

## The Role of Needle Exchange Programs in HIV Prevention

**Dr. Vlahov is a Professor of Epidemiology and Medicine at Johns Hopkins School of Hygiene and Public Health. He is Principal Investigator of the AIDS Linked to Intravenous Experiences (ALIVE) study, a longitudinal study of HIV infection among injecting drug users, and Principal Investigator of the Evaluation of the Baltimore Needle Exchange Program. Mr. Junge is Senior Research Coordinator with the Department of Epidemiology at the Johns Hopkins School of Hygiene and Public Health. He also is Evaluation Director for the Baltimore Needle Exchange Program.**

### SYNOPSIS

Injecting drug users (IDUs) are at high risk for infection by human immunodeficiency virus (HIV) and other blood-borne pathogens. In the United States, IDUs account for nearly one-third of the cases of acquired immunodeficiency syndrome (AIDS), either directly or indirectly (heterosexual and perinatal cases of AIDS where the source of infection was an IDU). IDUs also account for a substantial proportion of cases of hepatitis B (HBV) and hepatitis C (HCV) virus infections. The primary mode of transmission for HIV among IDUs is parenteral, through direct needle sharing or multiperson use of syringes. Despite high levels of knowledge about risk, multiperson use of needles and syringes is due primarily to fear of arrest and incarceration for violation of drug paraphernalia laws and ordinances that prohibit manufacture, sale, distribution, or possession of equipment and materials intended to be used with narcotics. It is estimated that in 1997 there were approximately 110 needle exchange programs (NEPs) in North America. In part, because of the ban on the use of Federal funds for the operation of needle exchange, it has been difficult to evaluate the efficacy of these programs. This chapter presents data from the studies that have evaluated the role of NEPs in HIV prevention.

Evidence for the efficacy of NEPs comes from three sources: (1) studies originally focused on the effectiveness of NEPs in non-HIV blood-borne infections, (2) mathematical modeling of data on needle exchange on HIV seroincidence, and (3) studies that examine the positive and negative impact of NEPs on HIV and AIDS.

**Address correspondence to:**

Dr. Vlahov, Department of Epidemiology, Johns Hopkins School of Hygiene and Public Health, Room E-6008, 615 North Wolfe Street, Baltimore MD 21205; tel. 410-955-1848; fax 410-955-1383; e-mail <DVLAHOV@jhsph.edu>.

Case-control studies have provided powerful data on the positive effect of NEPs on reduction of two blood-borne viral infections (HBV and HCV). For example, a case-control study in Tacoma, Washington, showed that a six-fold increase in HBV and a seven-fold increase in HCV infections in IDUs were associated with nonuse of the NEP.

The first federally funded study of needle exchange was an evaluation of the New Haven NEP, which is legally operated by the New Haven Health Department. Rather than relying on self-report of reduced risky injection drug use, this study utilized mathematical and statistical modeling, using data from a syringe tracking and testing system. Incidence of HIV infection among needle exchange participants was estimated to have decreased by 33% as a result of the NEP.

A series of Government-commissioned reports have reviewed the data on positive and negative outcomes of NEPs. The major reports are from the National Commission on AIDS; the U.S. General Accounting Office; the Centers for Disease Control/University of California; and the National Academy of Sciences. The latter two reports are used in this chapter.

The aggregated results support the positive benefit of NEPs and do not support negative outcomes from NEPs. When legal restrictions on both purchase and possession of syringes are removed, IDUs will change their syringe-sharing behaviors in ways that can reduce HIV transmission. NEPs do not result in increased drug use among participants or the recruitment of first-time drug users.

Injecting drug users (IDUs) are at risk for human immunodeficiency virus (HIV) and other blood-borne infections. The principal mode of transmission is parenteral through multiperson use of needles and syringes. The mechanism of contamination is through a behavior called registering, whereby drug users draw back on the plunger of a syringe after venous insertion to ensure venous placement before injecting drug solutions. Strategies to prevent or reduce parenteral transmission of HIV infection need to focus on reducing, if not eliminating altogether, the multiperson use of syringes that have been contaminated. The principle underlying these strategies has been stated clearly in the recommendations of the 1995 National Academy of Sciences Report on preventing HIV infection as follows: "For injection drugs the once only use of sterile needles and syringes remains the safest, most effective approach for limiting HIV transmission."<sup>1</sup> This principle was echoed in the 1996 American Medical Association's booklet *A Physician's Guide to HIV Prevention*<sup>2</sup> and in 1995 in the booklet of the U.S. Preventive Services Task Force *Guide to Clinical Preventive Services*.<sup>3</sup> More recently, this principle has been codified in a multiagency *HIV Prevention Bulletin*.<sup>4</sup>

