Journal of Acquired Immune Deficiency Syndromes & Human Retrovirology:
15 December 1997 - Volume 16 - Issue 5 - pp 400-406
Epidemiology

Reductions in High-Risk Drug Use Behaviors Among Participants in the Baltimore Needle Exchange Program

Vlahov, David*; Junge, Benjamin*; Brookmeyer, Ronald†; Cohn, Sylvia*; Riley, Elise*; Armenian, Haroutune*; Beilenson, Peter‡

Author Information

**Department of Epidemiology and †Department of Biostatistics, The Johns Hopkins School of Hygiene and Public Health, and‡Baltimore City Health Department, Baltimore, Maryland, U.S.A.*

Address correspondence and reprint requests to David Vlahov, The Johns Hopkins University School of Hygiene and Public Health, Room E-6008, 615 North Wolfe Street, Baltimore, MD 21205 U.S.A.

Manuscript received February 19, 1997; accepted June 25, 1997.

Abstract

Objective: To determine whether enrollment in the Baltimore Needle Exchange Program (NEP) was associated with short-term reduction in risky injection practices.

Methods: Demographic information was collected on NEP participants upon enrollment. A systematic sample of enrollees was interviewed at program entry, 2 weeks, and 6 months later on recent drug-related behaviors. Comparisons were performed using paired *t*-tests.

Results: Among 221 NEP participants who completed baseline, 2-week and 6-month follow-up visits, significant reductions ($p < .01$) were reported in using a previously used syringe (21.6%, 11.0%, 7.8%, respectively), lending one's used syringe to a friend (26.7%, 18.4%, 12%, respectively), and several indirect sharing activities. Reductions were reported in the mean number of injections per syringe and the mean number of injections per day ($p < .001$).

Conclusions: These results show rapid and mostly large reductions in a variety of risky injection drug use behaviors. Study findings are consistent with earlier reports showing an association between behavioral risk reduction and participation in a needle exchange program.

Injection drug users (IDUs) are at risk for a variety of bloodborne infections, including HIV and infection by both hepatitis B and C viruses, primarily through multiperson use of needles and syringes[1-3]. Through distribution of sterile syringes and collection of contaminated syringes, needle exchange programs (NEPs) have been designed to reduce multiperson syringe use and to thereby lower the incidence of bloodborne infections in this population[4-6]. The effect of NEPs on the incidence of bloodborne infections has been documented in studies with limited sample sizes[7,8], and has been estimated using mathematical models[9].

Until further studies using infection incidence data as the primary outcome variable become available, the most promising needle exchange evaluation strategy is to examine changes in the level of risk behaviors associated with transmission of infection. Risk behaviors associated with transmission of bloodborne infection include high frequency of drug injection, multiperson syringe use(which includes both injection with a previously used syringe as well as lending one's own used syringe to someone else), and the use of "shooting galleries" (clandestine locations where syringes can be rented and where an IDU can inject with some degree of privacy)[10,11]. More recent studies have described indirect sharing behaviors that might be associated with transmission of bloodborne infections, including sharing "cookers"(containers in which drugs are prepared for injection), cotton (to filter out particulate matter when drawing up the drug from the cooker), and rinse water (to remove visible blood from syringes between uses), and "backloading"(the process of drawing the drug into one syringe, a portion of which is then transferred into a second syringe)[12,13]. We hypothesize that participation in an NEP should reduce the frequency of at least some of these behaviors, thereby contributing to a reduced risk for acquiring bloodborne infections.

Beyond specific injection behaviors, it is important to consider the physical setting where injections occur, as well as syringe disposal. Injections performed in shooting galleries, in cars, or "on the street" are less likely to be hygienic than those performed in a residence[14]. Community leaders may be concerned that an NEP would increase the visibility of IDUs in the neighborhood[6]. Additionally, drug users who inject and then discard used syringes in public places pose a safety concern for community residents[5,6,15]. Because needle exchange provides a supply of sterile needles and then collects dirty needles so that IDUs do not need to scrounge for injection equipment, we hypothesized a decrease in the number of injections performed "outside" and a decrease in disposal of used syringes in public places (e.g., on the street), which might pose a public health risk.

In 1994, the Baltimore City Health Department established a mobile NEP, which operated at two sites. A systematic sample of all enrollees was recruited for detailed interviews on IDU-related behaviors at baseline, at 2 weeks, and 6 months after enrollment. The data presented here represent participants enrolled during the first year of program operations who were recruited into the evaluation sample.

