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Drug Sharing Among Heroin Networks: Implications for HIV and Hepatitis B and C Prevention

Stephen Koester,[1,3] Jason Glanz,[2] and Anna Barón[2]

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Qualitative and quantitative findings from the baseline survey of a longitudinal, socially-focused blood-borne disease intervention study among 611 heroin IDU in Denver indicate that high risk injection practices—the sharing of contaminated drug solution in particular—often occur as a consequence of how heroin is obtained, the quantity obtained and the setting where it is injected. Contamination occurs if a contaminated syringe is used to liquefy and apportion the shared drug. In our cohort of 304 heroin injecting networks there was at least one member who, when asked to describe their last injection, reported dividing the drug as a liquid (82%), using a reservoir of water that syringes had been rinsed in to mix drugs (67%), using a common cooker (86%)—a proxy for drug sharing—and beating a shared cotton filter (58%). In contrast, only 22% reported syringe sharing. Variables associated with various injection practices included location of the last injection episode, quantity of drug injected, dope sickness, and years injecting. When compared to those who injected in a safe setting, those in an unsafe location had almost three times the odds (OR = 2.9; 95% CI: 1.9, 4.6) of being part of an injection episode where there was cooker sharing; and the smaller the quantity of heroin ($\leq$1/4 gram v. >1/4 gram) present at the episode, the greater the odds that cooker sharing occurred (OR = 1.8; 95% CI: 1.2, 2.6). Use of a used, unbleached syringe to prepare shared drugs had twice the odds of occurring in "unsafe" v. safe settings (OR = 2.2; 95% CI: 1.3, 4.0) and in episodes in which a participant was dopesick (OR = 2.1; 95% CI: 1.2, 3.6). In summary, risky injection practices occur within an injection process that is, in part, a response to a structurally imposed risk environment. Lessening the blood-borne disease risks embedded within this process requires interventions designed to mitigate the environmental factors that influence it, including syringe accessibility, law enforcement strategies and the settings where IDU inject drugs.

KEY WORDS: injection drug users; HIV; hepatitis C; drug sharing.

INTRODUCTION

The research reported here demonstrates the importance of examining injection "risk behaviors" *as a process* rather than as distinct behaviors, and reaffirms the message that IDU should use a sterile syringe every time they inject. It confirms, as well, the need to extend this message to the syringe used to prepare "shared" or jointly purchased drugs. Specifically, we show that high risk injection practices—the sharing of contaminated drug solution in particular—often occur as a consequence of how drugs are obtained, the quantity of drug obtained and the setting in which the drug is injected. This study demonstrates that water, cooker and cotton sharing occur frequently as elements *within* the process of preparing and apportioning jointly purchased drugs. Among heroin IDU in Denver, these injection risks are most likely to occur

[1]Department of Anthropology, Program in Health & Behavioral Sciences, University of Colorado at Denver, Denver, Colorado.
[2]Department of Preventive Medicine & Biometrics, University of Colorado Health Sciences Center, Denver, Colorado.
[3]Correspondence should be directed to Stephen Koester, Ph.D., Associate Professor, Health & Behavioral Sciences, Campus Box 188, University of Colorado at Denver, P.O. Box 173364, Denver, Colorado 80217-3364; e-mail: steve.koester@cudenver.edu.

among groups of individuals with overlapping economic and personal ties.

Indirect or syringe-mediated sharing practices that may facilitate human immunodeficiency virus (HIV), hepatitis B (HBV) and hepatitis C (HCV) transmission include the preparation and distribution of jointly purchased drugs for injection as well as the communal use of injection paraphernalia, such as drug mixing containers ("cookers" or "spoons"), cotton filters, and water for mixing the drug into solution and for rinsing syringes (Bourgois *et al.*, 1997; Bourgois, 1999; Finlinson *et al.*, 2000; Finlinson *et al.*, 2005; Friedman *et al.* 1999; Grund *et al.*, 1991; Grund *et al.*, 1996; Inciardi and Page, 1991; Jose *et al.*, 1993; Koester *et al.*, 1990; Koester and Hoffer, 1994; Koester *et al.*, 1996b; Koester, 1998; Needle *et al.*, 1998; Page, 1990; Page *et al.*, 1990; Zule, 1992). While intervention programs have responded to these latter risks with prevention messages and intervention materials such as safer injection kits containing multiple vials of water, dental cottons, and metal caps for use as cookers, little has been done to address the transmission risks embedded within the process of preparing and apportioning shared drugs.

Likewise, drug sharing is often neglected or misunderstood in studies examining injection associated transmission risks (Koester *et al.*, 2003). This paper attempts to rectify this shortcoming by describing how the preparation of shared drugs may lead to viral transmission and identifying through quantitative analyses specific social, spatial and economic factors influencing the likelihood that drugs will be dissolved into solution and then divided and distributed. Like others, we refer to this process as drug sharing (Friedman *et al.*, 1999). However, we caution the reader that this term is not necessarily used or understood by IDUs. Lisa Maher observed that IDU in Sydney, Australia frequently backloaded shared drugs from a donor syringe to a receiving syringe but reported that injectors had no term to describe this practice (2002). With this in mind, the phrase drug sharing is used here as a research construct, not as an indigenous term. Drug sharing does not necessarily imply reciprocity. In many instances, a drug is shared because users have pooled their resources to obtain it.