The first line of prevention is to encourage IDUs to stop using drugs altogether. However, for drug users who cannot or will not stop drug use, owing to their addiction, other approaches are needed. Two major approaches have been developed to provide sufficient sterile needles and syringes to drug users to reduce transmission of HIV and other blood-borne infections. The first is needle exchange programs (NEPs), and the second is modification of syringe prescription and paraphernalia possession laws or ordinances. Hereafter, we will refer to the latter as deregulation of prescription and paraphernalia laws.

**NEPs.** There are now more than 110 NEPs in the United States.<sup>5</sup> By comparison, there are 2000 or more outlets in Australia and hundreds in Great Britain. The exchange programs are varied in terms of organizational characteristics.<sup>1,6</sup> Some operate out of fixed sites; others are mobile. Some are legally authorized; others are not. Funding, staffing patterns, policies, and hours of operation vary considerably among the different programs.

Despite different organizational characteristics, the basic description and goals of NEPs are the same. They provide sterile needles in exchange for contaminated or used needles to increase access to sterile needles and to remove contaminated syringes from circulation in the community. Equally important, needle exchanges are there

to establish contact with otherwise hard-to-reach populations to deliver health services, such as HIV testing and counseling, as well as referrals to treatment for drug abuse.

Over time, numerous questions have arisen about NEPs, such as whether these programs encourage drug use and whether they result in lower HIV incidence. These questions have been summarized and examined in a series of published reviews and Government-sponsored reports. The Government-sponsored reports include those from the National Commission on AIDS in 1991,<sup>7</sup> the U.S. General Accounting Office in 1993,<sup>8</sup> the University of California and Centers for Disease Control (CDC) Report in 1993,<sup>6</sup> and the National Academy of Sciences in 1995.<sup>1</sup>

As to whether NEPs increase drug use among participants, the 1993 California report examined published reports that involved comparison groups (Table 1). Because the sampling and data collection methods varied considerably among studies, the summary has been reduced here to show whether needle exchange was associated with a beneficial, neutral, or adverse effect. Of the eight reports that examined the issue of injection frequency, three showed a reduction in injection frequency, four showed a mixed or neutral effect (no change), and one initially recorded an increase in injection frequency.

In terms of attracting youth or new individuals into NEPs in the United States, programs that have no minimum age restriction have reported that recruitment of participants who are younger than 18 years old was consistently less than 1%; this low rate of use was noted in studies that were conducted in San Francisco<sup>9</sup> and New Haven<sup>10</sup> and in our recent studies in Baltimore.<sup>11</sup> However, recent studies also have shown that new injectors who are adolescent or young adults also are at extremely high risk for HIV infection.<sup>12</sup> In response to this problem, Los Angeles has recently developed an NEP specifically directed at new initiates into injection drug use (P. Kerndt, personal communication, February 10, 1996).

Another question is whether the presence of NEPs in a community conveys a message to youth that condones and encourages drug use. This issue is particularly difficult to study. In 1993, the authors of the University of California-CDC report examined longitudinal national drug use indicator data (data from the DAWN Project), which monitors emergency-room mentions of drug-abuse-related admissions.<sup>6</sup> Comparisons of data before and after the opening of needle exchanges and between cities with and without NEPs showed no significant trends.

The only systematic study to date of trends in drug use within a community following the opening of a needle

exchange comes from Amsterdam.<sup>13</sup> Using data on admissions to treatment for drug abuse, Buning and colleagues noted that the proportion of drug users younger than 22 declined from 14% in 1981 to 5% in 1986; the NEP opened in 1984. The opening of the needle exchange increased neither the proportion of drug users overall nor the proportion of those younger than 22 years. Thus, the currently available data argue against the belief that needle exchange encourages drug use.

