

## "Indirect Sharing": Additional HIV Risks Associated with Drug Injection

*Stephen K. Koester and Lee Hoffer*

In our ethnographic research among active drug injectors in Denver, the authors have found information about often ignored, yet common, behaviors associated with drug preparation and injection that may result in the transfer of HIV, even when injectors use separate syringes. We believe that these behaviors are regular, routinized components in the process of drug injection. In this article we describe these practices, and offer explanations for their occurrence. We also suggest that drug injectors have been left uninformed about the possible HIV risk that these behaviors pose.

"Indirect sharing" occurs when drug injectors share injection paraphernalia and/or divide a shared or jointly purchased drug while preparing and injecting it. We use the term "indirect sharing" to distinguish between these risky practices and those involved when two or more injectors use a common syringe. Researchers have observed and reported that injection-drug users (IDUs) share water for either mixing drugs and/or rinsing syringes; that they use common drug mixing containers

(cookers and spoons) and share "cottons" for filtering the drug solution as it is drawn up into the needle;<sup>1</sup> that injectors frontload, or transfer drugs from one syringe into another by removing the needle from the receiving syringe and squirting the drug solution into its hub;<sup>2</sup> that they backload, or transfer the drug solution from one syringe to another by removing the plunger from the receiving syringe and squirting the mixture from the donor syringe directly into its barrel;<sup>3</sup> and that they transfer drugs from one syringe to another by squirting part of the drug solution back into the drug mixing container and then drawing the solution into another syringe.<sup>4</sup> These practices are called indirect only because the risk they present is less directly apparent. The risk is obscured because contamination occurs during intermediate steps in the injection process. In these practices, the syringe itself is not shared, only its contents are.

Although these behaviors previously have been identified, we believe that they have been underreported and have received only cursory attention in

prevention efforts aimed at injection-drug users. The quantitative instruments that researchers currently use to assess HIV-risk behaviors do not adequately address these practices, and many educators continue to emphasize syringe "sharing" as *the* risky behavior associated with drug injection. With relatively few exceptions, authors have not discussed how these indirect sharing behaviors occur while IDUs share, prepare, and inject drugs.<sup>5</sup> As a result, authors often treat these behaviors as independent anomalies. In the following discussion we describe these and other behaviors as components of the injection process, and we show how and why drug injectors are more likely to practice indirect sharing than they are to practice the sharing of syringes.

### METHODS

While conducting our NIDA-funded, HIV-intervention program aimed at reducing high-risk behaviors among IDUs, we have focused our attention on behaviors associated with drug injection. In February 1993 we developed a protocol to study these behaviors in detail, and during the summer of 1993 we participated in a NIDA-funded, multi-site ethnographic study of needle hygiene.<sup>6</sup> In this article we report on data collected from these two studies. We conducted research with active injectors in Denver. We observed drug injections nine separate times, we conducted open-ended interviews with 28 active injectors, and we worked with one focus group of six active injectors. We used data collected in earlier interviews and observations to guide our inquiry.

We attempted to interview and observe individuals who reflected the demographic range of active injectors involved in our intervention: white, African-American, and Latino men and women who injected heroin, cocaine, and/or methamphetamine. Our research team interviewed African-American, Hispanic, and white male and female

*Stephen K. Koester, PhD, is an Assistant Professor in the Department of Psychiatry at the University of Colorado School of Medicine; an Adjunct Associate Professor of Anthropology at the University of Colorado-Denver; and a coprincipal investigator at Project Safe, a NIDA-funded, AIDS-prevention research project.*

*Lee Hoffer is a graduate student in anthropology at the University of Colorado-Denver and a research assistant at the University of Colorado School of Medicine.*

