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## HIV Prevention with Drug-Using Populations—Current Status and Future Prospects: Introduction and Overview

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This special volume of *Public Health Reports* chronicles the National Institute on Drug Abuse (NIDA) prevention research response to the epidemics of drug abuse, HIV (the human immunodeficiency virus) infection, and AIDS (the acquired immunodeficiency syndrome). In 1985, the Public Health Service (PHS) published a comprehensive plan to control and prevent the spread of HIV and AIDS.<sup>1</sup> A meeting held in 1986 resulted in recommendations on the prevention of HIV transmission in injecting drug users (IDUs). During that same year, Congress and the administration quadrupled NIDA's funding for research on the dual epidemics of drug abuse and drug abuse-related HIV infection and AIDS. In response to the challenges of these twin epidemics, researchers have conducted epidemiological and ethnographic studies to describe and monitor trends in populations at risk for HIV, their risk behaviors, and the contexts or settings within which those risks occur and their impact on HIV infection rates (prevalence and incidence). Researchers also have developed and implemented interventions to change risk behaviors to prevent the spread of HIV infection.

Epidemiological studies have documented that HIV is spread primarily through multiperson reuse (sharing) of contaminated syringes, needles, and other drug injection equipment and by unprotected sexual intercourse with infected individuals.<sup>2,3</sup> Ethnographic studies of IDUs in HIV and AIDS epicenters indicated that drug users who were knowledgeable about HIV risks associated with injection practices began making changes in their behaviors to reduce their risks for HIV.<sup>4,5</sup> Though IDUs understood the risk for HIV associated with their injection practices, many continued to engage in high levels of sharing (multiperson reuse of needles and

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syringes).<sup>6-8</sup> Laws and regulations restricting the sale, distribution, or possession of syringes made it difficult for IDUs to obtain sterile syringes.<sup>5,9,10</sup>

Epidemiological and ethnographic studies were crucial in guiding the development, implementation, and evaluation of early HIV prevention programs. Science-based interventions were implemented and shown to be effective in reaching at-risk populations, enabling them to reduce risk behaviors and thus reduce their risk of acquiring HIV. This prevention response has changed the course of the HIV epidemic for drug users. Changes in drug use, changing demographics, and risk profiles of vulnerable populations have challenged researchers to effectively adapt their interventions to respond to the challenges of dynamic epidemics.

The August 1997 Research Synthesis Symposium on the Prevention of HIV in Drug Abusers<sup>11</sup> and the papers in this volume provide a background with a brief historical perspective on the current status of the knowledge base on prevention of HIV in drug-using populations. In developing papers for this volume, national and international researchers who presented at the Research Synthesis Symposium were invited to submit manuscripts for consideration for publication. The papers were reviewed by NIDA guest editors and other scientists in their respective fields. The papers that appear in this special volume of *Public Health Reports* were peer reviewed and accepted for publication by NIDA. *Public Health Reports* did not review or edit the papers appearing in this supplement.

This volume is organized into five sections. The first section focuses on community-based outreach risk reduction interventions designed to prevent the spread of HIV in drug-using populations. The second section consists of a series of papers that address syringe exchange programs and access to sterile injection equipment. Four papers on the effectiveness of drug treatment as an HIV prevention strategy are included in the third section. Researchers report on the emerging and promising role of network strategies in preventing HIV in drug-using populations in section four. In the final section, researchers review the effectiveness of implementing HIV prevention strategies in other countries, assess progress made in addressing the epidemic, and discuss missed opportunities for prevention and future directions for HIV prevention research.

### **Community-Based Outreach Risk Reduction: Background**

In the 1980s, community-based outreach was the most feasible and potentially effective public health strategy to

reach and enable hard-to-reach (hidden) IDU populations to change their behaviors and reduce their risks for acquiring or transmitting HIV. Community-based outreach programs for drug use and HIV/AIDS prevention were introduced when multiperson reuse of injecting equipment was a widespread practice<sup>12,13</sup> and needle exchange programs (NEPs), which have as their primary goal to exchange new, sterile syringes for potentially contaminated syringes, were not a viable option in the United States.

Most IDUs (an estimated 85%) are not in drug treatment on any given day.<sup>14-17</sup> For the opiate-dependent population, methadone maintenance treatment is rarely an option because there are a limited number of slots. Starting in the late 1970s, cocaine use became more prevalent among IDUs, and cocaine use among opiate injectors was found to reduce the effectiveness of methadone maintenance programs in treating drug addiction and reducing HIV risk behaviors associated with injection practices. When compared with IDUs currently in treatment, out-of-treatment IDUs, many of whom have had previous treatment experiences but have relapsed to continue to inject drugs, are at significantly greater risk for HIV infection because they are much more likely to inject drugs more frequently, to share drugs and drug-injection equipment, and in some areas of the country, to inject in shooting galleries.<sup>18-20</sup>

The community-based HIV outreach risk reduction intervention strategy was an adaptation of the outreach model that originated in Chicago in the late 1960s in response to epidemic levels of heroin use. Hughes and colleagues hired former heroin addicts to provide targeted outreach to active IDUs in drug market areas of the city in an attempt to encourage them to enter methadone maintenance treatment.<sup>21,22</sup> Researchers in San Francisco (members of the MidCity Consortium To Combat AIDS, a coalition of five social, health, and research agencies) collaborated to address the spread of HIV in out-of-treatment IDUs,<sup>5,6,12</sup> and in Chicago Wiebel<sup>23,24</sup> incorporated features from Hughes' work into his models, training mobile teams of indigenous outreach workers to access, engage, and intervene with out-of-treatment IDUs in their own communities. The community-based outreach intervention strategy was designed to reach IDUs who could not or would not access drug treatment or who were unable or unwilling to stop injecting drugs to enable them to change the behaviors associated with risk of HIV infection—multiperson reuse of syringes. The San Francisco MidCity Consortium To Combat AIDS<sup>6</sup> developed, tested, and incorporated a bleach distribution

