Injection drug use continues to be one of the main routes of HIV transmission in many developed countries. In the United States alone, about half of all new HIV infections are among injection drug users. The situation is no better in developing countries; for example, in India, three-quarters of injection drug users are HIV-positive.

Three types of intervention are used to modify injection-related risk behavior. Individual-level interventions are designed to improve knowledge; social-level interventions target peer influence and seek to modify patterns of interaction among injection drug users; and structural-level interventions focus on improving the environment to allow for safer injection behavior to develop. The main structural-level modification used today is the provision of clean and sterile syringes. This is also the most controversial of all HIV-related preventative measures, the main criticism being that this harm reduction strategy encourages drug use. This article reviews the research literature in terms of the advantages and disadvantages of clean needle programs. It focuses on formal needle exchange programs, but also discusses pharmacy needle exchange programs and pharmacy sale of sterile syringes.

Injecting and HIV Risk

Researchers have identified eight factors associated with general HIV risk reduction:

1. Strong intention to implement risk-reduction behaviors;
2. Lack of environmental barriers blocking behavior change;
3. Skills to execute behavior change;
4. Perception of value of behavior change greater than the perception of obstacles;
5. Perception that peers encourage behavior change;
6. Consistency of self-image with new behaviors;
7. Positive reinforcement for new behaviors;
8. Belief in ability to perform new behaviors.

Further, HIV-related risk among injection drug users is associated with a range of variables, some of which directly relate to these eight factors. For example, some studies have found that injection drug users involved with informal social networks that provide friendship, advice, sexual interaction, and economic support have a higher incidence of sharing than users associated with networks that do not provide such support and who are thus more likely to get their needles from commercial sources. Other studies have found that sharing is directly related to peer group behavior, group attitudes toward sharing, and how difficult it is to obtain sterile syringes. Further, cocaine injection and having a sexual partner who injects drugs are, together, directly associated with unstable housing, low education, and commercial sex work.

Given this range of influences, three questions arise. Do needle exchange and similar programs have an effect on the incidence of needle sharing? Do these interventions reduce drug use and increase drug treatment? Are needle exchange programs cost effective?

Does Needle Exchange Reduce Sharing?

The bulk of the research demonstrates that needle exchange is associated with reduced injection risk behavior. For example, a New York study comparing needle exchange participants and non-participants found that participants had significantly lower HIV incidence rates (1.58 per 100 person-years compared to 5.26 per 100 person-years). Studies in Edinburgh, Glasgow, and London have reported similar findings. A comprehensive HIV incidence study found an average reduction of 5.8 percent in 29
Along with its virtues, simplicity has its limits; HIV prevention exemplifies this observation. Rarely is successful HIV prevention comprised of only one perspective or only one type of intervention. In the realm of prevention for injection drug users, compound approaches are particularly important for a population often facing both sexual and needle-related risks, as well as a host of psychosocial challenges ranging from poverty and homelessness to psychiatric disorders.

Among the most successful interventions for this group have been needle exchange and methadone maintenance therapy—despite the longstanding controversies that have surrounded both of these approaches. The most effective manifestations of these approaches have included at least the referral to other services if not the actual provision of services such as therapeutic and HIV prevention counseling, condom distribution, and access to medical, legal, and social services.

In this issue of FOCUS, Bahman Nedjat-Shokouhi reviews the recent literature on needle exchange and concludes that, despite fears to the contrary, needle exchange reduces the risk of HIV seroconversion and does not increase the likelihood of drug use. In fact, the most effective programs are those that “create a bridge to drug treatment services”; those programs that were not multifaceted, offering only needle exchange and no other prevention interventions, were least successful in controlling seroconversions.

Among the most successful prevention approaches, those that have shown the greatest impact are those that “create a bridge to drug treatment services;” and not needle exchange itself that “hampered the effectiveness of Vancouver’s needle exchange program.”

Similarly, Martin Iguchi discusses the efficacy of methadone maintenance programs. He states that programs that are effective in drug treatment and HIV prevention include not only the administration of methadone, but also an “emphasis on long-term maintenance rather than near-term abstinence; . . . and adequate availability of ‘wrap-around’ services (for example, legal, medical, social, and psychiatric).” Simple messages may have dramatic effects. For many, clarity about how HIV is transmitted and what behavior changes can minimize risk is enough to protect them from a lifetime of risk. This comforting fact has been lost in the wave of appropriate concern about rising HIV incidence.

