (51%) or a drug partner (20%). Most overdoses occurred in a private home (72%). On 13% of occasions, the overdose occurred in the participant's private residence. Bystanders were present in 88% of the events (one to three bystanders present 50% of the time and four or greater bystanders were present 38% of the time). A female bystander was present 78% of the time. The most frequently recognized overdose symptom reported was that the victim was unconscious (76%). The ambulance was called approximately half the time (23% by the participant and 22% by other bystanders). When the ambulance was called, it was nominated as the first action by 39% of the sample. Other bystander responses ranged from minimally harmful behaviors such as walking the victim around (20%), checking their pulse (4%) and breathing (2%) to behaviors that are potentially harmful such as using ice or cold water (45%), slapping (20%) and injecting with saline, milk or other drugs (8%).

Bivariate associations of participant calling 911 on individual, social and setting variables

Table 1 presents bivariate comparisons of participants calling 911 versus no one calling on individual, social

and setting variables. Individual level correlates that were associated with increased odds of calling 911 were having ever witnessed a fatal overdose ($P \leq 0.001$), having ever been exposed to the police during previously witnessed overdoses ($P \leq 0.001$) and fear of being arrested for drugs ($P \leq 0.05$). Individual level correlates associated with decreased odds of calling 911 were having ever overdosed ($P \leq 0.01$) and using drugs during the witnessed overdose ($P \leq 0.01$). The social factor, having any bystanders present versus none, decreased the odds that the participant called 911 ($P = 0.01$). Having any female present significantly increased the odds that the participant called 911 ($P \leq 0.001$). However, calling 911 did not vary by victim gender or location.

Multivariate logistic regression model of call 911 on individual, social and setting variables

As shown in Table 2, the addition of social variables to individual variables increased the amount of variance explained by the model (indicated by McFadden's R^2 statistic). Setting of the overdose did not significantly improve the model. Controlling for setting (model 3), having ever witnessed a fatal overdose and having prior exposure to the police were individual attribute variables associated with increased likelihood of calling 911. Having ever overdosed was associated with decreased likelihood of calling 911. The social variable, having any female present, increased the odds of calling 911. Having four or more bystanders present compared to zero was marginally associated with decreased odds of calling 911.

Two tests for interaction were conducted. Based upon social role literature (Eagly & Crowley 1986), we expected that males would be more likely to call 911 for female versus male victims. Results for this test of interaction were non-significant ($P = 0.79$). We also conducted an exploratory test for interaction between fear of arrest and prior exposure to police during an overdose. We expected that prior exposure to the police would modify the effects of fearing arrest. The two-way interaction between fear of arrest and police ever present was significant ($P < 0.05$), meaning that the impact of fear of arrest on calling 911 varied according to whether or not the respondent had exposure to the police during a previously witnessed overdose. Specifically, we observed an interaction for those who had prior police contact: high fear of arrest was associated with an odds ratio 2.37 (95% CI = 1.29–4.37) of calling 911 compared to low or no fear. For those who did not have prior police contact, fearing arrest was associated with decreased likelihood of calling 911 (OR = 0.84, 95% CI = 0.30–2.32).

For the final multivariate model we included the interaction between fear of arrest and prior police presence. We present the regression coefficients and 95%

Table 1 Bivariate associations of participant calling 911 (versus no one calling 911 on individual, social, and setting variables.

Variable	No one called 911 n = 216 (70%)	Participant called 911 n = 92 (30%)	χ^2 P-value*	UOR	95% CI
Individual level					
Gender of participant					
Male	137 (63)	48 (52)		1.00	–
Female	79 (37)	44 (48)	0.07	1.59	0.97–2.61
Education					
≥ 12 years	124 (57)	52 (57)	0.89	0.96	0.59–1.58
Currently employed					
Yes	61 (28)	20 (22)	0.23	0.70	0.39–1.25
Incarcerated past 6 months					
Yes	39 (18)	14 (15)	0.55	0.81	0.42–1.59
Homeless past 6 months					
Yes	41 (19)	10 (11)	0.08	0.52	0.25–1.09
HIV status					
Positive	49 (23)	24 (26)	0.52	1.20	0.68–2.11
Ever inject					
Yes	168 (78)	65 (71)	0.18	0.69	0.40–1.19
Inject in past 6 months					
Yes	97 (45)	32 (35)	0.10	0.65	0.39–1.09
Snort heroin in past 6 months					
Yes	64 (30)	29 (32)	0.74	1.09	0.64–1.85
Smoke crack in past 6 months					
Yes	72 (33)	39 (42)	0.13	1.47	0.89–2.43
Ever overdose					
Yes	92 (43)	23 (25)	<0.01	0.45	0.26–0.77
Ever witness fatal overdose					
Yes	84 (39)	58 (63)	<0.001	2.68	1.62–4.44
Police ever present					
Yes	119 (55)	74 (80)	<0.001	3.35	1.87–5.99
Fear of getting drug charge					
High	115 (53)	61 (66)	0.04	1.71	1.03–2.85
Participant using drugs during witnessed overdose					
Yes	156 (76)	54 (61)	<0.01	0.48	0.28–0.83
Social level					
Any bystanders present					
0	22 (10)	21 (23)		1.00	–
1–3	118 (55)	39 (42)		0.350.	0.17–0.70
≥ 4	74 (35)	32 (35)	0.01	0.45	22–0.94
Any female bystanders present					
Yes	141 (65)	80 (87)	<0.001	3.55	1.82–6.92
Gender of victim					
Female	53 (26)	25 (28)	0.71	1.11	0.64–1.94
Setting level					
Location					
Private	161 (75)	67 (73)	0.75	0.92	0.53–1.59

