Published in final edited form as:
Am J Public Health. 2010 August ; 100(8): 1449–1453. doi:10.2105/AJPH.2009.178467.

Syringe Sharing and HIV Incidence Among Injection Drug Users and Increased Access to Sterile Syringes

Thomas Kerr, PhD, **Will Small, PhD**, **Chris Buchner, MSc**, **Ruth Zhang, MSc**, **Kathy Li, PhD**, **Julio Montaner, MD**, and **Evan Wood, MD, PhD**

Thomas Kerr, Julio Montaner, and Evan Wood are with the British Columbia Centre for Excellence in HIV/AIDS and the Department of Medicine, University of British Columbia, Vancouver. Will Small and Ruth Zhang are with the British Columbia Centre for Excellence in HIV/AIDS, Vancouver. At the time of writing, Kathy Li was with the British Columbia Centre for Excellence in HIV/AIDS, Vancouver. Chris Buchner is with Vancouver Coastal Health, Vancouver

Abstract

Objectives—We assessed the effects of syringe exchange program (SEP) policy on rates of HIV risk behavior and HIV incidence among injection drug users.

Methods—Using a multivariate generalized estimating equation and Cox regression methods, we examined syringe borrowing, syringe lending, and HIV incidence among a prospective cohort of 1228 injection drug users in Vancouver, British Columbia.

Results—We observed substantial declines in rates of syringe borrowing (from 20.1% in 1998 to 9.2% in 2003) and syringe lending (from 19.1% in 1998 to 6.8% in 2003) following SEP policy change. These declines coincided with a statistically significant increase in the proportion of participants accessing sterile syringes from nontraditional SEP sources ($P<.001$). In multivariate analyses, the period following the change in SEP policy was independently associated with a greater than 40% reduction in syringe borrowing (adjusted odds ratio [AOR]=0.57; 95% confidence interval [CI]=0.49, 0.65) and lending (AOR=0.52; 95% CI=0.45, 0.60), as well as declining HIV incidence (adjusted hazard ratio=0.13; 95% CI=0.06, 0.31).

Conclusions—Widespread syringe distribution appears to be a more effective SEP policy than do more restrictive SEP policies that limit syringe access. Efforts should be made to ensure that SEP policies and program design serve to maximize rather than hinder syringe access.

Cities throughout the world are increasingly experiencing HIV epidemics among injection drug users (IDU) as a result of sharing contaminated injecting equipment.[1] In response, various initiatives such as syringe exchange programs (SEPs) have been established.[2]

Despite the growing implementation of SEPs, IDU-driven HIV epidemics have persisted in some settings.[3] This has been true of Vancouver, British Columbia, Canada, which experienced

Correspondence should be sent to Thomas Kerr, PhD, Urban Health Research Initiative, BC Centre for Excellence in HIV/AIDS, 608-1081 Burrard Street, Vancouver BC V6Z 1Y6, Canada (uhri@cfenet.ubc.ca). Reprints can be ordered at http://www.ajph.org by clicking the “Reprints/Eprints” link..

Contributors

T. Kerr and E. Wood designed the study. R. Zhang, K. Li, and T. Kerr conducted the statistical analyses. T. Kerr and E. Wood drafted the article and incorporated all suggestions. W. Small, J. Montaner, and C. Buchner made significant contributions to the conception and design of the analyses, interpretation of the data, and drafting of the article. T. Kerr is guarantor of this study. All authors approved the version to be published.