The potential link between drug sharing and blood-borne disease transmission has been described (Bourgois *et al.*, 1997; Bourgois, 1999; Finlinson *et al.*, 2000; Finlinson *et al.*, 2005; Friedman *et al.*, 1999; Grund *et al.*, 1991; Grund *et al.*, 1996; Inciardi and Page, 1991; Jose *et al.*, 1993; Koester and Hoffer, 1994; Koester *et al.*, 1996a; Koester 1998; Needle *et al.*, 1998; Page *et al.*, 1990; Page, 1999; Zule, 1992) and shown to occur more frequently than syringe sharing (Koester *et al.*, 1996b; Friedman *et al.*, 1997). Recently, a study by Colón and his colleagues found that jointly purchasing drugs was significantly associated with risky drug preparation behaviors among IDU in Puerto Rico and New York City (2001).

Studies have looked at paraphernalia sharing, a practice we argue is frequently a component of the drug sharing process, as well as particular forms of drug sharing, and found associations with blood-borne disease. HCV transmission has been found to be strongly associated with cooker sharing (Crofts *et al.*, 2000; Hagan *et al.*, 2001; Hahn *et al.*, 2002; Thorpe *et al.*, 2002;) and with backloading, a method of distributing shared drugs from one syringe into the barrel of another (Hahn *et al.*, 2002). However, other studies found no significant association between backloading and risk of HCV transmission (Hagan *et al.*, 2001; Thorpe *et al.*, 2002). Frontloading, a method of distributing shared drugs through needles with detachable syringes, was found to be associated with both HIV and HCV transmission (Stark *et al.*, 1996) and in a recent study, pooling money to buy drugs was associated with increased risk of HCV transmission (Hahn *et al.*, 2002). Finally, among young adult IDU in Baltimore, HCV seroprevalence was associated with both sharing ancillary injection paraphernalia (cookers, rinse water and cottons) and backloading (Garfein *et al.*, 1998). Some studies might have found even greater associations between blood-borne disease transmission and drug sharing had they focused on drug sharing as a process rather than on the specific elements within it or only on a single technique for distributing the shared drug solution (Koester *et al.*, 2003).[4]

The preparation and apportioning of jointly purchased drugs is potentially the most risky of indirect sharing practices, and a frequent cause of paraphernalia contamination among heroin injectors in

[4]We contend that the use of "backloading" as a general term for drug sharing has led to the underreporting of drug sharing. Backloading refers to a very specific and somewhat difficult method of transferring a drug solution from one syringe to another (Friedman *et al.*, 1999; Grund *et al.*, 1996). Many IDU prefer to simply squirt the solution back into the cooker and let other participants draw up their shares. We suggest that researchers and interventionists should be careful in the use of terms like "backloading" that capture only one form of drug sharing and may not be part of local drug injectors' vernacular.

Denver. If a previously used syringe is used to prepare a shared drug into solution and apportion it, bioburden from this contaminated syringe may be flushed into the solution and subsequently distributed to the other injection episode participants. In a typical injection episode, this will occur twice: first, when water is squirted from the syringe into the mixing container holding the drug, and again when the solution is drawn up into the syringe, measured and then distributed. The drug is most frequently distributed by simply squirting the other participants' shares out of the syringe and back into the cooker.[5] Each participant then draws up his or her share (Finlinson *et al.*, 2005; Koester and Hoffer, 1994; Koester, 1998; Needle *et al.*, 1998). As will be shown, backloading is a less common method of distribution and frontloading is not possible with most insulin syringes that IDU in the United States use because the needles are not detachable.

In this study, we examine drug sharing as a product of social interaction between members of injection networks and the circumstances in which those interactions take place. Increasingly, researchers and interventionists have turned their attention to IDUs' social networks to overcome the limitations of individual approaches to understanding and addressing HIV risk (Klovdahl, 1985; Latkin *et al.*, 1995; Neaigus *et al.*, 1994; Neaigus, 1998; Rothenberg *et al.*, 1995; Trotter *et al.*, 1995). As Neaigus explains, "HIV transmission is structured by social relationships" (1998: 141).

As used here, injection networks are groups of people who regularly interact in the process of obtaining, sharing and injecting drugs. Such networks may be as small as a dyad or they may incorporate much larger groups of people. For analytical purposes, we focus on personal or egocentric injection networks consisting of an index subject and the people with whom s/he engages directly in risk behaviors (Friedman *et al.*, 1997). Drug use may be only one of the ties that bind these individuals. Frequently, IDU are linked as well through kinship, friendship, sex and other social and economic ties. As we demonstrate, network members frequently form cooperative and reciprocal relationships to obtain drugs and other necessities (Neaigus *et al.*, 1994). Members' drug scene roles, the stage they are at in their drug-using career, policing, and numerous other factors influence the stability of egocentric networks (Friedman *et al.*, 1999).

[5]For "thick" descriptive accounts of drug sharing see Finlinson *et al.*, 2005 and Friedman *et al.*, 1999.

The egocentric injection networks recruited for our study were parts of larger neighborhood and drug market based IDU networks. In a study of heroin injectors in Bushwick, Brooklyn, Curtis and his colleagues divided these neighborhood-based drug scenes into a core and periphery. The core consisted of drug scene "regulars." Inclusion as a core member was based on the observations of the research team and validated by other core network members. Drug sharing was found to be a normative behavior between core network members and as such, used as a criterion for determining core network membership. IDU who used drugs less often, used alone or came into the neighborhood to purchase drugs were defined as the periphery. On occasion, some members of this group injected and shared drugs with members of the core (Curtis *et al.*, 1995). This conceptual framework is useful for understanding the social organization of street level injection drug use in Denver. Personal injection networks are usually tied to larger neighborhood based injection scenes and their accompanying drug markets. As is the case in Bushwick, drug sharing appears to be a standard practice of the IDU who frequent these scenes.