Another issue is whether needle exchanges will result in more contaminated syringes found on the street. If a needle exchange is designed as a one-for-one exchange, the answer is no. In Baltimore, a carefully designed systematic street survey showed no increase in discarded needles following the opening of an NEP.<sup>14</sup> An update following two years of surveys has shown a similar trend of no increase.<sup>15</sup>

Findings of behavioral change associated with needle exchange are varied. A number of published studies have compared levels of risky behavior among IDUs participating and those not participating in needle exchange. As the University of California-CDC report noted,<sup>6</sup> methods varied considerably among these published reports, so that the summary here (Table 1) sorts the studies into whether and how the needle exchange has shown an effect—risk reduction, no effect, or adverse effect.

In terms of drug risks, Table 1 shows that there were 14 studies that looked at the frequency of needle sharing, the most dangerous behavior in terms of drug-related risk of HIV transmission. In those studies, 10 showed a reduction in needle sharing frequency, four had no effect, and none showed any increase in needle sharing.

Similar trends were noted for the practice of giving away syringes: three showed a reduction in this practice, one no effect, and one an increase. Three out of four studies reporting on this needle cleaning showed a positive effect. Finally, in terms of sexual risk behavior, few studies overall have examined the impact of needle exchange on sexual risks. Sexual transmission among IDUs is an important area that merits further investigation.

The next question about NEPs is whether such programs actually reduce the incidence of HIV infection in IDUs. While the idea of using only sterile needles makes the question of efficacy seem obvious, the real question centers on how effective the programs are in practice and how subject such programs are to the ubiquitous "law of unintended consequences."

Studies of the impact of needle exchange on the incidence of HIV infection in the United States are few, primarily because funding for such evaluation is relatively

recent and sample size requirements are large. The first study (shown in Table 2) was conducted by Hagan and colleagues in Tacoma, Washington.<sup>16</sup> In that city, the prevalence and, therefore, the incidence of HIV were extremely low. A needle exchange was initiated with the goal of maintaining HIV incidence at a low level. Two case-controlled analyses used hepatitis B and hepatitis C virus infection as outcome variables because the epidemiology of these two viruses is similar to HIV, although transmission of hepatitis is more efficient than HIV. In these studies, needle exchange participation was associated with more than an 80% reduction in the incidence of hepatitis infection. Over time, HIV prevalence has not risen.

In terms of HIV studies, Kaplan and Heimer at Yale utilized information about HIV test results of washes from syringes returned to the New Haven Needle Exchange Program by constructing an elegant statistical model to estimate that needle exchange reduced HIV incidence by 33%.<sup>17</sup> This model has been reviewed by three independent statistical reviewers who have judged the model sound in estimates as reasonable or even conservative.<sup>1,6,8</sup>

More recently, Des Jarlais and colleagues from New York City<sup>18</sup> published a prospective study of seroconversion between attendees and nonattendees of needle exchange. In this study, they estimated a 70% reduction in HIV incidence. Several other studies are ongoing in San Francisco, Chicago, and Baltimore, but their findings are too preliminary to present at this time.

In terms of HIV seroconversion studies from needle exchanges with comparison groups from outside the United States, data are available from Amsterdam and Montreal.<sup>19,20</sup> In Amsterdam, data from a case-control study nested within an ongoing cohort study identified a slightly increased risk of HIV seroconversion with needle

exchange use. However, when the analyses were examined by calendar time, the needle exchange was initially protective, but the association reversed over time.<sup>19</sup> The authors attributed their results to the needle exchange losing lower risk users to pharmacy access over time, leaving a core of highest risk users within the exchange.

More recently a study was published using a case-control analysis nested within a cohort study in Montreal.<sup>20</sup> Of 974 HIV-seronegative subjects followed an average of 22 months, 89 subjects seroconverted. Consistent use of needle exchange compared with nonuse was associated with an odds ratio for HIV seroconversion of 10.5, which remained elevated even during multivariate adjustment. The authors concluded that NEPs were associated with higher HIV rates and speculated that the exchange may have facilitated formation of new social networks that might have permitted broader HIV transmission. In an accompanying commentary,<sup>22</sup> Lurie criticized the Montreal study saying that the more likely explanation for the findings was that powerful selection forces attracted the most risky IDUs as evidenced by substantial differences in the baseline data for the exchangers *vs.* nonexchangers: exchangers had higher injection frequencies, were less likely to have a history of drug abuse treatment, were more likely to share needles and use shooting galleries, and had a high HIV prevalence. Lurie attributed the differences to the hours and locations of the exchange (late night in the red-light district) attracting only a select subset of users.