**Table 1. HIV prevention strategies for drug-using populations: an overview**

	<i>Intervention strategy</i>			
	<i>Community-based outreach</i>	<i>Needle exchange program</i>	<i>Drug abuse treatment</i>	<i>Network</i>
<b>Targeted populations</b>	<ul style="list-style-type: none"> <li>• Out-of-treatment injecting drug users (IDUs)</li> <li>• Sexual partners of IDUs</li> <li>• Non-IDUs</li> <li>• Drug-using networks</li> </ul>	<ul style="list-style-type: none"> <li>• In- or out-of-treatment IDUs</li> <li>• Special subgroups (e.g., female IDUs)</li> <li>• Methamphetamine users</li> </ul>	<ul style="list-style-type: none"> <li>• Out-of-treatment IDUs</li> <li>• Non-IDUs</li> <li>• In treatment (retention)</li> </ul>	<ul style="list-style-type: none"> <li>• In or out of treatment</li> <li>• Drug use and sexual risk networks of IDUs</li> <li>• Drug use and sexual risk networks of non-IDUs</li> </ul>
<b>Strategies to reach populations*</b>	<ul style="list-style-type: none"> <li>• Community health outreach workers</li> <li>• Indigenous leaders</li> <li>• Peer opinion leaders</li> <li>• Networks</li> <li>• Street</li> <li>• Storefronts</li> <li>• Shooting galleries</li> <li>• Mobile vans</li> </ul>	<ul style="list-style-type: none"> <li>• Street</li> <li>• Storefronts</li> <li>• Mobile vans</li> <li>• Clinics</li> <li>• Pharmacies</li> <li>• Secondary exchange</li> <li>• Satellite exchangers (diffusion)</li> <li>• User groups</li> </ul>	<ul style="list-style-type: none"> <li>• Outreach</li> <li>• Self-referral</li> <li>• Needle exchange programs (NEPs)</li> <li>• Courts</li> <li>• Employee assistance programs</li> <li>• Mobile van</li> </ul>	<ul style="list-style-type: none"> <li>• Indigenous outreach leaders</li> <li>• Opinion leaders</li> <li>• Satellite exchangers</li> <li>• In-treatment drug users</li> </ul>
<b>Risk and protective behaviors/factors</b>	<ul style="list-style-type: none"> <li>• Multiperson reuse of needles/syringes and other injection equipment</li> <li>• Needle disinfection</li> <li>• Injection frequency</li> <li>• Condom use</li> </ul>	<ul style="list-style-type: none"> <li>• Multiperson reuse of needles/syringes and other injection equipment</li> <li>• Needle disinfection</li> <li>• Disposal of used syringes</li> <li>• Injection frequency</li> <li>• Drug use</li> <li>• Condom use</li> <li>• Norms</li> </ul>	<ul style="list-style-type: none"> <li>• Retain in treatment</li> <li>• Prevent relapse</li> <li>• Injection and noninjection risk behavior</li> </ul>	<ul style="list-style-type: none"> <li>• Network norms</li> <li>• Risk network structure/dynamics</li> <li>• Drug use and sexual risk behaviors of individual network members</li> </ul>
<b>Means for changing behaviors</b>	<ul style="list-style-type: none"> <li>• Hierarchical risk reduction messages</li> <li>• Bleach distribution</li> <li>• HIV testing and counseling</li> <li>• Treatment referrals</li> <li>• Condom distribution</li> <li>• Norms related to drug use and sexual risk behaviors</li> </ul>	<ul style="list-style-type: none"> <li>• Exchange of potentially contaminated syringes for sterile syringes</li> <li>• Bleach distribution</li> <li>• Treatment referrals</li> <li>• Condom distribution</li> <li>• Hierarchical risk reduction messages</li> <li>• HIV testing/counseling</li> <li>• TB screening</li> <li>• STD screening</li> <li>• Changes in prescription and paraphernalia laws</li> </ul>	<ul style="list-style-type: none"> <li>• Methadone maintenance treatment</li> <li>• Individual and/or group counseling</li> <li>• HIV testing/counseling</li> <li>• Referrals to other health care services</li> <li>• Risk reduction education</li> </ul>	<ul style="list-style-type: none"> <li>• Normative influence on risk behaviors</li> <li>• Diffusion of information about HIV</li> <li>• Risk reduction supplies</li> </ul>
<b>Findings</b>	<ul style="list-style-type: none"> <li>• Reduces drug use risk behaviors</li> <li>• Reduces sexual risk behaviors</li> <li>• Increases drug treatment referrals</li> <li>• Reduces HIV incidence</li> </ul>	<ul style="list-style-type: none"> <li>• Reduces drug injection risk behaviors</li> <li>• Does not encourage drug use</li> <li>• Increases drug treatment referrals</li> <li>• Neither increases nor decreases number of improperly discarded syringes</li> <li>• Stabilizes or decreases HIV, HBV, and HCV prevalence</li> <li>• Reduces HIV, HBV, and HCV incidence</li> </ul>	<ul style="list-style-type: none"> <li>• Eliminates and reduces drug use</li> <li>• Reduces HIV drug risk behaviors</li> <li>• Reduces HIV, HBV, and HCV infection rates</li> </ul>	<ul style="list-style-type: none"> <li>• Effects adoption of new HIV risk reduction information</li> <li>• Reaches large number of IDUs in their networks</li> <li>• Increases number of IDUs not using NEPs who have access to sterile syringes</li> <li>• Reduces drug-related and sexual risk behaviors in drug use networks</li> </ul>

Table 1 (continued)

	<i>Intervention strategy</i>			
	<i>Community-based outreach</i>	<i>Needle exchange program</i>	<i>Drug abuse treatment</i>	<i>Network</i>
Change mechanisms	Reach the hard-to-reach, high risk populations. Provide information and the means for behavior change to enable drug-using populations, including referrals to drug treatment, to reduce their HIV risk and prevent HIV infection.	As needles are removed from circulation (exchanged), the means of circulation time of the needles declines, which is associated with a decline in probability of infection. The provision of sterile needles in exchange for used ones reduces sharing, the number of times contaminated syringes are shared, limiting the number of viral transmission events.	Individuals who enter and remain in treatment reduce their drug use, which leads to fewer episodes of risk behaviors, which in turn results in a lower rate of exposure to HIV.	Change norms and transactional patterns of risk among network members, resulting in reduced high risk behaviors (e.g., multiperson reuse of syringes), accelerating readiness for treatment, and limiting the spread of HIV.

\*Strategies to reach at-risk populations include both the interventionist and the context or setting in which individual populations are located.

component into their community-based outreach program; following this initiative, bleach distribution proliferated rapidly in cities across the United States and around the world.

Community-based outreach depends on indigenous members from the community (most of whom are recovering drug users) to access out-of-treatment IDUs, establish trust and rapport, and initiate risk reduction activities on the streets or in other neighborhood settings.<sup>23,24</sup> A composite overview of the community-based HIV prevention strategy is presented in Table 1. Early in the epidemic, outreach workers provided IDUs with a set of behavioral options and the means for behavior change, which constituted the hierarchy of HIV risk reduction: First, stop using and injecting drugs; if you cannot stop, use your own injection equipment and do not share it; if you must reuse or share injection equipment, disinfect with bleach to reduce transmission of HIV. Materials distributed with the behavioral options include information on safer drug use and bleach; information on safer sex and condoms; and referrals to community-based programs for HIV testing and counseling, drug treatment, and medical and social services. It was during this time (the late 1980s) that congressional action restricted the use of funds for any kind of NEPs, and discussions were held about banning the distribution of bleach. In late 1989, Congress considered amending the 1990 U.S. Departments of Labor, Health and Human Services, Education, and Related Agencies

Appropriation Acts (H.R. 3566) by prohibiting the use of funds for any program that distributed bleach to IDUs. Although the restriction on Federal funds for participation in or support of NEPs was enacted, all language relative to funds for the distribution of bleach was stricken. Moreover, the benefits associated with incorporating bleach into community-based interventions in the United States led to the diffusion of this U.S. innovation to programs in Argentina, Belarus, Brazil, China, India, Malaysia, Nepal, Russia, Thailand, Ukraine, and Vietnam (see Ball, this volume) and into user group-operated NEPs in The Netherlands and other parts of Europe.