To understand why practices like drug sharing appear to be normative behaviors among IDU requires an understanding of the environment in which drug use occurs. Increasingly, studies have begun examining how micro and macro environmental factors influence risk taking and risk avoidance (Blankenship and Koester, 2002; Bourgois *et al.*, 1997; Burris *et al.*, 2004; Carlson, 2000; Friedman *et al.*, 1999; Koester, 1994; Maher, 2002; Maher and Dixon, 1999; Ouellet *et al.*, 1991; Page, 1999; Rhodes *et al.*, 1999; Rhodes, 2002; Rhodes *et al.*, 2003; Singer *et al.*, 1992; Singer *et al.*, 2000; Wallace, 1990; Weeks *et al.*, 2002). In a recent article, Tim Rhodes suggests shifting our attention from "individualistic modes of self-survival" to the social and environmental conditions that influence health. As he contends, "A focus on the risk environment encourages us to think about the social situations and places in which harm is produced and reduced. We can define the risk environment as the space—whether social or physical—in which a variety of factors interact to increase the chances of drug-related harm" (2002: 88). In our paper, the risk environment is defined in both time and space. Specifically, we focus on the most recent, micro-level social event, the last injection episode, and we show how certain environmental factors influence the occurrence of drug sharing among the participants.

METHODS

This article follows the lead of others in combining qualitative and quantitative methods to provide a comprehensive view of blood-borne disease risk among injection drug users (Carlson *et al.*, 1996; Colón *et al.* 2001; Deren *et al.* 2003; Friedman *et al.*, 1999; Finlinson *et al.*, 2000; Page, 1999; Weeks *et al.*, 2001). The results described are based on the analysis of baseline interviews and ethnographic research conducted as part of a socially focused intervention project for injection drug users in Denver, Colorado.

Subject Recruitment

Subjects recruited for this intervention study were "street-based" injectors of heroin, pharmaceutical drugs, cocaine and/or methamphetamine. Active use was defined as having injected within thirty days of recruitment, and determined by recent signs of venipuncture and a series of screening questions regarding drug injection. By "street-based," we mean that these were mostly impoverished IDU who frequented neighborhood-based drug markets. Subjects were recruited by members of an outreach team made up of individuals with long-term experience with and intimate knowledge of Denver's injection drug scenes.

We implemented a targeted sampling plan to ensure recruitment of subjects from areas of the city heavily frequented by IDU (Bluthenthal and Watters, 1995; Carlson *et al.*, 1994; Watters and Biernacki, 1989). Ecological data on drug-related arrests and incidence of STDs potentially reflective of HIV incidence were combined and geo-coded to census tracts in the Denver metro area to identify high and low risk areas for sampling. Because these measures are somewhat static, we also enlisted the experiences of our outreach workers and key informant participants. We asked them to identify in a dynamic fashion the high-risk locales around Denver for drug acquisition and injection.

Outreach staff used the targeted sampling plan to perform recruitment by approaching potential participants, asking if they would like to enter the study. If a potential participant responded positively s/he was then screened for recent injection drug use based on visible signs of venipuncture and responses to questions regarding patterns of drug use. Having passed the screening process, a potential participant was then required to recruit at least one other individual with whom s/he had injected in the last 30 days in order to be enrolled in the study. Participants received compensation once they completed the baseline interview and the first day of the intervention. The social groups resulting from this recruitment process, referred to as personal injection networks, ranged in size from two to six members, averaging between two and three members.

Measuring Injection-Related Behaviors

To assess the effectiveness of the interventions, a survey instrument designed to detail an individual's injection behaviors at the last injection episode was administered at baseline, three-months and six-months of follow-up. Data from this instrument, the Social Network Assessment of Injection Risks (SNAIR) were used to capture the process of drug preparation and injection among personal (egocentric) injection networks. In addition, we elicited information on history of drug use; frequent and occasional shooting partners; history of testing for and general knowledge of HIV and HCV; and health-related status. The instrument was based on a synthesis of several years of ethnographic data collection in Denver. To examine the factors that affect high-risk injection behaviors we used only the data reported at the baseline interview for the last injection episode. We limited our analysis to networks that reported injecting heroin at that episode.

Qualitative data are used to describe the drug preparation and injection process, to identify the contextual factors that influence it and to interpret the quantitative results. Data come from fieldnotes and open-ended interviews conducted during the course of the project by the lead author and trained MA level research assistants who followed networks of IDU over time. Interviews were conducted at the project field site and in the natural settings where IDU buy and use drugs. Networks were selected using a purposeful sampling strategy that was designed to reflect the heterogeneity of our intervention sample (Patton, 2002). As a result, we worked with networks representing the three major ethnic and racial groups in Denver. We followed heroin, poly-drug and methamphetamine networks. We recruited networks that included women as well as some that were exclusively male, and we recruited both new, young IDU and long-term users.

Analysis of qualitative data was both an ongoing iterative process and computer-assisted using Folio Views 4.0 (Folio Corporation, Provo, UT), a

text coding and retrieval program. All interview transcripts, field notes and intervention notes were entered into this program. Data on a particular coded topic could be retrieved from all our data sources and compared across groups defined, for example, by gender, ethnicity, drug of choice, and other domains of interest. Themes, patterns and exceptions were then identified and discussed. We analyzed 66 tape-recorded interviews in which drug sharing was discussed with 35 heroin-using IDU. Eighteen of these IDU were African–American, 11 were white and six were Hispanic. Twenty-three IDU were male and 12 female. The interpretation of these data is informed by the lead author's 14 years of fieldwork with IDUs in Denver and from the fieldnotes of project ethnographers.