Human Participant Protection

The Vancouver Injection Drug Users Study, from which the data for this report were derived, is approved by the University of British Columbia’s research ethics board.

one of North America's highest HIV rates although the city has been home to one of the continent's largest SEPs.[4] Preliminary reports have suggested that many local IDU have historically experienced difficulty accessing sterile syringes as a result of policy and programmatic factors such as limited hours of SEP operation and a rigid one-for-one syringe exchange policy (i.e., only 1 sterile syringe is distributed for every used syringe returned).[5,6] Indeed, studies from other settings have revealed the negative effects of restrictive SEP policies that limit access to sufficient numbers of sterile syringes, such as one-for-one exchange policies.[7–10]

In an effort to maximize sterile syringe access and reduce rates of syringe sharing, between 2000 and 2002 the health authority in Vancouver modified its SEP policies by shifting from a focus on syringe exchange to a focus on syringe distribution.[11] This change in policy involved decentralizing SEP services by increasing the number of sites distributing syringes, diversifying the methods used to distribute syringes (including hotel-based SEPs and foot patrols), and removing the limit on the number of syringes that could be obtained. Also, the health authority in Vancouver required local health clinics to provide sterile syringes to local IDU and asked programs, such as Vancouver's street nurse program, that were already providing outreach and care to IDU to include syringe distribution in their activities. Further, IDU were able to acquire sterile syringes without having used syringes to exchange, and syringe distribution and collection programs were separated. At the same time, a local drug user organization, recognizing the problem with access to syringes, opened a peer-run SEP in the city's central drug-using area.[12] This program included both a fixed SEP and an outreach-based SEP service. The peer-run fixed SEP was later found to be reaching a subpopulation of IDU at heightened risk for HIV infection.[13]

Although it has been suggested that SEPs are most effective when the focus of service is on distribution rather than exchange,[11] there is a dearth of evidence documenting the effect of such a focus on rates of syringe sharing and HIV incidence. Therefore, we sought to determine if the change in SEP policy was associated with changes in rates of used syringe sharing and HIV incidence among IDU.

METHODS

We report on data derived from the Vancouver Injection Drug Users Study (VIDUS), an ongoing prospective cohort study of IDU recruited through self-referral and street outreach since May 1996.[14,15] As part of the study, all participants complete an interviewer-administered questionnaire and provide a blood sample at baseline and semiannual follow-up visits so that drug use, HIV risk behavior, and HIV incidence can be tracked longitudinally.

We assessed the effect of changes in SEP policy on rates of self-reported syringe sharing and HIV incidence. We also examined self-reported use of different sources for sterile syringes. We conducted separate analyses to consider syringe borrowing, syringe lending, and HIV incidence. First, we a priori defined a 6-year period: 3 years before and 3 years after the change in SEP policy. We then graphically assessed the proportion of study participants who were actively injecting and who also reported borrowing and lending used syringes during the period 1998 through 2003 (i.e., we considered all follow-up visits occurring within this period). Rates of syringe borrowing and lending were ascertained using data derived from questions asking, "In the past 6 months, have you fixed with a rig that had already been used by someone else?" and "In the past 6 months, have you ever lent your used rigs to someone else?" Consistent with other studies,[16] to further investigate the patterns of rates of syringe borrowing and syringe lending, we built a generalized linear regression model in which the slopes of the regression lines in the 2 periods were compared:

$$Y_t = b_0 + b_1 X + b_2 t + b_3 tX + \varepsilon_t, \quad (1)$$

where Y_t is the logit of the probability of reporting syringe borrowing or lending at each 6-month follow-up visit, and X is a dummy variable (with X=0 for the period before the change in SEP policy and X=1 for the period after). We assessed the coefficient estimate for b_3 to determine whether a statistically detectable difference in slopes existed within the period and after the change in SEP policy.

Second, we conducted fixed multivariate generalized estimating equation (GEE) analyses with logit link for binary outcomes to determine whether the period following the change in SEP policy was associated with reductions in syringe borrowing and lending. These methods provided standard errors adjusted by multiple observations per person using an exchangeable correlation structure. We a priori defined an independent variable as before (1998 through 2000) versus after (2001 through 2003) the SEP policy was modified and examined if this period was associated with changes in syringe sharing after intensive covariate adjustment. We chose to define the period after the SEP policy change as 2001–2003, as the majority of changes were implemented by the beginning of 2001. Potential confounders between syringe sharing rates and the period of the SEP policy change that we considered included the following: age, gender, Aboriginal ancestry, daily heroin injection, daily cocaine injection, and HIV-positive serostatus.