In 1987, NIDA launched a 29-site, community-based outreach research program called the National AIDS Demonstration Research Program (NADR)<sup>25</sup> and in 1990 the 23-site Cooperative Agreement (CA) for AIDS Community-Based Outreach/Intervention Research Program. Three outreach-based behavior change intervention models were developed and tested within the NADR research demonstration program. These included (1) the Behavioral Counseling Model,<sup>26</sup> (2) the Indigenous Leader Outreach Model,<sup>24</sup> and (3) the NIDA HIV Counseling and Education Intervention Model.<sup>27</sup> These and other behavior change intervention models were delivered to more than 150,000 IDUs and their sex partners. NIDA's HIV Counseling and Education Intervention Model was revised, adapted, and implemented in the multisite AIDS Community-Based Outreach/Intervention

Research Program. In addition to IDUs and their sex partners, community-based outreach interventions have been adapted for use with crack users and tailored to the needs of specific at-risk subgroups, such as women who inject drugs, drug-using men who have sex with men, and drug using and sexual risk networks. To date, more than 16,000 IDUs and 13,000 noninjecting crack users have been helped by the CA. Over time, the prevention message and the medical advice provided by outreach workers to drug users have become more comprehensive and now include information on behavioral risk reduction for HIV as well as hepatitis B (HBV), hepatitis C (HCV), and other parenterally and sexually transmitted diseases (STDs). The U.S. Department of Health and Human Services' *HIV Prevention Bulletin* (May 1997)<sup>28</sup> advises health care workers involved in programs that serve drug users that persons who inject drugs should be regularly counseled to stop using and injecting drugs; to enter and complete substance abuse treatment (including relapse prevention); and, if they continue to inject, to take these steps to reduce personal and public health risks: Never reuse or share syringes, water, or drug preparation equipment; use only syringes obtained from a reliable source (pharmacies); use a new, sterile syringe to inject drugs; use sterile water or otherwise use clean water from a reliable source (fresh tap water) and a new or disinfected container (cooker) and a new filter (cotton) to prepare drugs; clean the injection site with a new alcohol swab prior to injection; and safely dispose of syringes after one use.<sup>29</sup> In both NADR and CA prevention research programs, referring out-of-treatment drug users to drug treatment and a range of other services was a fundamental feature of the outreach strategy. These programs are described in more detail in this volume, and results are reported on the effectiveness of outreach programs in changing drug use and sexual risk behaviors as well as HIV infection rates.

### Community-Based Outreach: Synopsis

In this volume, Coyle and colleagues review 36 scientific publications from studies on community-based outreach HIV prevention interventions. The specific focus of their review was on street-based interventions and risk behavior change (as measured by HIV-related behavioral and/or serological outcomes) among out-of-treatment IDUs. Of the 36 research publications, 19 were from NADR, 12 were from CA, and 5 were other studies. The studies were highly consistent in reporting significant reductions in HIV risk behaviors of IDUs who participated in their

outreach interventions. Specifically, significant reductions were seen for several major risk behaviors (IDUs either stopped injecting drugs or reduced injection frequency, stopped reusing syringes and other equipment, and stopped using crack). The studies also reported strong intervention effects in encouraging IDUs to enter drug treatment programs and to disinfect their needles and other injection equipment. Although there were significant reductions in sexual risk behaviors among IDUs (such as increased use of condoms), the majority continued to practice unsafe sex—a finding that indicates the need to strengthen and improve the sex-related component of outreach interventions. While the authors acknowledge that questions remain about outreach components—how they work separately and in combination and how they work with different risk groups and populations—they conclude that (1) outreach is an effective strategy for reaching out-of-treatment IDUs and providing the means for behavior change; (2) a majority of IDUs will reduce their risk behaviors after participating in outreach; and (3) most importantly, reductions in risk behaviors among IDUs are directly associated with lower rates of new HIV infections in the population.

In a population of out-of-treatment crack cocaine users, Cottler and colleagues evaluated the impact on HIV risk behaviors of either a peer-delivered enhanced intervention or the NIDA standard intervention (see Cottler and colleagues in this volume for a description of the content of the standard and enhanced interventions). The authors reported that 80% of the entire sample either reduced their use of crack or maintained their use at very low levels between baseline and follow-up assessments, but crack users in the enhanced intervention group were significantly more likely to reduce their risk than those assigned to the standard intervention. Persons in both interventions reported more abstinence, more monogamy, or fewer sex partners between baseline and follow-up, but there were no significant differences between the enhanced and the standard groups. Last, the findings suggest that peers are effective role models for promoting reductions in drug-related HIV risk behaviors among out-of-treatment drug users, although they appear to be much less effective in changing sexual risk behaviors.

The paper by Broadhead and colleagues adds to the weight of evidence on the role of peers as effective messengers for HIV prevention among out-of-treatment IDUs in their natural settings and communities. Broadhead's group compared traditional outreach (the provider/client approach, which uses professional outreach workers) with peer-driven outreach (the social network approach)

and IDU behaviors, focusing on the effectiveness of HIV education, compliance rates with AIDS risk reduction recommendations, and relative cost. They found that both intervention approaches were associated with significant reductions in HIV risk behaviors, but that the peer-driven intervention was superior on the basis of number of IDUs recruited, ethnic and geographic representation of the recruits, effectiveness of HIV prevention education, and costs. The findings from this study suggest that peer-driven interventions can be effective for reaching large and diverse IDUs at modest cost, and that IDU peers can be empowered to assume more effective roles in community-based outreach efforts.

The final paper in the community-based outreach HIV interventions section is based on a study by Kumar and colleagues conducted with street-recruited drug users in two locations in Madras, India. Two groups of IDUs (outreach and control) were recruited for the study. The outreach group received information about HIV from recovering drug users indigenous to the community who were familiar to their IDU peers and networks. They also were given literature about preventing HIV, along with bleach, condoms, and advice on accessing medical and social services. In contrast, IDUs in the control group location did not receive outreach services. There were no differences between the groups at baseline, but 18 months later at follow-up, the outreach group reported significantly fewer injection risk behaviors (decreased needle sharing, increased use of bleach to disinfect syringes), although there were no changes in sexual risk behaviors. These findings add to the knowledge base about the role of outreach in reducing injection drug-related risk behaviors. However, as in other studies on outreach, there were no changes in sexual risk behaviors, underscoring the importance of improving the sexual risk reduction message of community-based outreach interventions.

### **Needle Exchange Programs: Background**

NEPs began as an experiment in the summer of 1984 in Amsterdam.<sup>30</sup> At that time, a league of drug addicts known as the "Junky Union" was alarmed by an outbreak of HBV among Dutch IDUs. They proposed to open an NEP to avert new infections and were permitted by the Municipal Health Service to do so but only on an experimental basis. A year later, in 1985, AIDS had emerged as a major health concern, and by 1986, NEPs were recognized as serving a critical role in Amsterdam's comprehensive public health effort to slow the spread

of HIV and AIDS.<sup>31</sup> The epidemic of HIV in some drug-using populations in the United States and Western European countries during the 1980s, and more recently in Canada, Eastern Europe, and countries of the former Soviet Union, demonstrates how quickly HIV infection can spread and reinforces the need for an effective and rapid public health response to prevent new HIV seroconversions and to regain control of the epidemic.<sup>32,33</sup>

In the mid-1980s, countries concerned about the potential for the rapid spread of HIV among IDUs introduced NEPs in combination with community-based outreach. In 1986, in light of new data about the spread of AIDS among IDUs, health authorities in England and in parts of Scotland withdrew governmental restrictions on retail pharmacies, permitting them to sell syringes directly to IDUs (although in practice, many pharmacists were reluctant to do so for fear that IDUs would frighten their other customers). Today, most European countries have implemented NEPs, and some are being operated by or with the assistance of user groups. NEPs were first introduced in the United States in the late 1980s (in Tacoma, Portland, San Francisco, and New York City). Moreover, as discussed by Ball and colleagues in this volume, several developing and transitional countries also have implemented NEPs. Developing and transitional countries that currently offer such programs include Brazil, the Czech Republic, Hungary, India, Nepal, the Philippines, Poland, Russia, Thailand, and Vietnam.