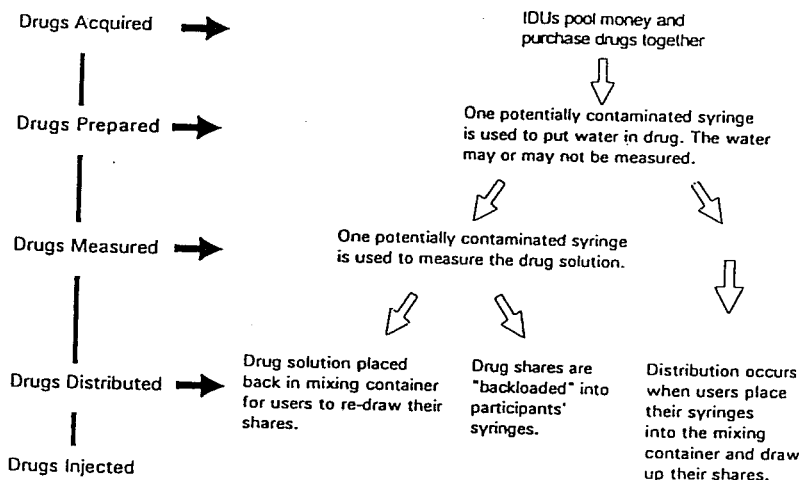


Figure 1. How the process of drug acquisition, preparation, and injection leads to indirect sharing

and its cost. As soon as possible after each observation, the researcher would interview two or more of the participants about the injection episode. These interviews would seek clarification and explanation for the practices we witnessed. We asked the injectors why they prepared, measured, and distributed the drug as we had witnessed, and asked them to compare this injection episode with other recent times they injected.

RESULTS

INDIRECT SHARING

Nine potentially contaminating "indirect sharing" practices were identified during these observations: (1) rinsing previously used, inadequately disinfected syringe(s) in a shared water container prior to preparing and injecting the drug; (2) using one participant's used, inadequately disinfected syringe to draw up water for dissolving the drug; (3) using the rubber, internal end of a participant's "dirty" syringe plunger to mix water with the drug; (4) using one participant's used syringe to measure and distribute shares of the drug solution to each participant--distribution then occurs through backloading or frontloading (methods of squirting the solution from the donor syringe into the receiving syringe) or by squirting the other users' shares back into the cooker (Figure 1); (5) drawing drug shares through a common cotton filter; (6) returning the drug solution to the common cooker or directly to another injector's syringe when an injector inadvertently draws up more than his or her share; (7) returning the drug solution to the cooker or directly into another's syringe to "kick them out a taste"; (8) "beating a cotton" that others have placed their needles in to draw up their dose; and (9) rinsing a used syringe in water in which others have previously placed used syringes for mixing and rinsing. We witnessed each of these indirect sharing behaviors in one or more of the nine injecting

drug injectors recruited from neighborhoods where we are currently conducting our intervention program. Respondents averaged 40 years of age. Some respondents injected only heroin, others only cocaine, and some injected combinations of cocaine and heroin or cocaine and methamphetamine. Participants who were interviewed individually and those who were in the focus group had lengthy drug-injection histories, ranging in length from 10 to 35 years. The IDUs we interviewed individually and those who were members of the focus group varied in their drug use from daily injecting to injecting a few times a week. The respondents reported injecting drugs with two to 15 people during the week prior to their interview. Typically, the IDUs injected the drugs in their own homes, in shooting galleries, in friends' houses, alleys, parks, and public restrooms, and in automobiles.

During the interviews we centered questions on the process of obtaining drugs, preparing them for injection, and using them. Our team asked de-

tailed questions about the last few times the IDUs had acquired and used drugs, including how they had obtained the money to purchase the drug, with whom they used the drug, how the drug was prepared for injection, how the drug was divided, in what sequence the drug was injected, and why they engaged in the behaviors they described.