Third, we conducted a multivariate Cox proportional hazards regression analysis to estimate adjusted relative hazards of HIV seroconversion. Potential confounders between HIV incidence and the period of the SEP policy change that we considered included the following: age, gender, Aboriginal ancestry, daily heroin injection, daily cocaine injection, and unprotected sex (i.e., unprotected vaginal or anal intercourse). Potential covariates were selected on the basis of having a known relationship to HIV risk behavior or HIV incidence in this setting (e.g., gender, Aboriginal ancestry, frequent cocaine injection, unsafe sexual intercourse)[17–19] or on the basis of having a potential relationship to the frequency of injecting within the area.

Last, we also used the regression method to compare rates of syringe borrowing and lending to compare rates of access to nontraditional SEPs (hereafter referred to as “other SEPs”) before and after the SEP policy change was implemented. Specifically, we assessed rates of access to different SEPs by asking participants to indicate all the SEP sources they had used in the previous 6 months. The SEP sources considered included the following: pharmacies, the fixed SEP (main fixed SEP in the downtown core), SEP vans, other SEPs (all nontraditional sources for sterile syringes, including street nurses, health clinics, hotel-based SEPs, and the “Health Van,” which provides a range of primary care services for drug users and sex workers), and the drug user–led SEP that was initiated at the beginning of 2001. All behavioral variables, which are listed in Table 1, were identical to prior reports and we treated them as time-updated covariates.[5,6] All P values are 2 sided. We conducted all analyses using SAS version 9.1 (SAS Institute, Cary, NC).

RESULTS

Overall, 1228 participants were included in the study, including 472 (38.4%) women and 351 (28.6%) individuals of Aboriginal ancestry. The median age of participants at baseline was 33.4 years. In total, 1114 (91%) of the 1228 participants were seen in the 3 years before the change in SEP policy, and 854 (60%) were seen in the 3 years after the change. In total, we saw 740 (60%) participants in both periods.

The median number of follow-up visits among participants was 8 (interquartile range 4–11), and 179 (16%) participants died during the study period. Among those participants eligible to participate in more than 1 study visit because they completed a baseline interview before December 2002 (n=1085), 143 (11.6%) were seen only once. In total, 159 (2.2%) of 7367 observations had missing values and were excluded from the analyses. Univariate GEE analyses revealed no differences between those who were and were not seen more than once with respect to gender, ancestry, and age (all $P>.05$); however, there were differences in rates of syringe borrowing and lending among the 2 groups, with those seen only once during follow-up being more likely to report syringe borrowing and lending than were those who were seen more than once ($P<.05$).

In total, 520 (42.3%) participants reported syringe borrowing at least once during the study period, whereas 504 (41.0%) participants reported syringe lending at least once. As indicated in Figure 1, reductions in the proportion of participants reporting syringe borrowing (from 20.1% to 9.2%) and syringe lending (from 19.1% to 6.8%) were observed during the study period, and visual inspection of the data implied that the most dramatic change occurred following the change in SEP policy. For syringe borrowing, the coefficient estimate for b_3 indicates a statistically significant difference in slopes during the periods before and after the change in SEP policy ($P<.001$). For syringe lending, the coefficient for b_3 also revealed a statistically significant difference in slopes during the before and after periods ($P<.001$).