In the United States, most of the communities that introduced NEPs were able to incorporate risk reduction components that had been developed and tested earlier by community-based outreach risk reduction strategies. In the United States, a series of Federal statutes enacted since 1988 specifically prohibited or restricted the use of federally appropriated funds to support NEPs. The language contained in Section 2025 of the 1988 Anti-Drug Abuse Act stipulates that states may not use Federal funds to carry out any program of distributing sterile needles for the hypodermic injection of any illicit drug or distribute bleach for the purpose of cleansing needles for such hypodermic injection. The latest version of the U.S. Department of Health and Human Services Appropriation Act (FY98) states that the Federal ban can be lifted if the Secretary of Health and Human Services determines that exchange projects are effective in preventing the spread of HIV and do not encourage the use of illicit drugs. On April 20, 1998, Health and Human Services Secretary Donna E. Shalala announced that, on the basis of the findings of extensive scientific research, she has determined that NEPs can be an effective part

of a comprehensive strategy to reduce the incidence of HIV transmission and do not encourage the use of illicit drugs. The act's restriction on Federal funding, however, was not lifted.

NIDA initiated its needle exchange research program in 1992 with support of a project in New Haven, Connecticut, called "A Syringe Tracking and Testing System for IDU Epidemics." The outreach staff at the New Haven NEP actually began working there in 1990, following the passage of a public act by the Connecticut House of Representatives, which permitted a demonstration needle and syringe exchange program.<sup>34</sup> Kaplan and colleagues developed an innovative syringe tracking and testing system model-based evaluation of the New Haven NEP. Empirical evidence about NEP operations revealed that the mechanisms necessary for change were in place. As a substantial number of needles were exchanged (removed from circulation), the frequency of exchange increased and the mean circulation time of needles declined. Empirical findings also showed that the decrease in mean circulation time of needles was associated with a decline in infection rate of returned syringes, a decline in probability of infection (in needles used by program participants) as well as reported reductions in the frequency of sharing among program participants. The New Haven group established the research foundation and underlying logic that have sustained the viability of NEPs. This landmark evaluation study has had substantial impact on public health policy. Many states and local legislative bodies have relied on this study's findings to modify or repeal laws that prohibit or restrict their ability to implement NEPs.

Before 1995, approximately 50 NEPs were known to be operating in the United States; in 1995, 22 new NEPs began, and 14 more began in 1996.<sup>35</sup> As of April 1997, there were over 100 NEPs known to be operating in 70 or more cities, 28 states, and one territory of the United States, as collaborative members of the North American Syringe Exchange Network (NASEN).<sup>36</sup>

An estimated 53% of NEPs operate legally in the United States; that is, they operate in a state that has no law against purchasing hypodermic syringes without a prescription (a prescription law). As presented in Table 1, NEPs reach diverse at-risk populations in a variety of locations—street corners, fixed sites (drug treatment centers and storefront clinics), and mobile vans (which include NEPs that provide home delivery). Recently, NEPs in some locations have designated special hours of operation for women injectors,<sup>36,37</sup> have expanded outreach efforts to methamphetamine injectors, and more

recently, as illustrated by the Baltimore NEP, have developed linkages with community-based pharmacies to provide access to new syringes in exchange for old ones. NEPs vary in the numbers of hours, days, and nights of operation and in their syringe exchange ratio (one old syringe in exchange for one new syringe or one old for two or more new syringes).

Today, components of risk reduction combined with syringe exchange are included in most programs. All NEPs provide information about safer injection techniques and using bleach to disinfect injection equipment, including cookers and cotton. Most if not all NEPs provide referrals to drug treatment programs, educational information to prevent sexual transmission of HIV and other STDs, and condoms.<sup>35</sup> Additional ancillary services of NEPs may include on-site HIV testing and counseling, crisis intervention, and screening for tuberculosis, HBV, HCV,<sup>38,39</sup> and other infections.

Some recent NEP research initiatives have integrated risk reduction activities and evaluation components into their projects, allowing them to assess the effect of NEP exposure on the incidence of other blood-borne diseases, such as HBV and HCV. They also have expanded the range of services NEPs can offer as a bridge to IDUs for facilitating access to vaccines as well as entry to drug treatment programs. An overview of the needle exchange HIV prevention strategy is presented in Table 1. Recent studies have examined the effect of satellite exchangers (SEs), who collect used syringes from IDUs in their networks and communities to exchange for new ones for them (see Valente et al., this volume), and the SE's role in preventing HIV in the community by providing HIV prevention supplies (bleach and condoms), literature, and sterile syringes. And Brooner and associates in this volume describe recent research efforts focused on gaining a better understanding of the NEP drug treatment nexus and the combined and unique effects these interventions have on the HIV risk behaviors of IDUs.

### Needle Exchange Programs: Synopsis

In this volume, Heimer delineates how biological and behavioral factors interact to influence the transmission of HIV. In doing so, he provides a sound framework for investigating the epidemiology and impact of NEPs on disease transmission. According to Heimer, HIV transmission among IDUs is influenced by four primary factors—three biological and one behavioral: (1) the prevalence of active infection within a community, (2) infectivity given injection with a contaminated syringe,

(3) durability of the virus inside the syringe, and (4) the level of sharing among IDUs. Heimer incorporates these four factors into a mathematical expression that functionally characterizes incidence rate. That is, he demonstrates how the incidence rate among IDUs can be characterized as being equal to the rate at which needles are shared (by an uninfected individual), multiplied by the probability of using an infected syringe (that was not disinfected), multiplied by the rate at which such needle/syringe exposure transmits the infection. This predictive model points out some elements that can be targeted to affect infection rates among IDUs. To date, most interventions have focused on reducing incidence by reducing the prevalence of multiperson reuse of syringes (sharing, indirect sharing, backloading) and by reducing the likelihood of coming into contact with an infected syringe (by reducing circulation time). Finally, in his review of NEP effects in terms of these factors, Heimer highlights how such programs not only offer benefits in terms of disease transmission but also provide substantial health improvements through ancillary service deliveries.

Vlahov and Junge review scientific findings from studies on the efficacy of NEPs in preventing HIV and AIDS, including studies of the role of NEPs in reducing the spread of blood-borne infections other than HIV, studies involving mathematical models of the relationship between NEPs and HIV seroincidence, and studies of NEPs and their positive and negative effects on HIV and AIDS. Their review of the scientific literature confirms that NEPs have substantially positive effects on preventing adverse health consequences associated with injection drug use and do not increase drug use. Specifically, they conclude that, if the legal penalties associated with purchasing and/or possessing syringes were removed, IDUs would modify their risk behaviors to reduce the spread of new infection. In addition, they found no evidence to suggest that NEPs increase the prevalence of drug use among NEP exchangers or the recruitment of first-time injectors. These findings are consistent with those in earlier scientific evaluation reports issued by a variety of multidisciplinary nongovernmental and governmental scientific panels and groups, including the National Commission on AIDS,<sup>40</sup> the University of California/Centers for Disease Control and Prevention,<sup>41</sup> the National Academy of Sciences,<sup>42</sup> and the National Institutes of Health Consensus Development Conference.<sup>43</sup> The scientific reviews by these independent groups have consistently shown that NEPs reduce the spread of HIV infection, do not appear to increase drug use, and do not pose risks to the public.

Singer and colleagues make an important contribution to HIV prevention science by evaluating the impact of providing pharmacy access to syringes among IDUs in Hartford, Connecticut. Connecticut was one of the first states to rescind a 14-year ban on pharmacy sales of syringes without a physician's prescription. After the ban was lifted in 1992, IDUs had expanded access to sterile syringes at pharmacies. However, pharmacy discretion played a key role in whether a pharmacy actually provided IDUs with syringes without first requiring a physician's prescription. As a result, while pharmacies had the discretion to provide syringes when the NEP was not operating or was operating elsewhere, not all pharmacists agreed to do so, leaving large numbers of Hartford's IDUs without access to sterile syringes from any source.