The research design for this study was approved by the University of Colorado Health Sciences Center IRB. Written, informed consent was obtained from all subjects prior to the administration of the questionnaire or a qualitative interview. Verbal consent was obtained before a project ethnographer conducted any observational research with participants. Participants were compensated for taking part in the survey or interview.

Variable Definition

The process of preparing and injecting drugs includes a complex of practices that may lead to bloodborne disease transmission. Several of these practices can occur independently. However, when the drug is divided as a liquid several of these practices are unavoidable, including the use of a single syringe to prepare and apportion the drug, a single cooker or mixing container to dissolve the drug in, a single source of water to mix the drug, and a single cotton to filter out undiluted particles in the solution.

We divided the injection process into two parts and modeled them separately: the acquisition stage (pre-injection period) and the preparation and injection stage (mixing the drug into solution, measuring, dividing and distributing shares, injecting and the post-injection rinsing of syringes). For the purpose of analysis, we operationalized the acquisition of drugs using the survey question addressing the frequency of acquiring drugs with other IDU in a respondent's network (all the time, most of the time, half of the time v. sometimes, rarely, never).

In our analysis, cooker sharing is synonymous with preparing and apportioning the shared drug as a liquid. The question in our survey used to measure this activity asks, "During this shooting episode, did anyone's drug share come from a common cooker or mixer?" This measure leaves little room for interpretation; it does not refer to the consecutive use of a single cooker by injection participants. Thus, sharing the cooker is used as a surrogate for sharing the drug as a solution.[6]

"Cooking" refers to the process of briefly heating the drug to help it dissolve and to warm the solution. One study has demonstrated that "cooking" tar heroin inactivates HIV (Clatts *et al.*, 1999). However, as described here, the drug solution is frequently drawn back into the preparer's syringe *after* it has been heated to measure each participant's share using the calibrations on the syringe barrel. The other participants' shares are then squirted out of the syringe and back into the cooker or in some instances, the barrels of the other participants' syringes. This procedure provides a second opportunity for the solution to become contaminated through the preparer's syringe. "Cooking" or heating is almost always required for "tar" heroin, but is optional for powder heroin.

During the injection process, water is used for two distinct purposes: to mix the drug into solution and to rinse syringes. Often times IDU pull water into their syringe before injecting to lubricate it and to make sure it isn't clogged. Most IDU rinse their syringe with water after injecting to prevent clogging. In either case, syringes that enter the water after a contaminated syringe may become contaminated as well. If the water is used to mix drugs into solution, the solution may also become contaminated. We were particularly interested in finding out whether, prior to injecting, injection participants rinsed their syringes in the same water that was then used to dissolve the drug. We also asked if, after the episode, participants rinsed their syringes in a common water container.

At the conclusion of the injection, the only remaining drug solution is in the cotton filter. As a consequence, an episode participant may "beat the cotton," (also described as "a rinse, "cotton shot" or "a wash"). The IDU takes the cotton filter that has become saturated with the shared drug solution (and touched by each participants' syringe), puts a small amount of water on it, swirls it around in the cooker, draws up and injects. This practice may take place

[6] We are well aware that IDU frequently re-use and "share" cookers. This appears to occur in part as a matter of convenience and because many IDU have not, until recently, considered it to be a risk. Cooker re-use occurs as well because some drug users believe that residual heroin accumulates in the cooker from repeated use.

immediately after the initial injection, or the cotton may be saved for a later injection.

These practices become potential avenues for blood-borne disease transmission if the syringe used to prepare the shared drug was previously used and not properly disinfected with bleach. In general, there are three other scenarios in which the shared drug can become contaminated even if the syringe used to prepare the drug was sterile. First, this can occur if an episode participant rinses a previously used syringe in the water that will be used to mix the drug. Second, contamination can result when participants use their syringes to pull their portion of the drug solution from a communal cooker and cotton filter and third, if they squirt some of the solution from their syringe back into the cooker. This latter scenario occurs when a participant takes too much or gives a portion of their shot to someone else. Contamination of the shared drug solution may occur if any of these syringes were used previously. Finally, syringes may become contaminated with blood-borne disease at the conclusion of the episode if a common container of water is used to rinse these just-used syringes. For our analysis we also created a dependent variable called *syringe status* for the syringe that was used to prepare the drug solution. This variable distinguishes between used, unbleached syringes and syringes that are either new, used but bleached, or used as donor syringes (i.e., used only to prepare the drug).

The above mentioned injection-related risks were quantified using a series of mixed effects logistic regression models with frequency of acquiring heroin with another IDU, the status of the syringe used for drug preparation, and the common use of a cooker as separate outcome variables. These mixed effects models allowed for the inclusion of a random network effect such that the behaviors of the individuals within networks were allowed to be correlated, while the behaviors of individuals across networks were assumed independent.

We examined three independent variables with respect to the frequency of acquiring heroin with another IDU: hustling (daily or weekly v. monthly, rarely or never), hanging out (daily or weekly v. monthly, rarely or never) and the relationship with the injection partner (close or distant). We defined acquiring heroin as pooling money or exchanging services to purchase the drug. Hustling refers to the quasi-legal or illegal activities and behavior in which impoverished individuals engage to survive. Among drug users such activities may include dealing small quantities of drugs, connecting drug buyers with sellers, sex work, shoplifting, jimmying coin boxes, con games etc. Hanging out refers to "socializing" or spending time with someone outside of hustling and injecting drugs. Relationships with family members, girl/boy friends, spouses and best friends were considered "close;" and relationships with co-workers, acquaintances, dealers, ex-spouses, ex-girl/boy friends and roommates were defined as "distant."