But for those who are at greatest risk of infection—those whose psychology, history, and socioeconomic circumstances conspire to make behavior change difficult—the complexity of their relationship to behavior change must be matched by a complexity of prevention approach. Needle exchange and methadone maintenance programs have proven that they can provide both the breadth and depth of service necessary to take on these challenges. Simplicity may seem desirable, but it is not a panacea, and in this context, the data suggest that a comprehensive approach works better.

References
suggested, was the fact that addicts switched from injecting heroin to injecting cocaine. Cocaine is active for a shorter period, requiring more injections and greater numbers of clean needles; until recently, the Vancouver exchange had had a limit on the number of needles an individual could exchange in a given period. The authors do suggest that needle exchange is only part of the answer to HIV risk reduction and that the inadequate access to drug treatment and counseling services has hampered the effectiveness of Vancouver’s needle exchange program.

The authors of the second Canadian study in Montreal also carried out two further investigations, the results of which suggest that the increase in HIV rates in that city could be the result of far fewer needles being distributed than what was actually needed. They too proposed that additional strategies would be needed to assist injection drug users in maintaining low-risk practices.

Does Needle Exchange Reduce Drug Use?

The fear that needle exchange programs might increase drug use seems to be ill-founded. In fact, many studies have commented on the fact that, by attracting people who inject drugs, needle exchange programs create a bridge to drug treatment services. During the first seven months of the New Haven, Connecticut needle exchange program, as many as one-quarter of the clients requested drug treatment and one-seventh began drug treatment. In addition, some data show that particular substance abuse treatments, especially methadone maintenance, lower the incidence of risky drug injection, making the two programs complementary. (See “Methadone Treatment as HIV Prevention” in this issue of FOCUS.)

Factors associated with failure to enter treatment include long waiting lists, insufficient health insurance, cocaine use, and requests for primary detoxification only without follow-up after-care. On the other hand, a follow-up of the New Haven study found that the needle exchange program also attracted non-exchanging individuals, who used it as a channel to request drug treatment. The study concluded “One measure of success of the drug treatment program was the degree to which it had its impacts on a community larger than that served by the needle exchange program in its primary role as a provider of clean needles.”

Is Needle Exchange Cost-Effective?

With the soaring cost of life-long medical treatment for people with HIV (estimated at $195,188 per person per year), it is important to consider the economic advantages of needle exchange programs. Studies have compared both the cost of providing sterile syringes with the cost per HIV infection averted and the cost of needle exchange programs with other means of sterile needle provision such as pharmacy-based needle exchange programs and pharmacy sale of sterile syringes.

A U.S. study compared the cost per syringe distributed in terms of type of program: $0.97 for stand-alone needle exchange programs, $0.37 for pharmacy-based needle exchange programs, and $0.15 for pharmacy syringe sales. Due to the high cost of stand-alone needle exchange, the best approach may be to integrate different methods of distribution (facilitated by the fact that different users have different preferences). For example, researchers estimate that a nationwide program with a combination of 25 percent stand-alone needle exchange and 75 percent pharmacy sale of syringes would cost $400 million a year and avert about $1.3 billion in medical care and treatment costs, saving about $900 million.

Other calculations indicate that all needle exchange strategies are likely to be cost-effective as long as the annual baseline seroconversion rate among injection drug users exceeds 2.1 percent; for pharmacy syringe sales alone, this pre-needle exchange rate can be as low as 0.3 percent. The cost-benefit is evident and could be realized in a variety of cities, including New York and London, and especially in cities without needle exchange, where the average seroconversion rate is 5.9 percent. In addition, by preventing HIV among injection drug users, needle exchange programs also protect users’ sexual partners and children.

Since the different needle exchange methods are complementary to each other, there is flexibility for implementing programs that sustain benefits and control costs. For example, in cities with small populations of injection drug users, it may not be feasible to establish stand-alone needle exchange programs, but pharmacy-based needle exchange and syringe sales can take advantage of already existing infrastructure.
Another argument for using a combination of programs is the fact that each option has advantages and disadvantages, and different individuals may prefer particular options. For example, pharmacy-based exchanges have the advantage of having longer opening hours and providing greater anonymity, whereas stand-alone needle exchange programs can dispose of needles more safely and incorporate more user-oriented services such as medical care and drug treatment referral.

Conclusion

Research suggests that providing sterile syringes can combat HIV among injection drug users by reducing the incidence of needle sharing. The few needle exchange studies that have found an increase in HIV rates concluded that needle exchange nonetheless played a protective role, and without it, HIV incidence would have been much worse. In addition, providing injection drug users with clean needles protects them from other blood-borne diseases such as hepatitis B and C. Finally, injection equipment sold on the illicit market as “new” often includes used and repackaged material, heightening the need for legally obtainable syringes that can be certified as sterile.