In Vancouver, Strathdee reported on HIV incidence in a cohort of IDUs of whom 92% were enrolled in needle exchange.<sup>22</sup> The incidence of 18.6 (100 person-years) was associated with low education, unstable housing, commercial sex, borrowing needles, injecting with others, and frequent use of needle exchange. The related study

**Table 1. Summary of studies of behavioral change within NEPs**

<i>Outcome measures</i>	<i>Beneficial NEP effect</i>	<i>Mixed or neutral NEP effect</i>	<i>Adverse NEP effect</i>
Drug risk:			
Sharing frequency	10	4	—
Give away syringes	3	1	1
Needle cleaning	3	1	—
Injection frequency	3	4	1
Sex risk:			
Number of partners	2	1	—
Partner choice	1	1	—
Condom use	1	1	1

SOURCE: Reference 6

by Archibald and colleagues demonstrates a selection of higher risk individuals into needle exchange in Vancouver.<sup>23</sup>

The point to consider is what accounts for the discrepancy between the U.S. and non-U.S. studies. From a methodological perspective, selection factors could be operating. For example, in Vancouver, a study compared characteristics of exchangers with those of nonexchangers, or high frequency vs. low frequency exchangers; this study showed that the high frequency exchangers were more likely to engage in high risk activities.<sup>23</sup> While the Vancouver study showed that self-selection into needle exchange results in leaving a comparison group that is not similar in other respects, the data do suggest that needle exchange has been successful in recruiting high risk users.

At another level, the U.S. studies involve evaluation of a needle exchange in comparison with people who do not have access to an NEP or to sterile needles through other sources. In contrast, the Canadian and Dutch studies have involved comparisons that do have an alternative source for sterile needles, principally through pharmacies; their studies may have selected into the needle exchange the people who cannot get needles from pharmacies. The effectiveness of NEPs depends on understanding who constitutes the comparison group.

More recently, an ecological analysis was published with serial HIV seroprevalence data for 29 cities with NEPs and 52 cities without such programs.<sup>24</sup> The results, although subject to a possible ecological fallacy, indicated a 5.8% decline in HIV prevalence per year in cities with NEPs and a 5.9% increase in cities without exchange.

**Deregulating syringe prescription and paraphernalia laws.** In 1992, Connecticut changed the state laws to permit sale and possession of up to 10 syringes at a time. The CDC, in conjunction with the state of Connecticut, conducted initial studies that examined whether IDUs utilized pharmacies and discovered that they did.<sup>25</sup> The CDC and the state of Connecticut then examined how pharmacy utilization affected needle-sharing behaviors in the two samples of IDUs that were interviewed: 52% reported sharing needles before the law changed, and 31% did so after the law changed.<sup>26</sup> While these data are encouraging, data on needle disposal and HIV incidence are not yet available.

## SUMMARY

Access to sterile needles and syringes is an important, even vital, component of a comprehensive HIV prevention program for IDUs. The data on needle exchange in the United States are consistent with the conclusion that these programs do not encourage drug use and that needle exchanges can be effective in reducing HIV incidence. Other data show that NEPs help people stop drug use through referral to drug treatment programs.<sup>6</sup> The studies outside of the United States are important for reminding us that unintended consequences can occur. While changes in needle prescription and possession laws and regulations have shown promise, the identification of organizational components that improve or hinder effectiveness of needle exchange and pharmacy-based access are needed.

**Table 2. Impact of NEPs on incidence of blood-borne infections in the United States**

Author	City	Design	Outcome	Percent reduction
Hagan et al. <sup>a</sup>	Tacoma	Case-control	HBV HCV	83 86
Kaplan et al. <sup>b</sup>	New Haven	Mathematical modeling based on testing of syringes returned to NEP	HIV	33
Des Jarlais et al. <sup>c</sup>	New York	Prospective study of seroconversion; NEP is external cohort and IDUs in neighboring regions	HIV	70

<sup>a</sup>Reference 16

<sup>b</sup>Reference 17

<sup>c</sup>Reference 18

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