We observed different groups of IDUs injecting drugs on nine separate occasions. The groups ranged from two to five people; a total of 17 people were observed in all. The IDUs observed were ethnically diverse. Eight of these injection episodes occurred in IDUs' apartments or homes, and one injection was observed in the cab of a pickup truck. Seven occasions involved heroin injection, one occasion involved both heroin and cocaine injections, and another occasion involved cocaine only. In some cases, we would ask questions we felt would not influence their injecting behavior, and at times during the injection process. Typically, these would be inquiries about the quantity of the drug being prepared

observations, and all of the injectors that we interviewed, including the six focus group participants, reported that they frequently engaged in one or more of these practices.

As Bryan Page and his colleagues have noted, "Intercommunity variations in self-injection practices are potentially infinite, and each variant may be accomplished by different kinds of risk of HIV infection." This is an important point; through our observations and interviews we have come to believe that indirect sharing practices occur in a variety of combinations, and, while some may appear similar in form, their purposes are different. We have found that these behaviors are common, and that they occur regularly when injectors prepare and inject drugs together--particularly when preparing jointly purchased, or "shared" drugs.

#### DRUG PREPARATION: MIXING, DIVIDING, AND DISTRIBUTING

Drug injectors may expose themselves to potential HIV contamination in a variety of ways and at various steps when preparing drugs for injection. They may share water, cookers, and cottons even when each injector separately prepares his or her drug dose. We frequently observed injectors using a common container of water for rinsing syringes and/or mixing with the drug even though each injector was preparing his or her own individual dose in a separate cooker. Most frequently, however, injectors share water, as well as cottons and cookers, when they divide and distribute a "shared" drug during the course of preparing it for injection.

Commonly injected drugs, such as heroin, cocaine, or methamphetamine, can be divided and distributed either in solid form prior to preparation for injection or after they have been dissolved into a liquid as part of the injection process. This latter method of distribution places injectors at the most risk for transmission of HIV or other bloodborne infections. IDUs divide drugs this way most frequently when

they buy small quantities of drugs for immediate use, either as single doses or as a sequence of doses taken over a short period of time. Injectors might jointly purchase enough heroin to "get well" or to get a "fix," or they might buy a quantity of cocaine to consume together over the course of a single injection episode.

*Step 1: Mixing.* Typically, one injector will take responsibility for preparing and dividing the drug. This is often the person who contributed the

the cooker); or (2) The container of water used for mixing with the drug has already been used for rinsing syringes or mixing drugs during an earlier injection episode. In every episode we witnessed, injectors began by rinsing their syringes once or twice with water. Usually they did this before mixing the water with the drug to "lubricate" the syringe and make sure it was working properly.

*Step 2: Measuring and Distributing Shares.* After mixing it, the injector

### Commonly injected drugs can be divided and distributed either in solid form prior to preparation for injection or after they have been dissolved into a liquid. This latter method of distribution places injectors at the most risk for transmission of HIV.

most to the drug's purchase and/or actually "copped" (bought) the drug from the "connect" (dealer). He or she places the drug in the cooker, and then, using his or her syringe, draws up water and discharges it into the cooker. Generally, 10 to 25 units of water are drawn up for each injector. We observed the drug preparer measure water using the calibrations on the donor syringe barrel at times and at other times estimate the measurement. The person who is preparing the drug then stirs it with his or her syringe plunger until it dissolves. When preparing heroin, injectors sometimes heat the solution by placing a match under the container for a few seconds.

HIV contamination may be possible during mixing if either of two conditions is met: (1) The syringe used for drawing up the water has been used previously and not adequately disinfected. (Residue of HIV-infected blood may be flushed out of the needle when the water for mixing is discharged into

preparing the drug places a "cotton" filter, oftentimes a cigarette filter or a cotton from a cotton swab, in the cooker. He or she pushes the cotton around the spoon with the syringe to soak up the solution. He or she then draws the entire solution through this filter and into the syringe. The cotton captures particles that might otherwise clog the syringe. Using the calibrations on his or her syringe barrel, this same injector then measures the total amount of the drug to determine each injector's share. After calculating the portions, this injector squirts all but his or her share of the drug back into the cooker or directly into the barrels of the other injectors' syringes. Some IDUs prefer this latter method of distribution, sometimes called backloading, because it saves time and eliminates the need to draw the drug through the cotton filter a second time, a step that may result in the loss of some of the drug. HIV may be transferred if infected blood in the syringe used for measuring is flushed

out of the needle when the drug solution is discharged into the mixing container or directly into other IDUs' syringes.