METHODS

Program Operations

Authorized by state legislation that exempted participants and staff from prosecution under drug paraphernalia laws, the NEP was opened on August 12, 1994 by the Baltimore City Health Department. During the first year in operation, a van operated 4 days per week for 2 hours daily each on the east and west sides of the city. In the first year, the NEP was staffed by three full-time employees who served 2965 registrants by distributing a total of 218,665

program syringes during an average of 278 visits per week.

On the first visit to the van, participants could receive two syringes without having to turn in a used syringe. On subsequent visits, however, exchange was on a one-for-one basis with no upper limit. In addition to exchanging needles, injection kits containing alcohol pads to clean their skin before injection, clean cotton balls, cookers, condoms, and HIV prevention brochures were dispensed. All participants were offered free HIV testing with pre- and posttest counseling and referrals as appropriate. Counseling included recommendations to reduce the number of injections per syringe and needle sharing. Ninety prepaid addiction treatment slots were set aside for program participants on a first-come, first-serve basis.

Study Population

All persons who enrolled in the Baltimore NEP during its first 12 months of operation were eligible based solely on self-reported history of IDU; no age restrictions were set. A systematic sampling scheme was employed whereby approximately every seventh newly enrolled participant was invited to join the evaluation study, except on days when the volume of enrollees did not permit sufficient time to maintain this algorithm. The participation rate exceeded 98%.

Data Collection

All participants, whether they were included in the evaluation sample or not, were given a brief interview by program staff on the van at the time of the first visit, covering demographics and drug injection behavior(e.g., drug types, injection frequency) for the previous 6 months. After completing the enrollment interviews, each participant received a unique identification number linked to three reverse identifier variables: date of birth, mother's maiden name, and the last four digits of patricipant's social security number). For any visit to the van, participants were required to reproduce these three variables to confirm their identities.

In a separate area of the van, evaluation study participants underwent a standardized behavioral interview, preceded by a detailed consent procedure, both of which were approved by the institutional review board of the affiliated university. The consent and interview were administered by a trained study interviewer. Interview topics included drug types, frequency of injection, total number of syringes used, location of injections, syringe acquisition sources, syringe disposal, direct multiperson syringe use, and indirect sharing activities (e.g., sharing cookers, cotton, and rinse water). The time frame for all drug use questions was the prior 2 weeks. Following baseline interviews, all evaluation participants received pretest counseling before venipuncture to test for HIV antibodies. HIV test results were subsequently disclosed with posttest counseling and referrals as appropriate. Evaluation participants were reimbursed $15 U.S. for their time at each interview.

Laboratory Methods

Using sera from study participants, antibody to HIV was assayed using commercial enzyme-linked immunosorbent assay (ELISA; Genetic Systems, Seattle, WA, U.S.A.) and confirmed with Western blot(Du Pont, Wilmington, DE, U.S.A.) using standard criteria.

Statistical Methods

Chi-square tests for contingency tables were used to compare the distributions for categorical variables among those NEP participants recruited and not recruited into the evaluation study. Two sample*t*-tests were used to compare continuous variables. To

evaluate behavior change following entry into the NEP, each evaluation study participant served as their own control. For continuous variables, the means were calculated at baseline, at 2 weeks, and 6 months. Differences in means, 95% confidence intervals (CI), and paired *t*-tests were used to assess whether changes were significant since baseline in these variables. For binary (dichotomous) variables, percentages were computed at baseline, 2 weeks, and 6 months for comparison using a test for correlated proportions. Individuals were assigned the value 0 or 1 depending on whether or not they had the behavior, and a paired *t*-test was performed[(16)].

RESULTS

Of the 2965 individuals who enrolled in the Baltimore Needle Exchange Program during its first year of operation, 422 (14.2%) were recruited into the evaluation study. Table 1 compares the demographic and drug use characteristics of participants in the evaluation component versus those participants not in the evaluation. Although the two groups were statistically similar with respect to most demographic and drug use variables, participants in the evaluation component were more likely to be female (33.2% vs. 26.9%, $p = .007$). In addition, evaluation participants had a higher proportion of daily speedball (i.e., heroin and cocaine mixed in the same syringe) injectors (72.1% vs. 64.3%, $p = .002$), daily heroin injectors (77.0% vs. 71.7%, $p = .081$), and those who had initiated injection drug use at a younger age(20.1 vs. 20.8 years old, $p = .016$). Within the evaluation study group, 29.9% were HIV-seropositive at baseline.