The effectiveness of needle exchange programs may be improved by addressing as many of the factors associated with general HIV risk reduction as possible. Some needle exchange programs provide only a single service, that is, clients exchange their used needles for sterile ones, and some have a maximum limit on the number of needles a person can exchange in a given period. However, as many have suggested, needle exchange programs alone may not be the answer to the problem. These programs need to be part of a comprehensive strategy that includes increased availability of drug treatment, increased public education about recreational drugs, and increased commitment to other programs related to HIV prevention, for example, condom distribution. Indeed, in the United States, 97 percent of needle exchanges offer some of these additional services.

In terms of structure, detailed ethnographic mapping of injection drug use communities may help in identifying sites and times that make needle exchange convenient for the majority of users. It may also be important to staff exchanges with recovering injection drug users drawn from the communities they serve: this would ensure that staff have ethnographic knowledge of the community and are viewed as role models for behavior change. For a variety of reasons, including a history of arrest warrants or parole violations, some users may be unwilling to attend needle exchanges themselves. In response, allowing drug users to exchange needles for others in their friendship networks would mitigate this obstacle.8

In the United States, the ban on federal funding for needle exchange programs has hampered the effectiveness of the small number of needle exchange programs that exist. Federal funding would result not only in expansion of such programs, but also in better communication between needle exchanges and other government-sponsored services such as drug treatment programs. In London for example, the seroconversion rate among drug users has fallen from 70 percent to 7 percent since the introduction of needle exchanges in the early 1990s. In addition, although there is much evidence for the effectiveness of needle exchange, behavior change is a dynamic process. Enduring behavior change requires that needle exchange programs also be lasting and able to expand to include other innovative and preventive services.

Clearinghouse: Prevention for Drug Users

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Hagan H, McGough JP, Thiede H, et al. Reduced injection frequency and increased entry and retention in drug treatment associated with needle-
Methadone Treatment and Needle Use Prevention
Martin Iguchi, PhD

Methadone is a medication used in the treatment of opiate addicts. Like heroin, methadone is itself an addictive opiate drug, but unlike heroin, it can be taken orally, is available through legal treatment centers, and has effects that last longer. These qualities relieve opiate injectors of the dangers, including HIV-related risk, associated with frequent injections and with the time- and resource-intensive process of obtaining illicit drugs. As a result, individuals on methadone maintenance are more capable of leading productive lives and supporting their families than are illegal heroin users, and they are less likely to be involved in the crime and violence associated with illegal drug markets. This article provides a brief overview of methadone treatment and examines the ways in which methadone treatment reduces the risk of HIV transmission.

Methadone Maintenance Therapy

Methadone is a “mu opioid agonist” with a half-life—the amount of time before it loses half of its effect—of 24 hours to 36 hours. The drug is qualitatively similar to morphine and activates the same brain receptors as heroin, morphine, and other opiates. Over time, opioid receptors become less and less responsive to activation by the same amount of the drug, a process known as “tolerance.” Tolerance to methadone results in cross-tolerance to other narcotic analgesics such as heroin. Thus, methadone works by effectively blocking the euphoric and analgesic properties of heroin and other opiates, while reducing subjective cravings for these drugs. Unfortunately, methadone maintenance therapy alone cannot address other problems related to heroin use, including other substance abuse (such as alcohol and cocaine), and psychosocial and physical distress. For this reason, methadone maintenance generally requires counseling and supplementary care to help clients achieve satisfying drug-free lives.

Individuals receiving methadone treatment report to a licensed narcotic treatment facility daily to receive an oral dose of medication. Clinic staff collect and test random urine samples. Clients are required to meet with counselors periodically and may request additional counseling. Over time, some individuals become eligible to receive some doses of methadone in take-home bottles, reducing the frequency clinic visits. The effective components of methadone maintenance therapy include: treatment with an adequate dose; emphasis on long-term maintenance rather than near-term abstinence; care by well-trained and motivated staff; adequate availability of “wrap-around” services (for example, legal, medical, social, and psychiatric); and a philosophy emphasizing reinforcement and support versus punishment and confrontation.

Inadequate funding, a shortage of qualified personnel, time limitations on treatment, a treatment population with multiple psychiatric and medical disorders, and constant community pressures all interact to undermine program effectiveness. Despite these limitations, participation in methadone maintenance has been consistently associated with significant benefits including: reductions in opiate and other drug use; reductions in criminal behavior; up to a four-fold reduction in mortality; and improved socioeconomic circumstances.