Independent variables for models of the outcomes, *common use of a cooker* and *syringe status* included location of the injection episode, whether or not any participant was dope sick, the quantity of heroin injected at this episode ($\leq$0.25 gram v. $>$0.25 gram), chipping in money, providing the drug and/or goods or services in order to participate in the injection episode, and years of injection drug use. Location was dichotomized into what we defined as a "safe" location or an "unsafe" injection setting. Safe locations referred to areas with privacy and security, and included one's own residence, a friend or relative's residence and a hotel room. Unsafe locations were defined as visible areas without privacy, and included alleys, cars, shooting galleries, parks, abandoned buildings and public bathrooms. Our assumption, based on similar typologies (Friedman *et al.*, 1999; Weeks *et al.*, 2001) as well as ethnographic data from observations, interviews and focus groups, is that "safe" locations are more likely to provide individuals with the time and resources necessary to prepare and inject drugs in a manner that reduces transmission risks.

Statistical Methods

We estimated at the network and individual levels, the prevalence of 10 risk behaviors from the use of used, unbleached syringes to beating the cotton. At the network level, the prevalence was the proportion of the networks in which one or more of the network participants reported the behavior to be frequent (all, most or half of the time) over the last 6 months. For individuals the prevalence was the proportion of all participants who reported the behavior to be frequent (all, most or half of the time) over the last 6 months. We used mixed logistic regression with manual backward elimination to build our models for injection risk behaviors (Hosmer and Lemeshow, 2000; Kleinbaum, 1998). Initially, all possible bivariate regressions with the independent variables were fit. Those that were significant at the $\alpha = 0.25$ level were included into a full model. Each independent variable that was not

significant at the $\alpha = 0.05$ level was removed and its confounding potential was assessed. If a covariate was removed and the coefficients of the other variables changed by more than 15%, the variable was left in the model. This process was repeated until covariates could no longer be eliminated, leaving a preliminary main effects model. At this point, meaningful interactions with the main effects were constructed, and their statistical significance was evaluated. Those significant at the $\alpha = 0.05$ were included in the model. Because of missing values for some variables, model results are based on varying sample sizes. We used SAS 8.1 for all descriptive statistics, regression modeling and hypothesis testing (SAS Institute Inc. 1999–2000©, Cary, North Carolina).

RESULTS

Sample

In total, 357 injection drug-using networks (777 individuals) participated in the Urban Links socially focused intervention study from May 1997 until July 2000. Of these, 304 networks comprising 611 individuals reported using heroin at their last injection episode. The heroin-using groups were the focus of the analyses for this investigation. Seventy percent of these participants self-reported daily heroin injection. Less than 10% reported daily use of other injectable drugs (cocaine, crack, methamphetamine). The participants were 21% African American, 35 % Latino and 40% Caucasian. Thirty percent were female, median age was 41 years (range: 18–68 years), 66% had completed high school, 42% reported having a legal job or temporary work, and 40% reported being homeless.

Injection Practices

Potentially high-risk drug preparation practices were common among heroin networks (58–86%), while the direct sharing of syringes was, by comparison, relatively low (22%). At least one member in 82% of the 304 networks reported dividing the drug as a liquid, 86% use of a common *cooker,* 35% reported the use of a used, unbleached syringe to prepare the drug solution, 67% reported the use of water that syringes had been rinsed in for mixing drugs, and 58% beat *a cotton*. Only 5% reported backloading the drug solution from one syringe into the barrel of another as the method used for distributing shared drugs (Table I).

Table I. Prevalence of Injection-Related Behaviors Among 304 Heroin Injecting Networks, 611 Intervention Participants

	Network		Individual	
Injection behavior	No	%	No	%
Use of used and not bleached syringe	106	35	139	23
Divided the drug as a liquid	248	82	391	64
Common use of mixing water	203	67	279	46
Common use of a cooker	260	86	420	69
Drawn up through cooker	303	99	605	99
Backloading	15	5	28	5
Squirting back into cooker	114	38	134	22
Shared syringes	66	22	82	13
Common use of a reservoir of rinse water	217	71	325	53
Beating the cotton	176	58	229	38
Total	304	100	611	100

At the individual level, syringe sharing was reported by 13% of the participants. In contrast, almost two-thirds of the respondents reported dividing the drug as a liquid, about 70% reported the common use of a cooker, and 23% reported the use of used unbleached syringe for drug preparation. Thirty-eight percent beat a cotton and only 5% backloaded.

Acquiring Heroin with Another IDU

Three independent variables were significantly associated with acquiring heroin with another IDU: *hustling (daily or weekly v. monthly, rarely or never), hanging out (daily or weekly v. monthly, rarely or never)* and the *relationship* with the injection partner (Table II). Individuals who hustled with their injection partners had approximately 29 times the odds of acquiring heroin with them compared to those who did not hustle with their injection partners (OR = 28.8; 95% CI: 20.3, 40.8), while those who hung out with

Table II. Mixed Effects Logistic Regression Analysis of Frequency of *Acquiring Drugs* Together with Other IDU Among 304 Networks (609 Heroin Injectors) Interviewed at Baseline

Explanatory variables	OR[a]	(95% CI)[b]
Hustle with injection partner	28.8	(20.3, 40.8)
Did not hustle with injection partner	1.0	REF[c]
Hang out with injection partner	11.7	(8.2, 16.8)
Did not hang out with injection partner	1.0	REF[c]
Close relationship	1.5	(1.1, 2.1)
Distant relationship	1.0	REF[c]

[a] OR, odds ratio.
[b] CI, confidence interval.
[c] REF, reference category.