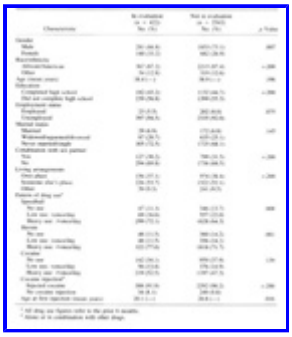

Table 1

Of 422 evaluation participants who completed a baseline interview, 335 (79.4%) returned for an interview after 2 weeks. A comparison of the 335 persons who completed both interviews with the 87 who did not return for the 2-week follow-up interview showed that these two groups were statistically similar with respect to demographic variables. With the exception of using a needle previously used by someone else (baseline measurements were 20.0% for returnees vs. 30.2% for dropouts;$p = .041$), drug use characteristics were also statistically similar. Seroprevalence for returnees (32.5%) was slightly higher than for the original baseline cohort of 422.

Drug use patterns and related behaviors before and after enrollment were compared for the 335 evaluation participants who completed the baseline and the 2-week follow-up interviews. After joining the NEP, the proportion of evaluation participants who injected at least daily declined (97.0% vs. 88.0%; $p = < .001$). The population who reported having been in drug treatment during the prior 2 weeks increased somewhat from 6.3% to 9.0% before and after enrollment in the NEP ($p = .117$). Following enrollment into the NEP, declines were observed in the use of a syringe previously used by another person(20.0% vs. 11.7%; $p < .001$), lending one's used syringe to a friend (27.7% vs. 20.1%, $p = .003$), backloading(11.7% vs. 8.1%; $p = .051$), sharing cookers (60.5 vs. 42.5%; $p < .001$), and sharing cotton (45.8% vs. 33.5%;$p < .001$).

Injection frequency and syringe use variables were examined. The mean injections per day decreased from 5.9 to 4.9 (mean change = -1.09; 95% CI = -1.50,-0.68). The mean number of injections per syringe was 12.4 in the 2 weeks before and 8.5 in the 2 weeks after entry into the exchange program (mean change = -3.98; 95% CI = -5.85, -2.11) whereas the median injections per syringe decreased from 6 to 4.3.

With regard to syringe acquisition following enrollment into the NEP, declines were reported in the proportion of evaluation participants who reported buying needles off the street from a nondiabetic (64.2% vs. 40.3%; $p < .001$), from a diabetic (28.1% vs. 11.6%; $p < .001$) and getting needles from pharmacies (14.0% vs. 9.3%; $p = .016$). In terms of syringe disposal following enrollment into the NEP, declines were reported in the proportion of participants who discarded needles in a street, alley, sewer, or gutter (28.2% vs. 15.6%; $p < .001$) and in the garbage or a dumpster (42.4% vs. 29.1%; $p < .001$).

Following enrollment in the NEP, injection settings changed significantly. Declines were observed in injections performed in friends' places (53.2% vs. 41.7%; $p < .001$); streets, parks, and restrooms (24.0% vs. 16.2%; $p < .001$); empty houses and abandoned buildings (38.1%vs. 21.6%; $p < .001$); cars (11.4% vs. 5.4%; $p = .002$); and shooting galleries (22.9% vs. 12.4%; $p < .001$). There was a modest but not statistically significant increase in using one's own place (81.9% vs. 84.9%; $p > .200$).

We then examined data on those who returned for the 6-month visit. Of the 335 who completed the 2-week visit, 221 (66%) returned for the 6-month interview. A comparison of the 221 returnees with the 114 who did not return showed that these two groups were statistically similar with respect to demographic and drug use variables(data not shown). Figure 1 shows the proportion who reported daily injection, who were in drug treatment, use of syringe previously used by another person, lending one's own used syringe to a friend, backloading, sharing cotton and sharing cookers at baseline, at 2 weeks and 6 months. In all cases, the proportion engaging in the behaviors showed a sustained reduction at the 6-month visit. Table 2 shows injection frequency and selected drug use variables for the baseline, 2-week and 6-month measurements. With the exception of backloading($p = .238$), all other behavioral changes from baseline to 6 months were statistically significant with $p < .001$. Although the number of daily injections decreased from 5.6 to 4.1 from baseline to 6 months ($p < .001$), the number of syringes used per day increased, from 1.1 to 1.6 ($p < .001$). Accordingly, the mean and median number of injections per syringe declined substantially from 12.4 at baseline to 8.5 at 2 weeks, and 3.6 at the 6-month follow-up visit (medians 6.0, 4.3, and 2, respectively).