Sometimes drugs are mixed and measured in other sequences. In some cases, IDUs will measure the water for mixing the drug and not remeasure the drug solution. In these instances the drug mixture is not drawn back into the syringe used for measuring. Instead, it is left in the mixing container for each injector to draw up his or her share. While this method reduces the number of times the liquid passes through the syringe used for measuring, it does not necessarily decrease risk. Conceivably, HIV could be transferred by any needle touching the common filter and mixing container. Furthermore, when injectors draw their shares from a common container, they frequently take more than their share. When this happens, the extra amount is discharged back into the container. As a result, the drug solution could be contaminated, not only by the syringe used for measuring, but by other injectors' syringes as well.

#### ADDITIONAL RISKS: SHARING THROUGH COTTON FILTERS

Indirect sharing also occurs when an injector (1) "kicks a taste" back into the spoon or cooker for another injector, (2) leaves a "wet cotton" or a "taste" in the spoon or cooker for another injector, or (3) "beats a cotton." A "taste" or "wet cotton" is generally a small (less than half) portion of an individual's drug dose. An injector often exchanges this small amount for a service or gives it to another injector who is unable to contribute to the purchase of the drug and/or who is sick. Leaving a taste or a wet cotton may cause the transfer of HIV because it is likely that the drug, or the water used to prepare it, has been in the syringe of the person supplying the drug, or that the drug has become contaminated from other IDUs placing their needles in the cotton and cooker.

"Beating a cotton" is also a potential source of HIV transmission.<sup>8</sup> After everyone has withdrawn his or her share from the cooker and injected it, one injector will attempt to squeeze out any drug solution remaining in the cotton filter. This injector adds a small amount of water to the cooker, gently stirs it with the syringe plunger, and then soaks it up with the cotton. He or she then draws this solution into his or her syringe and injects. Some injectors do not beat cottons because they do not believe there is enough sufficient drug left in the cotton to warrant it and because they think "beating a cotton" is demeaning. The drug solution that is drawn through the cotton may be a source of HIV because (1) it may contain infected blood from the syringe used to mix and measure the solution, (2) other injectors' needles have come in contact with it, and (3) the water used to "beat" it may have become contaminated if other injectors have already used the container it came from for mixing their drugs and rinsing their syringes.

#### WHAT DRIVES THESE PRACTICES?

We believe that IDUs practice indirect sharing more often than they practice the sharing of syringes because (1) drug injectors have a variety of reasons, in addition to potential HIV contamination, for not sharing syringes but few if any reasons not to engage in these practices; (2) they find that these practices are efficient ways to prepare and divide shared drugs; and (3) they may not realize that these procedures put them at risk for contracting HIV.<sup>9</sup>

Drug injectors generally practice indirect sharing in response to conditions out of their control. They reuse syringes because they are scarce, and syringes are scarce because states and municipalities enforce laws that prohibit their possession.<sup>10</sup> Likewise, many injectors commonly risk HIV infection when preparing drugs because they

buy drugs together, and they buy drugs together because they are poor.