As shown in Table 1, factors that remained independently associated with syringe borrowing included age (adjusted odds ratio [AOR] per year older=0.97; 95% confidence interval [CI] =0.96, 0.98; $P<.001$), Aboriginal ancestry (AOR=0.64; 95% CI=0.50, 0.81; $P<.001$), daily heroin injection (AOR=1.31; 95% CI=1.13, 1.52; $P<.001$), daily cocaine injection (AOR=1.34; 95% CI=1.16, 1.54; $P<.001$), HIV-positive serostatus (AOR=0.70; 95% CI=0.56, 0.87; $P=.002$), and the period following the change in SEP policy (AOR= 0.57; 95% CI=0.49, 0.65; $P<.001$). As shown in Table 2, factors that remained independently associated with syringe lending included age (AOR per year older=0.97; 95% CI=0.96, 0.98; $P<.001$), gender (AOR=1.63; 95% CI=1.32, 2.03; $P<.001$), Aboriginal ancestry (AOR=0.62; 95% CI=0.49, 0.79; $P<.001$), daily heroin injection (AOR=1.53; 95% CI=1.32, 1.79; $P<.001$), daily cocaine injection (AOR=1.20; 95% CI=1.03, 1.41; $P=.021$), HIV-positive serostatus (AOR=0.49; 95% CI=0.39, 0.62; $P<.001$), and the period following the change in SEP policy (AOR= 0.52; 95% CI=0.45, 0.60; $P<.001$).

As indicated in Table 3, factors that remained independently associated with HIV incidence included Aboriginal ancestry (adjusted hazard ratio [AHR]=1.71; 95% CI=1.19, 2.46; $P=.004$), daily cocaine injection (AHR=3.19; 95% CI=2.22, 4.57; $P<.001$), and the period following the change in SEP policy (AHR=0.13; 95% CI=0.06, 0.31; $P<.001$).

As shown in Figure 2, the rates of access to various sources of sterile syringes changed significantly over time. Specifically, the proportion of participants accessing pharmacies (from 32% at baseline to12% at last follow-up), the fixed SEP (from 83% at baseline to 60% at last follow-up), and the SEP vans (from 73% at 2baseline to 50% at last follow-up) declined over time. However, there was a statistically detectable increase in the proportion of participants who accessed other SEPs (from 5% at baseline to 43% at last follow-up; $P<.001$) when the period before the change in SEP policy was compared with the period after the SEP policy was implemented. Further, as indicated in Figure 2, use of the drug user–led SEP increased quickly after the program was implemented, with approximately 30% to 40% of participants accessing this service every 6 months.

DISCUSSION

We have found that a period resulting in increased access to sterile syringes was independently associated with substantial reductions in syringe borrowing, syringe lending, and HIV incidence among local IDU. Specifically, a constellation of policy changes aimed at improving access to sterile syringes, including a shift in emphasis from syringe exchange to syringe distribution, a decentralization of the SEP, and an increase in the number and types of sites distributing syringes, appeared to lead to improvements in program effectiveness. Policy changes that led to the removal of the number of syringes that could be distributed at any one time also may have contributed to observed reductions in syringe sharing and HIV incidence. It is also notable that a local drug user organization opened an SEP at the time of the policy change, and eventually peer involvement in the delivery of the SEP became the standard locally. Previous studies have indicated that drug users can help extend the reach and effectiveness of SEPs.[20,21]

Previous evaluations of SEPs have demonstrated that these programs are associated with reductions in syringe sharing and HIV incidence[3] as well as increased rates of entry into addiction treatment programs.[22,23] Further, previous evaluations have found that SEPs do not increase drug use, crime, or discarded syringes.[3,24] However, the HIV outbreak observed in Vancouver in 1997 that occurred in the presence of a large SEP has been cited as among the key reasons for the federal ban on SEP funding in the United States.[25] Although local characteristics that explain the HIV outbreak have been previously described,[15,26] our findings may help inform changes to this policy as well as policies in other settings where SEPs remain banned or limited. Results of the present study indicate that the effectiveness of the Vancouver SEP may have been limited as a result of policies that restricted the availability of sterile syringes locally. Indeed, previous studies have demonstrated that restrictive SEP policies are associated with lower sterile syringe coverage and elevated injection-related risk behavior.[8,27] To maximize the benefits of SEPs, efforts must be made to ensure that policies and programmatic limitations do not undermine SEP effectiveness.