Table III. Mixed Effects Logistic Regression Analysis of the *Common Use of a Cooker* Among 610 Heroin Injectors Interviewed at Baseline

Explanatory variables	OR[a]	(95% CI)[b]
"Unsafe" injection location	2.9	(1.9, 4.6)
"Safe" injection location	1.0	REF[c]
Less than or equal to 1/4 gram (2–3 pills) present at the last injection episode	1.8	(1.2, 2.6)
More than a 1/4 gram (>3 pills) present at the last injection episode	1.0	REF[c]

[a]OR, odds ratio.
[b]CI, confidence interval.
[c]REF, reference category; Non-significant factors include gender, ethnicity, age, years of injection drug use, and anyone dopesick at the last injection episode.

Table IV. Mixed Effects Logistic Regression Analysis of *Syringe Status* (Used, Unbleached v. New "Sterile, Never Used, Right Out of the Wrapper," Used and Bleached or Donor Used Only to Prepare Drugs Syringe) Among 600 Heroin Injectors Interviewed at Baseline

Explanatory variables	OR[a]	(95% CI)[b]
"Unsafe" injection location	2.2	(1.3, 4.0)
"Safe" injection location	1.00	REF[c]
Dopesick	2.1	(1.2, 3.6)
Not dopesick	1.00	REF[c]
Years injecting (per 10-year increment)	0.64	(0.5, 0.8)

[a]OR, odds ratio.
[b]CI, confidence interval.
[c]REF, reference category; Non-significant factors include gender, ethnicity, and age.

their partners had over 11 times the odds of acquiring heroin compared to those who did not hang out (OR = 11.7; 95% CI: 8.2, 16.8). Finally, those who had a close relationship with their partners had 1.5 times the odds of obtaining heroin with them compared to those who had a distant relationship (OR = 1.5; 95% CI: 1.1, 2.1).

Common Use of a Cooker

With respect to the common use of a cooker, two variables surfaced as statistically significant factors: the *location* of the last injection episode and the *quantity* of heroin present at the last injection episode (Table III). Individuals who injected in an unsafe setting had approximately three times the odds of being a part of an injection episode where the common use of a cooker was reported compared to those who injected in a safe area (OR, 2.9; 95% CI, 1.9, 4.6). The logistic model revealed that the smaller the quantity present, the greater the odds that an individual reported the common use of a cooker (OR, 1.8; 95% CI, 1.2, 2.6).

Use of a Used and Not Bleached Syringe for Drug Preparation

Three significant factors were associated with reporting the use of a used, unbleached syringe: the location of the injection episode, having someone dopesick present, and the years of injection use of the reporting participant (Table IV).

Injection episodes that occurred in "unsafe" locations showed about two times the odds of having the shared drugs prepared with a used, unbleached syringe compared to injection episodes occurring in "safe" locations (OR = 2.2; 95% CI: 1.3, 4.0). Likewise, when someone at the episode was dopesick, the odds of preparing shared drugs with a used, unbleached syringe increased two-fold compared with episodes where no one was dopesick (OR = 2.1; 95% CI: 1.2, 3.6). Finally, when comparing a participant who had been injecting drugs 10 years longer than another participant, the odds of reporting that shared drugs were injected with a used, unbleached syringe at the last injection episode decreased by almost 40% (OR = 0.64; 95% CI: 0.51, 0.80).

DISCUSSION

Indirect sharing practices, opportunities for blood-borne disease transmission embedded in the preparation and distribution of injection drugs, were common at the last injection episode reported by heroin IDU in Denver. As we hypothesized, they were reported far more frequently than syringe transfer (syringe sharing). Practices that could lead to the contamination of water and thus the drug solution occurred in over two thirds of the episodes; dividing the drug as a solution and the common use of a cooker, a proxy for drug sharing, occurred in more than 80 percent of network episodes. In more than a third of these episodes, a participant squirted solution from a syringe back into the cooker. If that participant's syringe was used, contamination of the drug solution could occur even if the syringe used initially to prepare the drug was sterile. The likelihood of contamination from these practices is apparent from the finding that used unbleached syringes were used at over a third of these injection episodes. These findings, along with the finding that more than 20 percent of last injection episodes included syringe sharing, suggest that

the potential for disease transmission remains high among heroin injectors in Denver.

These practices often occur among IDU who acquire heroin together and are tied through social and economic relationships. IDU participants are far more likely to acquire drugs with individuals they hustle and hang out with, and are more likely to acquire drugs with someone they feel close to. IDU might acquire, prepare and inject together and engage in injection related risk behaviors simply because drug use is, for many, a social activity. However, both our quantitative and qualitative data support the findings of others (Bourgois *et al.*, 1997; Curtis *et al.*, 1995; Friedman *et al.*, 1999; Maher, 2002; Rhodes *et al.*, 2003.), and suggest that the formation and maintenance of these small, multiple role injection networks, and a pattern of drug use that includes acquiring heroin together and then reallocating it in the process of preparing it for injection are in part a response to economic marginality, the exigencies of the local heroin market and the illegality of injection drug use.