IDUs use a variety of legal, quasi-legal, and illegal activities--few of which are particularly secure or financially rewarding--to make a living. As a result, injectors develop ways to obtain drugs even when they are short of cash. Among the most reliable ways to accomplish this are to (1) form temporary partnerships, combine resources, and jointly purchase a drug, (2) perform a service in exchange for a drug, and (3) rely on the kindness of others for a "taste" of a drug. Drug injectors regularly use all three of these methods, and each one leads to indirect sharing. Each requires that the participants share the drugs they obtain. The procedures of indirect sharing are among the easiest and most efficient ways to accomplish this division. By dividing a drug after it is made into a solution, IDUs are able to use the calibrations on the syringe for measuring equal shares. By dividing a drug during the injection process, IDUs eliminate the extra step of dividing it prior to preparation, an important consideration for individuals who may be sick or whose privacy for engaging in this illegal activity may be only momentary.

Heroin injectors and speedball (heroin and cocaine combined) injectors may be more likely to divide drugs while preparing them than cocaine injectors are. To suppress the symptoms of withdrawal, heroin injectors waste little time between acquiring their drugs and injecting them, and they carefully calculate the dose necessary to "get well." Cocaine injectors interviewed for this study reported that, while they sometimes divide a shared drug during its preparation, they also regularly divide small amounts of powdered cocaine prior to liquefying it, by "eyeballing" equivalent shares. We recommend that additional research be conducted to describe the differences that may be found in the level of risk taken by injectors of various drugs.

## DISCUSSION

The individuals that we observed and those that we interviewed for this study were ethnically diverse, used different drugs, and were long-term injectors who reported rarely sharing syringes themselves. In addition, over 70 percent of these injectors are currently, or had been, participants in our intervention program, which is aimed at reducing behaviors associated with risk for HIV. At a minimum, this intervention consisted of HIV testing, pre- and post-test counseling sessions that stressed injection-related risks, access to bleach and condoms, and one or two detail-ed, structured questionnaires about their risk behaviors. Nonetheless, all of the drug injectors that we interviewed had recently engaged in various indirect sharing practices. We saw that in most of these cases the subjects were unaware of the potential danger these practices represented. The following exchange illustrates this point; the injector was oblivious to the risky behavior he described:

*Researcher:* Who shoots first?

*Informant:* He'll draw it all up and shoot part of it back in the spoon. Then I'll draw up mine.

*Researcher:* Now does he clean that syringe with bleach?

*Informant:* No, but he's the only one that uses that particular rig (syringe).

Only two of the IDUs who we interviewed were aware that using a used, inadequately disinfected syringe to mix and distribute a shared drug puts them at risk for contamination; and even so, they did not consistently avoid this danger. The remaining injectors who we interviewed were unaware of this risk and did nothing to avoid it. They did not insist that the syringe used in mixing, measuring, and distributing shared drugs be disinfected, and they did not regularly disinfect their own syringes before and after injecting. Based on these findings, we suggest

that indirect sharing may be a frequent, and perhaps integral, part of drug injection. We also conclude that even experienced injectors do not perceive the danger inherent in transferring shared drugs. Information gained from discussions with ethnographers in other cities and more informal interviews with a large number of injectors throughout the Denver metropolitan area support our conclusion that these indirect sharing behaviors are not an anomaly.<sup>11</sup>

The primary message of many intervention programs has been that sharing syringes is *the* practice that places drug injectors most at risk for HIV infection and that this is *the* injection behavior that they must change. As a consequence, many drug injectors remain ill-informed about the dangers of "indirect sharing" practices, believing that if they do not share syringes they will be safe from HIV infection. Researchers must continue to investigate these poorly understood avenues of HIV transmission, and public health efforts must include messages and interventions addressing them. As Page and his colleagues cautioned regarding additional high-risk injection procedures, "Intervention to prevent the subtler gateways of contagion needs to be based on detailed understanding of the behaviors it seeks to change and thorough cultural understanding of the contexts in which these behaviors occur."<sup>12</sup>

Those in the fight against AIDS will have trouble finding ways to change these behaviors, since they are embedded within the strategies IDUs use to acquire drugs. Public health officials must extend their current messages on syringes to include detailed information regarding the potential risks of indirect sharing. Likewise, bleach distribution programs and needle-exchange projects must alert their clients about these additional risks, since they occur even when IDUs have their own syringes.