*Pearson's χ^2 .

confidence intervals because the interaction term leads to a problematic interpretation of the main effects. The interaction term remained statistically significant and did not affect the magnitude or direction of the other covariates in the model. Having ever overdosed and hav-

ing four or more bystanders present (versus none) independently decreased the likelihood of calling 911. Having ever witnessed a fatal overdose and having any female bystanders present increased the likelihood of calling 911 (Table 3).

Table 2 Multivariate logistic regression of participant calling 911 during witnessed overdose on individual, social and setting variables ($n = 292$).

	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI)
Gender of participant			
Female	1.53 (0.88–2.67)	1.30 (0.72–2.34)	1.30 (0.72–2.34)
Ever overdose			
Yes	0.41 (0.22–0.76)**	0.44 (0.23–0.82)**	0.44 (0.23–0.82)**
Participant using drugs			
Yes	0.60 (0.33–1.07)†	0.59 (0.32–1.09)	0.59 (0.32–1.08)
Ever witness fatal overdose			
Yes	2.05 (1.08–3.89)*	1.96 (1.03–3.75)*	1.97 (1.03–3.77)*
Fear of drug charge			
High	1.48 (0.84–2.61)	1.53 (0.85–2.74)	1.53 (0.85–2.74)
Police ever present			
Yes	2.93 (1.44–5.95)**	2.99 (1.45–6.16)**	2.99 (1.45–6.18)**
Number of bystanders			
0	–	1.00 (–)	1.00 (–)
1–3	–	0.55 (0.24–1.25)	0.54 (0.23–1.25)
≥ 4	–	0.45 (0.20–1.02)†	0.45 (0.20–1.02)†
Any female bystanders			
Yes	–	2.40 (1.07–5.38)*	2.38 (1.05–5.41)*
Gender of victim			
Female	–	1.02 (0.54–1.90)	1.01 (0.54–1.90)
Location of witnessed overdose			
Private	–	–	1.04 (0.53–2.02)
McFadden's R^2	0.12	0.16	0.16

† $P \leq 0.10$; * $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$.**Table 3** Final multivariate logistic regression of participant calling 911 during witnessed overdose on individual, social, and setting variables.

Variables	Final model Regression coefficient (95% CI)
Ever overdose	
Yes	–1.00 (–1.61 to –0.39)***
Ever witness fatal overdose	
Yes	0.68 (0.04 to 1.31)*
Police ever present	
Yes	0.25 (–0.77 to 1.26)
Fear of drug charge	
High	–0.50 (–1.57 to 0.58)
Interaction term (fear of drug charge and police ever present)	1.27 (0.02 to 2.52)*
Number of bystanders	
1–3	–0.57 (–1.37 to 0.24)
≥ 4	–0.81 (–1.61 to 0.00)*
Any female bystanders	
Yes	1.11 (0.35 to 1.87)**

* $P \leq 0.05$; ** $P \leq 0.01$; *** $P \leq 0.001$.

DISCUSSION

The purpose of this study was to examine individual, social and setting correlates of calling emergency medical services during a witnessed overdose. Our results indicate that measures of social influence are independently associated with the likelihood of calling 911 in addition to individual level variables. The setting variable included in the analysis, location of the overdose, did not statistically improve the model.