Our study has limitations. First, this is an observational study, and therefore we cannot infer causation. As such, unmeasured factors occurring in the community, including increasing knowledge or other changes in local service delivery, may affect the observed reductions in syringe sharing and HIV incidence. Second, it is likely that the new SEP policies studied herein were not implemented in a uniform fashion, and it is difficult to know which specific policy changes accounted for the changes in syringe sharing and HIV incidence observed in the present study. Third, although it would have been ideal to incorporate a robust measure of SEP use, previous studies have shown that because high-risk IDU may over-report SEP use, statistical evidence of program benefits may be diminished.[28] Further, we have previously shown that frequent SEP users tend to possess other behavioral characteristics that render them more vulnerable to HIV infection, and therefore measures of intensity of SEP use tend to be fraught with selection bias.[15]

Fourth, VIDUS is not a random sample, and therefore the IDU participating in the present study may not be representative of local IDU. Fifth, the observed declines in HIV risk behavior and HIV incidence may reflect a cohort effect whereby lower-risk IDUs are less likely to be lost during follow-up. However, VIDUS is an open, prospective cohort study, and ongoing enrollment has been employed to address problems related to this type of cohort effect. Sixth, although studies have indicated that may underreport some behaviors,[29] self-reports of illicit drug use behaviors by IDU have been shown to be valid.[30] Importantly, we designed the present study after these data were collected, thus the participants and interviewers were blinded to this eventual use of the data. We believe this fact decreases the likelihood that interviewer bias or socially desirable responding accounts for our findings.

In sum, we found that a period resulting in increased access to sterile syringes was independently associated with substantial reductions in syringe borrowing, syringe lending, HIV incidence among local IDU. Together these findings suggest that the impact of SEPs may be maximized by ensuring a focus on syringe distribution rather than syringe exchange and by decentralizing SEPs and removing restrictive syringe exchange policies.

Acknowledgments

This study was supported by the NIH (grant R01 DA011591) and the Canadian Institutes of Health Research (grants HHP-67262 and RAA-79918). T. Kerr is additionally supported by the Michael Smith Foundation for Health Research (award CI-SCH-085 05-1) and the Canadian Institutes of Health Research (award MSH-80J36). W. Small is supported by a Senior Graduate Trainee Award from the Michael Smith Foundation for Health Research (award F09-02982) and a Canada Graduate Scholarship from Canadian Institutes of Health Research (award MFE-200583-157911).

We would particularly like to thank the Vancouver Injection Drug Users Study (VIDUS) participants for their willingness to be included in the study as well as current and past VIDUS investigators and staff. We would specifically like to thank Deborah Graham, Tricia Collingham, Leslie Rae, Caitlin Johnston, Steve Kain, and Calvin Lai for their research and administrative assistance. We would also like to thank Viviane Lima for her technical advice.