An important research question concerning the efficacy of NEPs is how to optimize the program benefits to a larger number of IDUs. The paper by Valente and colleagues examines the role of satellite exchangers (SEs), or persons who acquire syringes from NEPs to redistribute to other IDUs, in extending the effectiveness of NEPs in HIV and AIDS prevention. During a two-year period, data were collected on the number of syringes acquired and returned by more than 5,000 exchangers at the Baltimore NEP. The data showed that SEs represented only 10% of the NEP participants, but they accounted for more than 64% of all the needles distributed. Thus, with their large transaction networks, SEs appear to reach a significant number of IDUs, thereby extending an NEP's coverage and effectiveness. Since SEs are indigenous to the community and are recognized as peers, they serve as credible messengers for HIV prevention to IDUs who, for one reason or another (reluctance to being identified or difficulty getting to the NEP when it is open), do not use the NEP themselves.

### **Drug Treatment as HIV Prevention: Background**

PHS published a comprehensive plan (based on the Coolfont conference on the prevention and control of AIDS and the AIDS virus in June 1986) that included objectives to control and prevent the spread of HIV and AIDS among IDUs.<sup>1</sup> Conferees at the Coolfont meeting recognized that there was a great need to increase the capacity for treating IDUs, with the highest priority being given to establishing a strategy to move opiate-dependent, out-of-treatment IDUs off waiting lists and into methadone maintenance treatment. Epidemic levels of opiate use in the 1960s in the United States stimulated a search for effective treatments for opiate users that led



to the emergence of methadone maintenance treatment to maintain those opiate dependent with methadone as well as drug-free therapeutic communities. Studies revealed that IDUs who entered methadone maintenance treatment early in the epidemic and who remained in treatment had lower HIV seroprevalence rates than those who did not enter treatment or dropped out of treatment.<sup>44,45</sup> In the late 1970s, epidemic levels of powdered cocaine use peaked, and then in the mid-1980s crack cocaine use became widespread. Faced with the cocaine and HIV/AIDS epidemics, NIDA, as part of the larger AIDS prevention effort, established a research demonstration program to improve and expand treatment capacity and increase treatment effectiveness by testing innovative interventions.<sup>46-48</sup>

In 1990, in response to a congressional request by the House Subcommittee on Human Resources and Intergovernment Relations, the Office of Technology Assessment (OTA)<sup>17</sup> and a multidisciplinary panel of experts and researchers examined what was known about the effectiveness of drug abuse treatment relative to controlling the spread of HIV. The findings from this review indicated that drug treatment was indeed a necessary component of a comprehensive prevention program to help at-risk populations increase their protective behaviors and reduce their risks for HIV. This report found strong and consistent evidence for the effectiveness of methadone maintenance in reducing opiate use and risks for HIV transmission. Results for therapeutic communities and outpatient drug-free programs were mixed, primarily because of problems from high client dropout rates and the lack of uniformity or comparability across different programs. Moreover, as discussed by Ball and colleagues, evidence of effectiveness of methadone maintenance programs in preventing HIV infection and reducing risk behaviors has been one of the primary factors that facilitated the establishment and expansion of such programs in other countries. Essentially, drug users in treatment are less likely to inject drugs and are therefore less likely to be exposed to HIV infection from this practice.<sup>19,45,49-51</sup> Friedman<sup>52</sup> reported that NADR participants who entered treatment were less likely to seroconvert than those who remained out of treatment. The OTA report observed,<sup>17</sup> "no clearly efficacious treatment for cocaine, whose use in IV [by injection] and smokable forms is associated with behaviors at high risk of transmitting HIV, is available" (p. 11). Researchers recognized that opiate-dependent persons using cocaine was a serious problem and that the likelihood of successful outcomes from treatment would be reduced.<sup>53</sup>

These researchers' findings provide the scientific context for understanding the complementary roles and relationships of community-based outreach risk reduction interventions, NEPs, and drug treatment as HIV prevention. Specifically, community-based outreach and outreach workers are effective for accessing community populations of drug users to prevent HIV while also providing referrals to facilitate drug treatment entry and retention.<sup>18,54-56</sup> In addition, NEPs serve as major sources for referral of clients to drug treatment<sup>35</sup> as well as entry into treatment.<sup>41,57,58</sup> Treatment programs are ideal mechanisms for delivering and evaluating HIV prevention interventions (Metzger, this volume). Retention in drug treatment has been shown to be a strong predictor of positive outcomes,<sup>59,60</sup> conversely, premature termination from treatment is associated with relapse and resumption of illicit drug use as well as increased risk for HIV.<sup>18</sup> In light of the emergent nature of the AIDS epidemic among IDUs, an attempt to minimize the negative behavioral consequences of addiction was now viewed as a necessary strategy to help individuals who continued to inject drugs to reduce their risk of HIV infection. Moreover, this comprehensive approach also is consistent with a consensus statement from a group of independent drug abuse researchers,<sup>61</sup> which stated that "Drug abuse treatment programs should provide all clients HIV prevention/education counseling and the opportunity to obtain HIV testing." This statement was consistent with an earlier policy statement from NIDA. The Institute set aside funds for and provided resources to researchers to make HIV risk reduction counseling and HIV testing available to research subjects at high risk for acquiring or transmitting HIV. An overview of drug treatment as an HIV prevention strategy is presented in Table 1.

### **Drug Treatment as HIV Prevention: Synopsis**

The synthesis paper in this special issue, by Metzger and colleagues, provides a comprehensive review and discussion of the literature on the role of drug abuse treatment in the prevention of HIV. They observe that, because treatment is more commonly used when prevention fails, it is generally not considered a strategy in primary prevention. Most of the literature that Metzger and associates reviewed was on the impact of methadone maintenance treatment for heroin users, although they noted that studies are beginning to emerge on treatment programs for noninjecting drug use (crack cocaine use). These authors focus their review on studies with behavioral and serologic measures that have addressed the

association of treatment participation, HIV risk reduction, and HIV infection. The cumulative evidence shows that treatment provides HIV protection because drug users who enter and continue in treatment reduce their drug use and corresponding drug-related risk behaviors, such as multiperson use of syringes, as well as their sexual risk behaviors, thereby decreasing their risks for acquiring or transmitting HIV. Metzger and colleagues raise an important research question that deserves attention in the future, specifically, that treated drug users can represent a bridge to community IDUs and their social networks and can share information about HIV prevention and their treatment experiences with others.

Hartel and Schoenbaum examine the protective effects of methadone maintenance treatment against HIV infection from 20 years of data collected in the Bronx, New York. Underscoring the importance of retention in drug treatment, they found that longer time in treatment was associated with a lower likelihood of infection. The strongest protective associations against HIV in this population were early entry and continuous stay in methadone treatment plus a daily methadone dose of 80 milligrams or higher per day. Although these findings underscore the critical role of treatment, they were based exclusively on studies of opiate users. Cocaine injectors and crack smokers constitute a separate group at very high risk for HIV, a group that poses a unique and difficult challenge to the field of HIV prevention science.

The study reported by Booth and colleagues focused on intervention strategies for reaching out-of-treatment drug users, particularly IDUs, and facilitating their entry into drug abuse treatment. IDUs were recruited and randomly assigned to one of four conditions: two motivational interviewing intervention strategies (one with free access to treatment and the other without free access) and two risk reduction intervention conditions (one with free access to treatment and the other without free access). No differences were seen between the motivational interviewing and risk reduction intervention conditions, but there was a significant difference on the rate of treatment entry based on whether the treatment was free: 52% of the IDUs entered treatment when it was offered at no cost, compared with only 32% when they had to pay. Other important predictors of treatment entry were prior treatment experiences, perceived possibility of acquiring AIDS, greater frequency of heroin injecting, and fewer drug-using friends.