## ACKNOWLEDGMENTS

The authors wish to acknowledge the assistance provided by Robert Booth, PhD; Michael Clatts, PhD; Francesca Pinto, MPH; Joni Zisman, Steven Saiz, Larry Gallegos, Robert Peace, Anthony Prieto, Patricia Navarez, and Glenn Fisher.

This study was conducted as a subcontract of RII, Silver Spring, Md. It involved several other anthropologists throughout the United States, including Michael Clatts, PhD; Laurie Price, PhD; Ann Finlinson, PhD; Ricky Bluthenthal, and Todd Pierce. The study was coordinated by Carol Anglin. The Community Research Branch of the National Institute on Drug Abuse, under the direction of Richard Needle, PhD, sponsored the project, and Helen Cesari was the project officer.

## NOTES

1. S. Koester, R. Booth, and W. Wiebel, "The Risk of HIV Transmission from Sharing Water, Drug-Mixing Containers and Cotton Filters among Intravenous Drug Users," *International Journal of Drug Policy* 1, no. 6 (1990): 28-30; National Research Council, *AIDS: Sexual Behavior and Intravenous Drug Use*, ed. C.F. Turner, H.G. Miller, and L.E. Moses (Washington, D.C.: National Academy Press, 1989), 186-240; J.A. Newmeyer, "The Micro-World of Needle Sharing" (Paper prepared for the CBASSE Committee on AIDS Research and the Behavioral, Social, and Statistical Sciences, 1988); J.A. Inciardi and J.B. Page, "Drug Sharing among Intravenous Drug Users," *AIDS* 5, no. 6 (1991): 772-73.

2. Inciardi and Page, "Drug Sharing"; J.P.C. Grund, C. Kaplan, and N. Adriaans, "Needle Exchange and Drug Sharing: A View from Rotterdam," *Newsletter of the International Working Group on AIDS and IV Drug Use* 4, no. 1 (1989): 4-5; J.P.C. Grund *et al.*, "Drug Sharing and HIV Transmission Risks: The Practice of Frontloading in the Dutch Injecting Drug User Population," *Journal of Psychoactive Drugs* 23, no. 1 (1991): 1-10; B. Jose *et al.*, "Syringe-Mediated Drug-Sharing (Back-

loading): A New Risk Factor among Injecting Drug Users." *AIDS* 7, no. 12 (1993): 1653-60; J.P.C. Grund *et al.*, "The Limitations of the Concept of Needle Sharing: The Practice of Frontloading" (letter), *AIDS* 4 (1990): 819-21; J.F. Samuels *et al.*, "The Practice of 'Frontloading' among Intravenous Drug Users: Association with HIV-antibody" (letter), *AIDS* 5 (1991): 343.

3. Inciardi and Page, "Drug Sharing"; Jose *et al.*, "Syringe-Mediated Drug-Sharing"; S.K. Koester, "Ethnography and High Risk Drug Use," in *Problems of Drug Dependence, 1992: Proceedings of the 54th Annual Scientific Meeting* (Rockville, Md.: NIDA, 1993), 132; S.K. Koester, "Copping, Running and Paraphernalia Laws: Contextual Variables and Needle Risk Behavior among Injection Drug Users in Denver," *Human Organization* 53, no. 3 (Fall 1994); W.A. Zule, "Risk and Reciprocity: HIV and the Injection Drug User," *Journal of Psychoactive Drugs* 24, no. 3 (1992): 243-49; J.B. Page *et al.*, "Intravenous Drug Use and HIV Infection in Miami," *Medical Anthropology Quarterly* 4, no. 4 (1990): 56-71.