Our finding that cooker sharing—a surrogate for drug sharing—was almost twice as common at injection episodes where a quarter gram or less of heroin was present fits with our understanding of Denver's street-based heroin economy. A quarter gram is the equivalent of less than three "pills" of *tar heroin*, the most prevalent form of heroin in Denver and throughout the Western United States. It is a resin-like substance that has the consistency of a *Tootsie Roll*. In Denver, a pill, the smallest quantity sold, costs $20, a sum that is often times beyond an IDU's reach. To overcome this dilemma, IDUs frequently combine resources to buy a pill. Although considered a "single hit," IDU frequently combine resources to obtain a pill when they are trying to "get well" (reduce the feelings of withdrawal) or unable to afford a larger quantity.

Often times, users prepare two or three pills the same way. They throw the pills together into a common cooker, add water, draw the solution into a syringe and then divide each participant's share. Small amounts of tar heroin for immediate use are not conducive to being split in a solid state prior to injection. Users are reluctant to split the drug as a solid because they are concerned that they may receive a smaller amount of the actual drug or higher proportion of the adulterant used to cut it. By mixing the entire quantity into solution and then allocating shares using the calibrations on the syringe barrel, users can be assured they receive an equitable share. After measuring, the preparer squirts the other participants' shares back into the cooker. The other participant(s) then take their shares directly from the cooker by drawing the solution into their syringe(s) through the cotton. Dividing the drug in a solid state prior to preparation cannot duplicate this degree of accuracy.

Small quantities are also shared as a form of reciprocity. Street heroin users may "kick out a taste" or give a portion of a drug to another user who is without the resources to pay for it. Such reciprocity is a logical adaptation to the everyday uncertainties that impoverished heroin addicts face (Bourgois *et al.*, 1997; Bourgois, 1999; Friedman *et al.*, 1999; Maher, 2002).

On some occasions, IDU may go in on the purchase of heroin in order to get a better deal; the larger the quantity purchased, the lower the price per unit. The most common of these larger quantities is a "half-gram" (approximately four to five pills) and a gram (approximately 8 to 10 pills).[7] Half grams and portions of an entire gram may also be divided as a liquid. This depends, in part, on whether some of the heroin is for immediate use, the number of IDU involved in the purchase and the size of their habits.

Another reason for going in on the purchase of heroin is that not all users know or have access to a dealer. Dealers frequently reduce their risk of arrest by limiting the number of people who can make direct purchases (Hoffer, 2001). As a consequence, other users must go through "connects" to purchase drugs. The payment to the "connect" is usually a portion of the drug purchased. When the quantity is small, the payment received is usually a share of the drug solution (Koester, 1994).

While it seems to be in IDUs' interests to buy these larger amounts, this is not always the case. One of the advantages of using "a just in time" strategy for buying small amounts of heroin is to avoid the possibility of being arrested for possession. By only purchasing the amount needed, and preparing and injecting it quickly, IDU reduce their risk of arrest for narcotics possession.

The finding that IDU who reported their last injection episode occurred at an unsafe location were three times more likely to use a common cooker and twice as likely to use a used, unbleached syringe supports ethnographic data indicating that when privacy and safety are compromised IDU will inject as

[7] Such measurements are estimates at best since small quantities are not usually weighed and the number of pills made from a certain amount is often a reflection of the market. For example, when heroin is plentiful and dealers are competing, the size of the pill may be more generous (Hoffer, 2001).

quickly as possible. This imperative is driven in part by their desire to "get well" but also by their desire not to get caught holding drugs by the police (Bourgois *et al.*, 1997; Broadhead *et al.*, 2002; Koester, 1994; Friedman *et al.*, 1999; Maher and Dixon, 1999; McCoy and Inciardi, 1995).[8] Having one participant mix the entire drug purchase in a single cooker and apportion the drug to the other participants is the most efficient way to accomplish this. With access to sterile syringes limited in Denver—there are no syringe exchange programs and pharmacy sales are uncertain—and a paraphernalia law making it illegal to carry a syringe, it is not surprising that the only syringe available may already be used (Koester, 1994; Koester *et al.*, 2002). Under these circumstances, IDU are less likely to take the time to bleach used syringes.

The following interview excerpt demonstrates how the drug economy and law enforcement influence an injection episode and how users' responses to these conditions encourage risk-taking behavior. Eddie and Maxine are a long-term, heroin and crack using African American couple; Lucia, a Latina, supports her habit by connecting African American IDU with Latino street dealers. The fourth participant, another African American male, an acquaintance of Eddie, had the money to pay for half of the half of gram of heroin purchased.

Koester: Can you describe the injection scene last night?

Eddie: "In the car, and I had a half a gram of dope. So what I did was . . . okay, I broke the guy that went in half with me on the half gram, I broke him his half of the half gram, right? Okay, he had his own cooker. Little Lucia went to get it for us. She has to go as the go between in order to get it. Okay, so the normal pay for someone going to cop for you, especially a quantity, is to give them a pill. Rather than giving Lucia a separate pill, what I did was include Lucia's shot in . . . put it in the cooker with mine and Maxine's. As a convenience, you know, not to have three cookers in, and then you know there's the safety part. You don't want to have all this stuff where you can't get rid of it. So if you've got a bunch of cookers gathered around, you know, and something comes down, you can't lose it."