Bronner and colleagues examined the short-term effectiveness of drug abuse treatment on needle exchange-referred clients. Treatment responses were compared

among IDUs newly admitted to an outpatient treatment program for opiate addiction in Baltimore, MD, one group referred by the NEP and the other by more conventional sources (self, family, physician). The two groups were notably different in baseline characteristics, with NEP users being significantly older; more likely to be male, African American, and unemployed; and having longer drug use histories. Aside from baseline differences, the two groups were similar in achieving short-term goals of reduced drug use and criminal activity, and both did well in longer term goals of treatment retention. This study indicates that, over and above their immediate purpose of providing sterile syringes to IDUs in exchange for used ones, NEPs offer other benefits as gateways to drug treatment and, potentially, to other health and medical services.

### **Network Strategies for HIV Prevention: Background**

Auerbach and colleagues<sup>62</sup> began an investigation in 1982 to assess the social and sexual relationships among previously healthy gay men in whom AIDS, a new disease with an unknown etiological agent at that time, had been diagnosed. Using network diagrams to represent the sexual and social interconnections or links among the men in this bicoastal cluster of AIDS cases, Auerbach and colleagues<sup>62</sup> suggested that AIDS may be caused by an infectious agent that is transmissible from person to person through sexual contact or through parenteral exposure among IDUs in a manner analogous to hepatitis B virus infection. The use of network-related concepts and methods, and the practical implications for the prevention and control of STDs, dates back to the late 1930s.<sup>63</sup> In a seminal article, Klodahl bridged the formal literature on social networks, which had its origins in the late 1930s with the epidemiology of infectious disease.<sup>64</sup> Klodahl used the data from the study by Auerbach and colleagues<sup>62</sup> to evaluate the infection agent hypothesis and suggested strategies for limiting the spread of infectious STDs through personal relationships. Extending the network research paradigm to focus on the structure and dynamics of drug-using risk networks, HIV transmission, and prevention of the spread of HIV is fairly recent.<sup>65-67</sup>

The network paradigm represents a shift in perspective from examining risk behaviors from an individual perspective to examining them as behavioral transactions between and among individuals and groups and to focusing on the context in which drugs are procured, prepared, mixed, and shared and on sexual risk-taking behaviors. Network characteristics affect behavioral practices and the probability of viral transmission. The network perspective

provides some new approaches to designing, conducting, and analyzing the effectiveness of HIV prevention interventions with drug users. Since these interventions are designed to affect group-level influences and behaviors, the evaluation of interventions represents a shift to assessing change at that level, rather than relying only on individual reports of behavior change.<sup>67</sup> In the current volume, Neaigus and Friedman, Latkin and colleagues, Levy and Fox, and Valente and colleagues report that network-oriented interventions have been successful in introducing behavior change among network members, reducing high risk behaviors, accelerating readiness for treatment, and limiting the spread of HIV. Specifically, network approaches have been used to identify key players within the network, relying on these individuals to recruit and intervene with members of their drug-using and sexual risk networks and, through a process of diffusion of information and providing risk reduction supplies, reaching larger numbers of the at-risk population. An overview of the network HIV prevention strategy is presented in Table 1.

### Network Strategies for HIV Prevention: Synopsis

In this special issue, Neaigus and Friedman review the design and outcomes of network-based interventions among IDUs based on the network concepts of the dyad (two-person relationship), the personal risk networks (an index person plus his or her relationships), and the sociometric network (the dynamic linkages and inter-relationships among members of a population). The evidence reviewed indicates that IDUs' networks are significant determinants of their risk for becoming infected and, more importantly, can successfully be used to prevent disease transmission. Neaigus and Friedman report that some evaluation studies of personal risk network interventions have found them more effective than individual-based interventions in reducing risks. Moreover, Neaigus and Friedman point out that, by changing IDUs' behavioral norms and peer culture, sociometric network interventions have the potential for large-scale risk reduction, since large numbers of IDUs can be reached through a multiplier effect generated by their own social links. Neaigus and Friedman characterize the role of network analysis in research on HIV risk behaviors as fitting, because HIV is transmitted when infected and susceptible persons come into close contact from or under the influence of interactions, relationships, and norms.

Latkin reports on his study of the role of peer leaders as agents of behavioral change and HIV prevention in

their IDU networks and communities. Specifically, he trained peer leaders in Baltimore as HIV educators to promote HIV prevention among their IDU network members. At follow-up, both peer leaders and members of their network reported having reduced their level of drug use risk behaviors, including improved needle hygiene. Network members received HIV prevention information and needle-cleaning materials and supplies from peer leaders. The study provides a persuasive case for the role of individuals identified as leaders among IDUs as highly effective and prosocial agents of change who can promote HIV prevention within their networks and the community.

Levy and Fox report on the role of networks on outreach-assisted partner notification by IDUs. The authors examined two components of the partner notification process—identifying at-risk partners and preference for self-tell or outreach-assisted notification—in informing the partners of IDUs about their possible exposure to HIV. Sixty HIV-positive IDUs were assigned to either a minimal (standard) self-tell group or an enhanced group and could choose to inform their partners themselves (self-tell) or to have the outreach team do so (outreach-assisted). Of those in the enhanced group, 82% preferred having the outreach team inform at least one of their partners about possible exposure to HIV, and 71% of the partners named were notified in this manner. The findings indicate that IDUs are willing to and can notify their partners of possible HIV exposure, but that most prefer outreach-assisted notification. Moreover, this chapter shows not only how the use of a network paradigm can be an effective HIV prevention strategy, but also and contrary to traditional partner notification approaches—how this process can take advantage of recruited, disease-free, high risk individuals to deliver HIV prevention education so that they and their partners can remain seronegative. Levy and Fox conclude that expanding community-based network and outreach to include street-based counseling, testing, and partner notification seems a practical, workable, effective, and prudent HIV prevention strategy.

### Conclusion

This special volume of *Public Health Reports* includes chapters on the current status and future prospects of HIV prevention among drug-using populations. These chapters begin to address questions raised by Des Jarlais and Friedman (this volume) in their review of 15 years of research on preventing HIV infection among IDUs.

Des Jarlais and Friedman address the following questions: (1) what we have learned; (2) what we have not learned; (3) what we have done; and (4) what we have not done. And they conclude by stating that “the most important barrier to reducing HIV transmission among IDUs is not a lack of knowledge but the failure to implement effective prevention programs in many parts of the world.” Shriver and colleagues (this volume) raise other challenging issues. Specifically, they discuss strategies for bridging the gap between HIV prevention research and public health practices and challenge the research community to plan for more rapid translation and dissemination of evidence-based intervention findings into best practices to prevent HIV infection in drug-using populations. In the final chapter of this volume, Sloboda reviews the research presented by symposium participants, synthesizing the findings to extract a set of principles for effective HIV prevention. She concludes by identifying some of the challenges ahead and by making recommendations for new directions in research and for the translation of this research into more effective community-based interventions to prevent the further spread of HIV.

We have learned that NIDA science-based interventions have been effective in reaching at-risk populations and enabling them to reduce risk behaviors and, consequently, their risk of acquiring HIV/AIDS. NIDA's prevention response has changed the course of the HIV/AIDS epidemic for drug users. We also have learned that we need to anticipate the changing dynamics of the co-occurring and interrelated epidemics of drug abuse and HIV/AIDS and that we must rapidly and effectively respond to the challenges presented by emerging HIV-related issues to prevent the further spread of HIV. Research has demonstrated that HIV transmission in drug-using populations is preventable.