It is important to note that methadone is susceptible to drug-drug interactions with exchange participation in Seattle drug injectors. Journal of Substance Abuse Treatment. 2000; 19(3): 247–252.


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See also references cited in articles in this issue.
other medications requiring hepatic elimination (filtering by the liver). For example, Rifampin (a drug used to treat tuberculosis) and the anticonvulsant phenytoin each accelerate the metabolism of both methadone and the interacting drug, making both less effective. On the other hand, use of serotonin re-uptake inhibitor antidepressant medications such as fluoxetine (Prozac) and fluvoxamine (Luvox) significantly inhibits methadone elimination. Finally, many HIV treatments—including some of the protease inhibitors and nevirapine—may either (and unpredictably) induce or inhibit the elimination of methadone.

**Frequency of Illicit Drug Use**

There is little question that drug abuse treatment reduces HIV-related risk by reducing frequency of use. Since methadone blocks the experience of an opiate high through the development of tolerance, injection use diminishes considerably. In one study, individuals entering a 90-day methadone detoxification protocol decreased injection from 13 episodes per week prior to treatment to two episodes per week during the treatment.

Data from four large-scale studies of community-based substance abuse programs all reported reductions in heroin use of between 13 percent and 25 percent after at least one year for individuals discharged from methadone treatment; for individuals maintained on methadone, the reductions were between 39 percent and 69 percent after at least one year. Methadone treatment is also associated with a reduction in use of other injection drugs such as cocaine. The four studies found reductions in cocaine use, much by injection, of between 20 percent and 48 percent at least one year after treatment entry.

**Social Conditions and Drug Use Location**

In addition to the impact on frequency of injection drug use, methadone treatment also reduces HIV risk by significantly altering the location and social circumstances of drug use. For example, a Baltimore study found that nine of 51 individuals who used drugs in a “shooting gallery” in the two weeks prior to entering a methadone treatment program, a number that dropped to one person during the four weeks of treatment. One explanation for this is that methadone-related relief from acute withdrawal symptoms may also reduce perceptions of pressure to obtain heroin and, thus, riskier drug-seeking behavior. The methadone maintenance program environment also provides a “safe haven” away from circles of former drug-using acquaintances. Consistent with this, the Baltimore study found that participants who used illicit opiate drugs during treatment were much more likely than they had been at baseline to report always using alone or using significantly less frequently with acquaintances and others.

This near elimination of opiate drug use with acquaintances and strangers is important, since these relationships change frequently over time and form a bridge to other HIV-related risk networks. Many participants reported using with acquaintances and strangers only when they had difficulty locating drugs or had no money to buy drugs for themselves, pressures that are a byproduct of frequent drug use on a daily basis. It is also possible that consumption of large quantities of drugs impaired judgment, leading to drug use in riskier settings.

A Philadelphia study quantifies this point. Researchers compared a cohort of 152 injection drug users enrolled in methadone maintenance treatment (which had a 10 percent HIV seroprevalence at baseline) with a cohort of 103 not-in-treatment injection drug users (which had a 16 percent HIV seroprevalence at baseline). Follow-up of the HIV-negative subjects over 18 months showed conversion rates of 3.5 percent for those remaining in treatment versus 22 percent for those remaining out of treatment, a six-fold difference.

**Conclusion**

In the case of the HIV-related risk associated with needle sharing, treatment is prevention. Methadone maintenance dramatically reduces the frequency of drug use, the likelihood of seeking higher risk venues such as shooting galleries, and the amount of drug-related contact with acquaintances and strangers. Targeting close friends and family members for methadone maintenance might further reduce the potential for HIV transmission.

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Recent Reports

**Sex, Methadone, and HIV**

Methadone maintenance treatment patients in a Miami study reported fewer sexual partners and greater condom use than non-methadone patients. Researchers at a Miami methadone clinic recruited a convenience sample of 123 (50 percent men and 50 percent women) injection drug users, all of whom were White, heterosexual, and HIV-negative. The median age of subjects was 40 years old. Researchers conducted structured interviews with all participants between September 1992 and September 1993. Fifty percent of participants reported using methadone treatment services, forming the “methadone patient” cohort, and 50 percent reported not having accessed this service in the previous six months, the “nonmethadone patient” cohort.

During the six months prior to the study, methadone patients reported an average of one sexual partner, while nonmethadone patients reported an average of two partners. Methadone patients reported using condoms “sometimes/at least 25 percent of the time,” while nonmethadone patients reported they used condoms “rarely/a few times.” Women had more high-risk partners than men, and nonmethadone patients reported having more high-risk partners than those in treatment. Additionally, nonmethadone participants reported drinking alcohol two to three times a week while methadone patients drank one to three times per month. Methadone patients reported smoking more marijuana than those not in treatment.