In this case, all four participants contributed to the purchase of a half-gram of heroin. Eddie and Maxine contributed half the money and the other male contributed the other half. Lucia, a Latina, contributed by being the only person in the group who could buy the drugs from the Latino dealer without the risk of being "burned." By going in together, they were able to buy a quantity that reduced the price of each IDUs' share. Since the unnamed male contributed 50% of the money, he had a sufficient amount for more than a single injection. There was no incentive for him to prepare his shot with the others—"he had his own cooker." The three participants (Eddie, Maxine and Lucia) were left with approximately a quarter gram, an amount that together they could consume in a single episode. Rather than divide the quarter gram into three separate pills, Eddie simply threw the amount to be injected into the cooker and mixed it. This is the quickest way to prepare a shared drug, and as Eddie explained, it is both convenient and a form of "street" risk reduction. One of the reasons Eddie gives for putting Lucia's pill in with his and Maxine's pills is the "safety part"—"you don't want to have all this stuff where you can't get rid of it." Injecting in a car offers only limited privacy and minimal protection from law enforcement. Thus, the less paraphernalia the more likely the participants will be able to dispose of it or hide it if "something comes down."

CONCLUSION

This study combines data from a baseline survey with findings from qualitative research to examine a range of risk behaviors that have not been previously addressed in network studies of IDU. Specifically, we looked at behaviors that span the entire process of injecting drugs from their acquisition, to the way they are distributed among network members at the last injection episode, to the sharing of the drug solution and injection paraphernalia. By integrating survey and qualitative data and blending the results, we have contributed to our understanding of the social context in which drugs are acquired and injected, including the types and strength of relationships among network members, the safety of locations used for drug injection, and the amount of drug available for injection.

[8]Another reason IDU may want to inject quickly when using in "unsafe" or public locations that afford little, if any, privacy, is that drug injection is a very personal and private behavior. Alan Clear suggests that for many IDUs injecting is like going to the toilet (Personal Communication), and Friedman et al. found that many IDU in the Bushwick area of Brooklyn "expressed great shame about what they were doing, especially with regard to children seeing them" (1999:58).

However, we recognize that our results are limited by the self-report nature of the data collected. Because of the sensitivity of some of the information that was elicited it is highly likely that some behaviors were underreported. Over-reporting of other behaviors is also possible as a result of socially desirable response tendencies. Accuracy of self-report was probably greatest for injection episodes that only included the index IDU and one alter. In the absence of frequent, direct observation of IDU, however, we cannot quantify the extent of under- or over-reporting of injection-related risks. In addition, we have reported on the behaviors of IDU who primarily inject heroin. It is unclear how generalizable the results are to IDU who inject other drugs. Finally, we used targeted sampling in an effort to gain access to a wide range of networks of IDU. Despite our efforts to create a sampling plan that could adapt dynamically to local and short-term trends in the IDU scene, we cannot be sure that we captured the range in terms of size and composition of networks.

In spite of these limitations, this study has expanded our understanding of injection risks by examining them as part of a larger social process and situating them within the environment that they occur. Addressing the potential for disease transmission embedded within this drug acquisition, preparation and injection process requires an understanding of drug injectors' social relationships, their economic reality and the structural conditions that influence their behavior. In places like Denver, this includes understanding that practices like drug sharing are, in part, solutions to the constraints imposed by poverty and criminalization. Pooling money to "get well" and dividing the drug in the process of preparing it is an everyday reality for many heroin users. Far from being a "hidden" population, street-based heroin users are under constant scrutiny because of their inability to conceal their addiction. Preparing and injecting drugs as quickly as possible after obtaining them is one way to avoid the legal repercussions of being caught holding drugs.

Reducing the blood-borne disease risks embedded in this process will require interventions aimed at changing the environmental conditions that encourage them. If only brand new, sterile syringes were used to prepare shared drugs and inject drugs, the transmission of blood-borne disease between IDU would dramatically decline. Approximating this ideal requires comprehensive approaches aimed at increasing syringe availability (CDC & AED, 2000). Immediate steps include the implementation of legally sanctioned syringe exchange programs, and working with pharmacists to overcome any misgivings they might have about selling syringes to drug injectors. Additional steps include working with the legal system and police to modify law enforcement approaches that encourage drug users to take unnecessary risks (Burris *et al.*, 2004). In Denver this includes amending a state paraphernalia statute that criminalizes syringe possession.

In some settings and with some groups of IDU, providing safe places to inject drugs may be an effective way to lessen the blood-borne disease risks embedded in the injection process. Such facilities are already operational in several European cities and Australia. According to Broadhead *et al.*, at a minimum, safer injection facilities (SIFs) provide "a safe and hygienic environment in which injectors can consume pre-obtained drugs using sterile equipment provided on-site, overseen by a staff trained in basic first aid and cardio-pulmonary resuscitation" (2002: 333). Because they are legally sanctioned, SIFs also reduce IDUs' need to inject surreptitiously and quickly, thus encouraging more deliberate and careful injection practices. However, Philippe Bourgois provides a rather poignant description of a legal heroin-dispensing program in Switzerland that suggests the potential shortcomings of turning drug injection into a medical procedure. As he notes, IDU may not enjoy injecting under the supervision of a medical staff in a clinic setting (2002). No matter how well intended, interventions that lack the active, on-going input of drug injectors will not succeed in stopping the transmission of blood-borne disease.

Alleviating the health risks accompanying this complex behavioral process requires that we work closely with IDU in developing realistic and appropriate responses. When presented with the risks posed by drug sharing, IDU involved in our intervention project suggested ways to reduce these risks. These included the possibility of keeping a marked "donor" syringe that is used only to prepare drugs, and the idea that at the outset of an injection episode, participants should check with each other to determine which of them has a brand new, sterile syringe and then use that syringe to prepare and distribute the drug solution. We strongly recommend that intervention programs incorporate these suggestions. As others have suggested, we also urge programs to embrace participatory models for identifying and addressing risk practices and the situational factors that influence their occurrence (Des Jarlais, 2000; Friedman *et al.*, 1993).

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