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## References

1. Coolfont report: a PHS plan for prevention and control of AIDS and the AIDS virus. *Public Health Rep* 1986;101(4):341-8.
2. Marmor M, Des Jarlais D, Friedman S, Lyden M, El-Sadr W. The epidemic of AIDS and suggestions for its control in drug abusers. *J Subst Abuse Treat* 1984;1:237-47.
3. Friedland GH, Harris C, Butkus-Small C, Shine D, Moll B, Darrow W, Klein RS. Intravenous drug abusers and AIDS: demographics, drug use, and needle sharing practices. *Arch Intern Med* 1985;145:1413-7.
4. Friedman SR, Des Jarlais DC, Sotheran JL. AIDS health education for intravenous drug users. *Health Educ Q* 1986;13(4):383-93.
5. Feldman HW, Biernacki P. The ethnography of needle sharing among intravenous drug users and implications for public policies and intervention strategies. In: Battjes RJ, Pickens RW, editors. *Needle sharing among intravenous drug abusers: national and international perspectives*. National Institute on Drug Abuse Research Monograph 80. Washington: Government Printing Office; 1988. p. 28-39. DHHS Pub. No. (ADM) 89-1567.
6. Watters JK, Newmeyer JA, Feldman HW, Biernacki P. Street-based AIDS prevention for intravenous drug users in San Francisco: prospects, options, and obstacles. In: *Proceedings of the Community Epidemiology Work Group*, Rockville (MD): National Institute on Drug Abuse; 1986; p. II-37-II-43.
7. Watters JK. Meaning and context: the social facts of intravenous drug use and HIV transmission in the inner city. In: *Proceedings of the Community Epidemiology Work Group*, Rockville, MD: National Institute on Drug Abuse; 1987; p. II-336-II-344.
8. Selwyn PA, Cox CP, Feiner C, Lipshutz C, Cohen RL. Knowledge about AIDS and high-risk behavior among intravenous drug abusers in New York City. Presented at the Second International Conference on AIDS; 1986 Jun; Paris, France.
9. Des Jarlais DC, Friedman SR, Strug D. AIDS among intravenous drug users: a socio-cultural perspective. In: Feldman DA, Johnson TA, editors. *The social dimensions of AIDS: methods and theory*. New York: Praeger; 1986.
10. Gostin LO, Lazzarini Z. Prevention of HIV/AIDS among injection drug users: the theory and science of public health and criminal justice approaches to disease prevention. *Emory Law J* 1997;46:589-695.
11. National Institute on Drug Abuse (US). Fourth Science Forum: Research Synthesis Symposium on the Prevention of HIV in Drug Abusers [program & abstracts]. 1997 Aug 3-5; Northern Arizona Univ., Flagstaff, AZ.
12. Newmeyer JA. Why bleach? Development of a strategy to combat HIV contagion among San Francisco intravenous drug users. In: Battjes RJ, Pickens RW, editors. *Needle sharing among intravenous drug abusers: national and international perspectives*. National Institute on Drug Abuse Research Monograph 80. Washington: Government Printing Office; 1988. p. 151-9. DHHS Pub. No. (ADM) 89-1567.
13. Watters JK, Downing M, Case P, Lorvick J, Cheng Y, Fergusson B. AIDS prevention for intravenous drug users in the community: street-based education and risk behavior. *Am J Community Psychol* 1990;18(4):587-96.
14. Schuster CR. Intravenous drug use and HIV prevention. *Public Health Rep* 1988;103:261-3.
15. Hahn RA, Onorato IM, Jones TS, Dougherty J. Prevalence of HIV infection among intravenous drug users in the United States. *JAMA* 1989;261:2677-84.
16. Centers for Disease Control and Prevention (US). Risk behaviors for HIV transmission among intravenous drug users not in treatment—United States. *MMWR Morb Mortal Wkly Rep* 1990;39:273-6.
17. Office of Technology Assessment (US). *The effectiveness of drug abuse treatment: implications for controlling AIDS/HIV infection*. Washington: OTA; 1990.
18. Metzger DS, Woody GE, McLellan AT, O'Brien CP, Druly P, Navaline HA. Human immunodeficiency virus seroconversion among in- and out-of-treatment intravenous drug users: an 18-month prospective follow-up. *J Acquir Immune Defic Syndr* 1993;6:1049-56.
19. Metzger DS. Drug abuse treatment as HIV prevention. In: *Interventions to prevent HIV risk behaviors: programs and abstracts*. National Institutes of Health: Office of Medical Applications of Research, Consensus Development Conference; 1997:93-6.
20. Wiebel WW, Jimenez A, Johnson W, Ouellet L, Jovanovic B, Lampinen T, et al. Risk behavior and HIV seroincidence among out-of-treatment injection drug users: a four-year prospective study. *J Acquir Immune Defic Syndr* 1996;12:282-9.
21. Hughes PH, Crawford GA. A contagious disease model for researching and intervening in heroin epidemics. *Arch Gen Psychiatry* 1972;27:149-55.
22. Hughes PH. *Behind the wall of respect*. Chicago (IL): University Press; 1977.
23. Wiebel WW. Combining ethnographic and epidemiologic methods in targeted AIDS interventions: the Chicago model. In: Battjes RJ, Pickens RW, editors. *Needle sharing among intravenous drug abusers: national and international perspectives*. National Institute on Drug Abuse Research Monograph 80. Washington: Government Printing Office; 1988. p. 137-150. Pub. No. 89-1567.
24. Wiebel WW. *The indigenous leader outreach model: intervention manual*. Rockville (MD): National Institute on Drug Abuse; 1993.
25. Brown BS, Beschner GM, The National AIDS Research Consortium, editors. *Handbook on risk of AIDS: injection drug users and sexual partners*. Westport (CT): Greenwood Press; 1993.
26. Rhodes F. *The behavioral counseling model for injection drug users: intervention manual*. Rockville (MD): National Institute on Drug Abuse (US); 1993.
27. Coyle SL. *The NIDA HIV counseling and education intervention model: intervention manual*. Rockville (MD): National Institute on Drug Abuse (US); 1993.
28. Department of Health and Human Services (US). *HIV prevention bulletin: medical advice for persons who inject illicit drugs*. Public Health Services; May 9, 1997.
29. Public Health Service (US). *HIV prevention bulletin: medical advice for persons who inject illicit drugs*. Washington: GPO; 1997. Available from: URL: [http://www.cdc.gov/nchstp/hiv\\_aids/pubs/hiv\\_prev.txt](http://www.cdc.gov/nchstp/hiv_aids/pubs/hiv_prev.txt).
30. Buning EC, van Brussel GH, van Santen G. Amsterdam's drug policy and its implications for controlling needle sharing. In: Battjes RJ, Pickens RW, editors. *Needle sharing among*