Participants who had ever witnessed a fatal overdose were almost twice as likely to call 911. This was consistent with our expectations. The exposure to a previous fatality may sensitize drug users to the seriousness of overdose. Additionally, we expected that participants with previous overdose experience would be more aware of the potential life-threatening nature of overdose and therefore more likely to call 911. Our results did not support this hypothesis. Rather, having previously overdosed decreased the likelihood of calling 911 by approximately half. One explanation for this finding is that given their experience, survivors of overdose may feel more confident in their ability to resuscitate and care for overdose victims without external medical assistance. Street remedies can stimulate the victim, but they can also cause unintended

injuries such as burns, bruises, broken bones and hypertension (Warner-Smith *et al.* 2002). Drug users should be educated about the importance of having trained medical professionals available to administer naloxone, an opiate antagonist, and evaluate for overdose relapse or other complications. Alternatively, prior experience as an overdose victim, with paramedics or hospital staff or perceptions about the effectiveness of emergency medical services may be other factors that diminish an individual's likelihood of calling for an ambulance. Further research is needed to understand how drug users perceive the paramedics and their interactions with other emergency health professionals.

Fear of arrest has been identified as the primary barrier to seeking medical services during overdose. Unexpectedly, we found that fear of arrest was modified by prior exposure to the police during witnessed overdose. Among those with prior exposure to police, fear of arrest was significantly associated with increased likelihood of calling 911; yet, among those with no prior exposure, the trend indicated that fear was associated with not calling 911. Police were present in the majority of the cases when the participant called 911 (77%). Of these, arrest occurred in three instances. Little research has been conducted that examines police and bystander interactions during overdose. It is possible that exposure to police contradicts the perception that arrest is common, thus minimizing its effect as a barrier to calling 911. Conducting in-depth qualitative interviews with police and bystanders about their experiences during overdose may provide a better understanding of drug users' fear of arrest. As it was only a single item, the measure used to assess participants' fear of arrest was suboptimal. It is possible that when responding to this question, participants were estimating the likelihood of the police showing up at an overdose versus the likelihood of arrest for drugs.

Helping is inherently a social behavior and we aimed to examine the influence of social variables on calling for an ambulance using the Diffusion of Responsibility model to guide our selection of measures. As described in the model, bystanders may not assume that the responsibility to take action is theirs, thus decreasing the likelihood that they will help. We report that the presence of other bystanders during the overdose decreased the odds that the participant called 911. To reduce the potential for diffusion of responsibility, drug users should be trained to direct someone present to be responsible for calling the ambulance, while others attempt resuscitation.

Unexpectedly, the presence of any female bystander increased the odds of calling 911. It may be that having a female present enhances the social norm of helping during a medical emergency. Eagly & Crowley (1986) propose a social role theory of helping which suggests that the presence of an audience elicits heroic or chivalrous

behavior. In another study, women were found to score higher on measures of empathy in a helping situation (George *et al.* 1998). Further research is needed to understand social norms that drug users have about responding during overdose.

Our finding that the presence of other bystanders was associated with calling 911 suggests that intervention at the social level may be a viable means to affect bystander behavior. Prior network-based and social influence interventions have been used successfully for HIV prevention programs for drug users (Latkin *et al.* 2003) and men who have sex with men (Kelly *et al.* 1991). Social influence can be used to: (1) diffuse information into a network of individuals, (2) create social roles and (3) change social norms. For example, interventions can train key members in drug-using networks to call 911 and diffuse resuscitation information and skills to other drug users. Training individuals to advocate the use of emergency medical services during overdose could change attitudes towards calling 911 and norms of behavior during overdose. Also, these individuals may gain a prominent role within their networks.

One limitation of this study was that we were unable to determine if the participants had experience calling the ambulance during prior overdoses that they witnessed. Prior experience calling 911 and other variables, such as cumulative exposure to fatal overdoses, may change over time and are important to measure and control in statistical models. If prior experience calling 911 does increase the likelihood of calling 911 during future overdoses, using drug users with this experience as peer mentors in interventions would be warranted. The study measured behaviors from the most recent overdose witnessed, which may not be representative of behavior during all witnessed overdoses. Moreover, recall bias may exist, as this study relied on self-reported data. The generalizability of these results to other countries may be limited due to differences in governmental policies towards drug users, cultural differences and historical events.

Drug overdose is a significant problem in many countries (Darke & Hall 2003; Sporer 2003) and contributes to premature mortality and excessive morbidity among drug users. Through timely medical intervention, mortality is preventable and morbidity can be improved. This study identified a combination of individual and social factors that independently influence witness behavior. Future steps in developing overdose interventions should address the critical role of bystanders on helping responses.