4. Jose *et al.*, "Syringe-Mediated Drug-Sharing"; Koester, "Ethnography"; Koester, "Copping, Running"; Zule, "Risk and Reciprocity"; Page *et al.*, "Intravenous Drug Use"; L. Price, "Update on the Needle Hygiene Study" (Paper presented at the NIDA Cooperative Agreement Science Meeting, Flagstaff, Ariz., August 1993).

5. Inciardi and Page, "Drug Sharing"; Grund *et al.*, "Drug Sharing and HIV Transmission Risks"; Jose *et al.*, "Syringe-Mediated Drug-Sharing"; Koester, "Ethnography"; Koester, "Copping, Running"; Zule, "Risk and Reciprocity"; Page *et al.*, "Intravenous Drug Use"; Price, "Update."

6. Koester, Booth, and Wiebel, "The Risk of HIV Transmission."

7. Page *et al.*, "Intravenous Drug Use."

8. National Research Council, *AIDS*.

9. Koester, "Copping, Running"; R.G. Carlson, H.A. Siegal, and R.S. Falck, "Ethnography, Epidemiology and Public Policy: Needle Use Practices and Risk Reduction among IV Drug Users in the Midwest," in *Anthropology and Global AIDS Policy*, ed. D.A. Feldman (Westport, Conn.: Greenwood, in press).

10. Koester, "Copping, Running."

11. Koester, Booth, and Wiebel, "The Risk of HIV Transmission."

12. Page *et al.*, "Intravenous Drug Use."

## Book Reviews

### IVDUs and AIDS

Henry Blansfield

*AIDS and Intravenous Drug Use: The Influence of Morality, Politics, Social Science, and Race in the Making of a Tragedy*

By M. Daniel Fernando

167 pp. Westport, Conn., Praeger, 1993. \$45.00

The author of this treatise is an anthropologist whose experience in dealing with the problem of HIV infection among intravenous-drug users (IVDUs) has led to the justifiable conclusion that the principle reason for the spread of the disease among drug injectors is the unavailability of sterile injection paraphernalia. His recommendations are equally simple: allow unrestricted, over-the-counter acquisition of needles and syringes and make possession of injection paraphernalia no longer a felony.

The author describes the failure of social and medical science and the political establishment to deal adequately with AIDS as a morbid illness because of the pejorative moral implications projected on it by its frequent occurrence in those who are marginalized, generally despised, and considered disposable in our society--homosexual men and drug addicts. The use of the word *acquired*, for instance, implies that those who are HIV infected practice aberrant behavior that warrants condemnation, thus absolving neglect and indifference toward them on the part of the majority, which is heterosexual and does not use drugs.

Henry N. Blansfield, MD, is a member of the medical staff of the Chemical Dependency Section of Danbury Hospital, Danbury, Conn.; and is a member of the American Society of Addiction Medicine and the National Alliance of Methadone Advocates.

The author notes that in order to emphasize sexual misbehavior as a salient feature in the epidemiology of HIV, there has been an unsuccessful effort to substantiate the prediction that there will be a massive heterosexual spread of HIV in Central Africa. This prediction is based on the misconceptions that HIV is readily transmitted through sexual contact, that AIDS is simply another sexually transmitted disease (STD), and that promiscuity is indigenous and rampant among Africans. The failure of this projection to materialize reinforces the concept that HIV is spread more readily *blood to blood* and that its transmission through sexual contact is abetted by coincidental STDs that cause penile or vaginal/vulvar ulcerations and by anal-receptive intercourse wherein mucosal injury occurs. The stigmatizing of Africans as irresponsibly promiscuous and without moral restraint has serious racist implications; the unspoken implication is that they are to be held responsible for the pandemic itself.

Social scientists reporting on the incidence of HIV in IVDUs have invented the term *needle sharing*, which implies that using contaminated works has a ritualistic component. The information gleaned from drug users at the street level fails to confirm this widely held impression that camaraderie among drug users and *blood brotherhood* are factors in the use of nonsterile

MEDICAL LIBRARY