- intravenous drug abusers: national and international perspectives. National Institute on Drug Abuse Research Monograph 80. Washington: Government Printing Office; 1988. p. 59-74. DHHS Pub. No. (ADM) 89-1567.
31. Van den Hoek A, Coutinho R. Evaluation of the needle/syringe exchange in Amsterdam, The Netherlands. In: Proceedings, workshop on needle exchange and bleach distribution programs. National Research Council and Institute of Medicine. Washington: National Academy Press; 1994. p. 67-71.
  32. Strathdee SA, van Ameijden EJ, Mesquita F, Wodak A, Rana S, Vlahov D. Can HIV epidemics among injection drug users be prevented? *AIDS*. In press 1998.
  33. The World Bank. *Confronting AIDS: public priorities in a global epidemic*. New York: Oxford University Press; 1998.
  34. Kaplan EH, O'Keefe E. Let the needles do the talking! Evaluating the New Haven needle exchange. *Interfaces* 1993;23:7-26.
  35. Paone D, Des Jarlais DC, Clark J, Shi Q. Update: Syringe-Exchange Programs—United States 1996. *MMWR* 1997;46:565-8.
  36. Paone D, Caloir S, Shi Q, Des Jarlais DC. Sex, drugs, and syringe exchange in New York City: women's experiences. *J Am Med Wom Assoc* 1995;50(3-4):109-14.
  37. Rich JD, Astemborski J, Smith DK, Schoenbaum K, Davenney K, Schuman P, et al. Needle exchange programs: availability and participation among injecting drug using women. Poster presentation. In: Abstracts of the Fifth Conference on Retroviruses and Opportunistic Infections; 1998 Feb; Chicago, IL.
  38. Hagan H, Des Jarlais DC, Friedman SR, Purchase D, Alter MJ. Reduced risk of hepatitis B and hepatitis C among injecting drug users participating in the Tacoma syringe exchange program. *Am J Public Health* 1995;85(11):1531-7.
  39. Heimer R, Kaplan EH, Khoshnood K, Jariwala-Freeman B, Duncan B, Harima Y. Hepatitis in used syringes: the limits of sensitivity of techniques to detect HBV DNA, HCV RNA, and antibodies to HBV core and HCV antigens. *J Infect Dis* 1996;173(4):997-1000.
  40. National Commission on AIDS (US). *The twin epidemics of substance abuse and HIV*. Washington: 1991.
  41. Lurie P, Reingold AL, Bowser B, Chen D, Foley J, Guydish J, et al. The public health impact of needle exchange programs in the United States and abroad. San Francisco (CA): University of California; 1993.
  42. Normand J, Vlahov D, Moses LE. Preventing HIV transmission: the role of sterile needles and bleach. Washington: National Academy Press; 1995.
  43. Interventions to Prevent HIV Risk Behaviors. National Institutes of Health Consensus Statement 1997 Feb 11-13; 15(2).
  44. Novick DM, Kreek MJ, Des Jarlais DC, Spira TJ, Khuri ET, Ragnath J, et al. Abstract of clinical research findings: therapeutic and historical aspects. In: Harris LS, editor. *Problems of Drug Dependence, Proceedings of the 47th Annual Scientific Meeting*; National Institute on Drug Abuse Research Monograph 67; Washington: Government Printing Office; 1986. p. 318-20. DHHS Pub. No. (ADM) 86-1448.
  45. Ball JC, Lange RL, Myers CP, Friedman SR. Reducing the risk of AIDS through methadone maintenance treatment. *J Health Soc Behav* 1988;29:214-26.
  46. Inciardi JA, Tims FM, Fletcher BW. Innovative approaches in the treatment of drug abuse: programs, models, and strategies. Westport (CT): Greenwood Press; 1993.
  47. Tims FM, Fletcher BW, Inciardi JA, Horton AM. Introduction: an overview of the applied evaluation research portfolio. In: Tims FM, Inciardi JA, Fletcher BW, Horton AM, editors. *The effectiveness of innovative approaches in the treatment of drug abuse*. Westport (CT): Greenwood Press; 1997.
  48. Tims FM, Inciardi JA, Fletcher BW, Horton AM. The effectiveness of innovative approaches in the treatment of drug abuse. Westport (CT): Greenwood Press; 1997.
  49. Hubbard RL, Marsden ME, Cavanaugh E, Rachal JV, Ginzburg HM. Role of drug-abuse treatment in limiting the spread of AIDS. *Rev Infect Dis* 1988;10:377-84.
  50. Battjes RJ, Pickens RW. Needle sharing among intravenous drug abusers: an overview. In: Battjes RJ, Pickens RW, editors. *Needle sharing among intravenous drug abusers: national and international perspectives*. National Institute on Drug Abuse Research Monograph 80. Washington: Government Printing Office; 1988. p. 1-6. DHHS Pub. No. (ADM) 89-1567.
  51. Pickens RW, Fletcher BW. Overview of treatment issues. In: Pickens RW, Leukefeld CG, Schuster CR, editors. *Improving drug abuse treatment*. National Institute on Drug Abuse Research Monograph 106; Rockville (MD): NIDA; 1991. p. 1-19.
  52. Friedman SR, Jose B, Deren S, Des Jarlais DC, Neaigus A. Risk factors for human immunodeficiency virus seroconversion among out-of-treatment injectors in high and low seroprevalence cities. The National AIDS Research Consortium. *Am J Epidemiol* 1995;142:864-74.
  53. Fletcher BW, Tims FM, Brown BS. Drug Abuse Treatment Outcome Study (DATOS): treatment evaluation research in the United States. *Psychol Addict Behav* 1997;11(4):216-29.
  54. Vlahov D, Anthony JC, Munoz A, Margolick J, Nelson KE, Celantano DD, et al. The ALIVE study, a longitudinal study of HIV-1 infection in intravenous drug users: description of methods and characteristics of participants. In: Hartsock P, Genser SG, editors. *Longitudinal studies of HIV infection in intravenous drug users: methodological issues in natural history research*. National Institute on Drug Abuse Research Monograph 109. Washington: Government Printing Office; 1991. p. 75-100. DHHS Pub. No. (ADM) 91-1786.
  55. Booth RE, Wiebel WW. The effectiveness of reducing needle-related risks for HIV through indigenous outreach to injection drug users. *Am J Addict* 1992;1:277-88.
  56. Brown BS, Needle RH. Modifying the process of treatment to meet the threat of AIDS. *Int J Addict* 1994;29(13):1739-52.
  57. Heimer R, Lopes M. Needle exchange hastens entry into drug treatment [letter]. *JAMA* 1994;271(23):1825-6.
  58. Vlahov D. Role of needle exchange programs in AIDS prevention. In: Interventions to prevent HIV risk behaviors: programs and abstracts. National Institutes of Health: Office of Medical Applications of Research, Consensus Development Conference; 1997:87-92.
  59. Simpson DD. Treatment for drug abuse: follow-up outcomes and length of time spent. *Arch Gen Psychiatry* 1981;38:875-80.
  60. Hubbard RL, Marsden ME, Rachal JV, Harwood HJ, Cavanaugh ER, Ginzburg HM. Drug abuse treatment: a national study of

- effectiveness. Chapel Hill (NC): University of North Carolina Press; 1989.
61. Brown BS, McLellan AT. Special issue: HIV/AIDS and drug abuse treatment. *J Subst Abuse Treat* 1996;13(5).
  62. Auerbach DM, Darrow WW, Jaffe HW, Curran JW. Cluster of cases of the acquired immune deficiency syndrome: patients linked by sexual contact. *Am J Med* 1984;76:487-92.
  63. Rothenberg RB, Narramore J. The relevance of social network concepts to sexually transmitted disease control [commentary]. *Sex Transm Dis* 1996;23:24-30.
  64. Klovdahl AS. Social networks and the spread of infectious diseases: the AIDS example. *Soc Sci Med* 1985;21:1203-16.
  65. Needle RH. HIV risk behaviors of heterosexual male drug users. In: Battjes RJ, Sloboda Z, Grace WC, editors. The context of HIV risk among drug users and their sexual partners. National Institute on Drug Abuse Research Monograph 143. Washington: Government Printing Office; 1994. p. 5-8. NIH Pub. No. 94-3750.
  66. Needle RH, Coyle SL, Genser SG, Trotter RT, editors. Social networks, drug abuse, and HIV transmission. National Institute on Drug Abuse Research Monograph 151; Washington: Government Printing Office; 1995. p. 196-215. NIH Pub. No. 95-3889.
  67. Trotter RT, Rothenberg RB, Coyle SL. Drug abuse and HIV prevention research: expanding paradigms and network contributions to risk reduction. *Connections* 1995; 18(1):29-45. ■