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References

- Bennett, G. A. & Higgins, D. S. (1999) Accidental overdose among injecting drug users in Dorset, UK. *Addiction*, **94**, 1179–1189.
- Burris, S., Blankenship, K. M., Donoghoe, M., Sherman, S., Vernick, J. S., Case, P., Lazzarini, Z. & Koester, S. (2004) Addressing the 'risk environment' for injection drug users: the mysterious case of the missing cop. *Milbank Quarterly*, **82**, 125–156.
- Centers for Disease Control and Prevention (2000a) Heroin overdose deaths—Multnomah County, Oregon, 1993–99. *Morbidity Mortality Weekly Report*, **49**, 633–636.
- Centers for Disease Control and Prevention (2000b) Unintentional opiate overdose deaths—King County, Washington, 1990–99. *Morbidity Mortality Weekly Report*, **49**, 636–640.
- Darke, S. & Hall, W. (2003) Heroin overdose: research and evidence-based intervention. *Journal of Urban Health*, **80**, 189–200.
- Darke, S. & Ross, J. (1997) Overdose risk perceptions and behaviors among heroin users in Sydney, Australia. *European Addiction Research*, **3**, 87–92.
- Darke, S., Ross, J. & Hall, W. (1996) Overdose among heroin users in Sydney, Australia. I. Prevalence and correlates of non-fatal overdose. *Addiction*, **91**, 405–411.
- Darke, S., Ross, J., Zador, D. & Sunjic, S. (2000) Heroin-related deaths in New South Wales, Australia, 1992–96. *Drug and Alcohol Dependence*, **60**, 141–150.
- Darley, J. M. & Latane, B. (1968) Bystander intervention in emergencies: diffusion of responsibility. *Journal of Personality Social Psychology*, **8**, 377–383.
- Davidson, P. J., McLean, R. L., Kral, A. H., Gleghorn, A. A., Edlin, B. R. & Moss, A. R. (2003) Fatal heroin-related overdose in San Francisco, 1997–2000: a case for targeted intervention. *Journal of Urban Health*, **80**, 261–273.
- 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**, 1511–1516.
- Eagly, A. & Crowley, M. (1986) Gender and helping behavior: a meta-analytic review of the social psychological literature. *Psychological Bulletin*, **100**, 283–308.
- George, D., Carroll, P., Kersnick, R. & Calderon, K. (1998) Gender-related patterns of helping among friends. *Psychology of Women Quarterly*, **22**, 685–704.
- Hembree, C., Galea, S., Ahern, J., Tracy, M., Markham Piper, T., Miller, J., Vlahov, D. & Tardiff, K. (in press) The urban built environment and overdose mortality in New York city neighborhoods. *Health and Place*.
- Kelly, J. A., St Lawrence, J. S., Diaz, Y. E., Stevenson, L. Y., Hauth, A. C., Brasfield, T. L., Kalichman, S. C., Smith, J. E. & Andrew, M. E. (1991) HIV risk behavior reduction following intervention with key opinion leaders of population: an experimental analysis. *American Journal of Public Health*, **81**, 168–171.
- Latkin, C. A., Sherman, S. & Knowlton, A. (2003) HIV prevention among drug users: outcome of a network-oriented peer outreach intervention. *Health Psychology*, **22**, 332–339.
- Latkin, C. A. & Vlahov, D. (1998) Socially desirable response tendency as a correlate of accuracy of self-reported HIV serostatus for HIV seropositive injection drug users. *Addiction*, **93**, 1191–1197.
- McGregor, C., Darke, S., Ali, R. & Christie, P. (1998) Experience of non-fatal overdose among heroin users in Adelaide, Australia: circumstances and risk perceptions. *Addiction*, **93**, 701–711.
- Powis, B., Strang, J., Griffiths, P., Taylor, C., Williamson, S., Fountain, J. & Gossop, M. (1999) Self-reported overdose among injecting drug users in London: extent and nature of the problem. *Addiction*, **94**, 471–478.
- Sporer, K. A. (2003) Strategies for preventing heroin overdose. *BMJ*, **326**, 442–444.
- 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**, 437–445.
- Warner-Smith, M., Darke, S. & Day, C. (2002) Morbidity associated with non-fatal heroin overdose. *Addiction*, **97**, 963–967.
- Wilson, D. & Kahn, A. (1975) Rewards, costs, and sex differences in helping behavior. *Psychological Reports*, **36**, 31–34.
- Zador, D., Sunjic, S. & Darke, S. (1996) Heroin-related deaths in New South Wales, 1992: toxicological findings and circumstances. *Medical Journal of Australia*, **164**, 204–207.