Fig. 1 Table 2

We compared the 335 HIV-seropositive and -seronegative evaluation participants who returned for the 2-week interview with regard to baseline demographic and behavioral characteristics, as well as subsequent behavior change. Although mostly similar at baseline, the HIV-seropositive persons were more likely than seronegative persons to be older (39.9 vs. 38.1 mean years old; $p = .030$), to be unemployed (98.2% vs. 92.4%; $p = .033$), to share cookers (70.6% vs. 55.8%), to share cotton (52.3% vs. 42.9%), and to inject at a shooting gallery (29.4% vs. 19.8%). Over 6 months, declines in injection frequency and use of previously used syringes were similar by HIV serostatus (data not shown).

DISCUSSION

The major finding of this study is that IDUs reported lower levels of drug injection and HIV-related risk behaviors following entry into an NEP. These results are consistent with the bulk of previously published reports from NEPs in the United States and Europe[5,6].

The limitations of this study are centered around issues common to those inherent in before/after designs. Because no external comparison group existed, the possibility that behavior change was the result of factors other than the program cannot be excluded. Individuals enlisted themselves into the NEP. These self-selected individuals may have changed their behavior regardless of whether or not they were enrolled in the needle exchange. However, restricting interviews to 2-week segments on a sample recruited over 1 year argues against maturation or calendar time/period effects as explanatory. Although other studies have used nonequivalent comparison group designs and shown essentially similar results[5,6], for ethical reasons, no randomized allocation design has been performed to date[17].

Another possible limitation is the reliance on self-reporting, a well-known methodologic issue in drug abuse research[18]. Because the intervals for recall in the current study were relatively short, the problem is not likely to have been the result of memory decay. Although the NEP had no formal retention criteria, risk-reduction counseling was offered and participants may have presumed their responses to questions would affect eligibility for continued participation in the program or in the study. That there were improvements in nearly every measured variable is reason to take the possibility of social response bias seriously, especially because no comparison group of IDUs not using the exchange existed.

To address the issues of validity of self-reports, we performed an analysis of behavior change restricted to IDUs who did not decrease their frequency of injection(n = 241). The rationale was that this group was willing to admit to continuing a salient risk behavior that had been one of the targets for initial counseling and intervention. Admitting drug use, at least at the level reported at baseline, suggested that this group might be less subject to distortion of self-reports due to responses considered as socially desirable. In fact, within this group, we observed levels of decline for the other drug use-related variables measured that were similar to the overall sample (data not shown). This approach has been used in other studies. For example, Hagan et al.[19] reported on needle exchange participants in Tacoma, Washington for whom there was no observed decline in marijuana use(an activity not targeted by the NEP; therefore any decrease might have been attributed to responses deemed socially desirable); needle-related behaviors declined. Taken together, these analyses strengthen our confidence in the observed findings of behavioral change.

With the limitations acknowledged, some specific findings are noteworthy. The observed decreases in direct multiperson syringe use (e.g., use of a needle previously used by someone else and passing along one's own used needle to a friend) are plausible because of the increasing access to sterile injection equipment. Additionally, reductions in indirect multiperson syringe use behaviors (e.g., cooker and cotton sharing) is attributed to distribution of these items along with the sterile syringes at the NEP van. This is the first report to examine a reduction in backloading with use of a needle exchange program; an increase in availability of sterile syringes might account for the observed result. Despite community concerns that NEPs might draw out IDUs, making them more visible to the community[6], our results show a tendency for program participants to be slightly less likely to inject in public places. We noted that although NEP participants became less likely to obtain potentially"dirty" syringes from the street-based black market, they were less likely to obtain needles from "clean" sources other than the NEP (e.g., pharmacies). We speculate that the decrease in obtaining needles from non-NEP clean sources might have been

economically motivated, in that the syringes from needle exchange were free[(20)], but other reasons (e.g., a more convenient location, a more hospitable environment, and a desire for counseling and other services) might have contributed to this result. Finally, we considered whether knowledge of HIV serostatus might have a differential impact on behaviors among exchange participants, but similar levels of risk reductions were observed.

In conclusion, although constrained by the limitations of study design, the results show rapid and mostly sustained reductions in a wide variety of IDU behaviors that have been associated with transmission of HIV and other bloodborne pathogens. Our study findings provide additional support to the growing literature, which suggests that needle exchange can be an important component of a comprehensive HIV prevention program for IDUs.

Acknowledgments: The authors thank Liza Solomon and Noya Galai for assistance with organization and data management issues, respectively; Harriet Grossman and Steven Huettner for preparation of the manuscript; and Michele Brown, Lamont Coger, Rebecca Jackson, and George Laney for daily operations on the NEP van. Financial support was derived from grant DA09237 from the National Institute on Drug Abuse.

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Keywords:

HIV; Substance abuse; Injection drug use; Prevention; Needle exchange program