Researchers concluded that personality characteristics that lead some injection drug users to seek out methadone treatment might also lead them toward safer sexual and substance use behaviors. In addition, methadone treatment, and the resulting lower level of drug use, may reduce number and frequency of high-risk sexual encounters by limiting the frequency of impaired judgment. Finally, both groups of subjects had equally high perceptions of susceptibility to AIDS, suggesting that drug usage plays a greater role in risk behavior than sociocognitive perceptions of risk itself.

**Needle Exchange and HIV Seroconversion**
Gibson DR, Flynn NM, Perales D. Effectiveness of syringe exchange programs in reducing HIV risk behavior and HIV seroconversion among injecting drug users. AIDS. 2001; 15(11): 1329–1341. (University of California, Davis; University of California San Francisco; Haight-Ashbury Free Clinics, Inc.; and San Jose State University.)

An analysis of 42 published studies that evaluated the efficacy of syringe exchange programs found significant evidence for the conclusion that syringe exchange is effective in preventing both risky behavior and HIV seroconversion. Twenty-eight studies reported positive effects regarding the use of needle or syringe exchange, two found negative associations, and 14 found either no association or a combination of positive and negative effects.

Researchers reviewed all studies published during the period 1989 to 1999 that evaluated the effectiveness of syringe exchange on HIV risk and seroconversion. They broke these studies down by design type: community studies in which the behavior of injection drug users who used needle exchange was compared with the behavior of those who did not; studies that made these comparisons among samples of syringe exchange users only; studies conducted with both community samples and with syringe exchange program clients; and studies that evaluated the “ecological” (citywide) impact of syringe exchange programs.

Thirteen of the 14 studies that had negative or neutral findings occurred among the community studies. All of the studies conducted solely among syringe exchange clients, and five of the six ecological studies, suggested positive syringe exchange benefits. Of the community studies that reported negative findings, some study authors concluded that needle exchange alone may not be enough to curb new infection among injection drug users, an observation that suggests that needle exchange itself may be effective but not sufficient to prevent the spread of HIV.

However, the analysis of these studies concludes that selection and dilution biases also contributed to the negative and neutral findings: some findings suggest that higher risk drug users were more likely to stop using syringe exchange over a period of one

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**A meta-analysis of published studies found that the intensity of an intervention, rather than its duration or frequency, produced the greatest change.**
Another major factor that might account for the negative and neutral findings was the existence of other stable sources of syringes, such as pharmacies, which may contribute to limited or erratic visits to syringe exchanges and, therefore, might dilute a study sample. Other factors, for example, secondary exchange (receiving syringes from others who attend the syringe exchange program), may also confound study results.

**HIV Risk Reduction during Drug Treatment**


Another analysis of published studies confirmed that drug treatment programs with specific HIV risk reduction components were more effective in reducing HIV-related risk than drug treatment programs alone and found that the intensity of an intervention, rather than its duration or frequency, produced the greatest change.

Researchers began with a pool of 92 studies of HIV risk reduction interventions implemented within drug treatment programs, and eliminated those studies that were not published in English between 1985 and 1998, and that were not designed to include both an intervention and a comparison group. These criteria ensured sufficient similarity to allow further statistical analysis among all the studies.

Almost two-thirds of the studies reported statistically nonsignificant effects for HIV risk reduction interventions, even though nearly all study effects produced modest positive results. The power of the “meta-

analysis,” however, was its ability to combine these nonsignificant effects across the studies to uncover some reliable and significant positive effects, thereby offering insights into which approaches were most useful. Overall, the risk reduction interventions employed an average of five techniques. The most frequently utilized techniques were didactic lecture, condom use demonstration, negotiation skills building, syringe disinfection demonstration, peer group discussion/counseling, and audiovisual presentation.

The analysis yielded four other notable findings. First, interventions that included didactic lecture or peer group discussion/counseling produced the greatest emotional reaction and psychological change. Second, interventions delivered near the end of the drug treatment programs, presumably after clients were able to stabilize and focus, yielded greater effect sizes. Third, programs in which the participant makeup was all or predominately White were more effective than those in which participants were of different racial and ethnic backgrounds, and those programs with primarily ethnic minority clientele tended to be less comprehensive, offering a smaller number of intervention techniques. Fourth, programs that used six or more intervention techniques were more effective than those that used five or less.
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