References

1. UNAIDS. Report on the Global AIDS Epidemic. Geneva, Switzerland: UNAIDS; 2006.
2. Des Jarlais DC. Structural interventions to reduce HIV transmission among injecting drug users. AIDS 2000;14(suppl 1):S41–S46. [PubMed: 10981473]
3. Wodak A, Cooney A. Do needle syringe programs reduce HIV infection among injecting drug users: a comprehensive review of the international evidence. Subst Use Misuse 2006;41(6–7):777–813. [PubMed: 16809167]
4. Strathdee SA, Patrick DM, Currie SL, et al. Needle exchange is not enough: lessons from the Vancouver injecting drug use study. AIDS 1997;11(8):F59–F65. [PubMed: 9223727]
5. Wood E, Tyndall MW, Spittal PM, et al. Factors associated with persistent high-risk syringe sharing in the presence of an established needle exchange programme. AIDS 2002;16(6):941–943. [PubMed: 11919503]
6. Wood E, Tyndall MW, Spittal P, et al. Needle exchange and difficulty with needle access during an ongoing HIV epidemic. Int J Drug Policy 2002;13(2):95–102.
7. Rich JD, Strong L, Towe CW, et al. Obstacles to needle exchange participation in Rhode Island. J Acquir Immune Defic Syndr 1999;21(5):396–400. [PubMed: 10458620]
8. Kral AH, Anderson R, Flynn NM, et al. Injection risk behaviors among clients of syringe exchange programs with different syringe dispensation policies. J Acquir Immune Defic Syndr 2004;37(2): 1307–1312. [PubMed: 15385739]
9. Bluthenthal RN, Kral AH, Lorvick J, et al. Impact of law enforcement on syringe exchange programs: a look at Oakland and San Francisco. Med Anthropol 1997;18(1):61–83. [PubMed: 9458668]
10. Singer M, Baer HA, Scott G, et al. Pharmacy access to syringes among injecting drug users: follow-up findings from Hartford, Connecticut. Public Health Rep 1998;113(suppl 1):81–89. [PubMed: 9722813]
11. Hankins CA. Syringe exchange in Canada: good but not enough to stem the HIV tide. Subst Use Misuse 1998;33(5):1129–1146. [PubMed: 9596380]
12. Kerr T, Small W, Peeace W, et al. Harm reduction by a “user-run” organization: a case study of the Vancouver Area Network of Drug Users (VANDU). Int J Drug Policy 2006;17(2):61–69.
13. Wood E, Kerr T, Spittal PM, et al. An external evaluation of a peer-run “unsanctioned” syringe exchange program. J Urban Health 2003;80(3):455–464. [PubMed: 12930883]
14. Kerr T, Tyndall M, Li K, et al. Safer injection facility use and syringe sharing in injection drug users. Lancet 2005;366(9482):316–318. [PubMed: 16039335]
15. Wood E, Lloyd-Smith E, Li K, et al. Frequent needle exchange use and HIV incidence in Vancouver, Canada. Am J Med 2007;120(2):172–179. [PubMed: 17275459]

16. Fang CT, Hsu HM, Twu SJ, et al. Decreased HIV transmission after a policy of providing free access to highly active antiretroviral therapy in Taiwan. J Infect Dis 2004;190(5):879–885. [PubMed: 15295691]

17. Tyndall MW, Currie S, Spittal P, et al. Intensive injection cocaine use as the primary risk factor in the Vancouver HIV-1 epidemic. AIDS 2003;17(6):887–893. [PubMed: 12660536]

18. Craib KJ, Spittal PM, Wood E, et al. Risk factors for elevated HIV incidence among Aboriginal injection drug users in Vancouver. CMAJ 2003;168(1):19–24. [PubMed: 12515780]

19. Spittal PM, Craib KJ, Wood E, et al. Risk factors for elevated HIV incidence rates among female injection drug users in Vancouver. CMAJ 2002;166(7):894–899. [PubMed: 11949985]

20. Grund JP, Blanken P, Adriaans NF, et al. Reaching the unreached: targeting hidden IDU populations with clean needles via known user groups. J Psychoactive Drugs 1992;24(1):41–47. [PubMed: 1619521]

21. Broadhead RS, Heckathorn DD, Weakliem DL, et al. Harnessing peer networks as an instrument for AIDS prevention: results from a peer-driven intervention. Public Health Rep 1998;113(Suppl 1):42–57. [PubMed: 9722809]

22. Heimer R. Can syringe exchange serve as a conduit to substance abuse treatment? J Subst Abuse Treat 1998;15(3):183–191. [PubMed: 9633030]

23. Strathdee SA, Celentano DD, Shah N, et al. Needle-exchange attendance and health care utilization promote entry into detoxification. J Urban Health 1999;76(4):448–460. [PubMed: 10609594]

24. Watters JK, Estilo MJ, Clark GL, et al. Syringe and needle exchange as HIV/AIDS prevention for injection drug users. JAMA 1994;271(2):115–120. [PubMed: 8264065]

25. Vlahov D, Des Jarlais DC, Goosby E, et al. Needle exchange programs for the prevention of human immunodeficiency virus infection: epidemiology and policy. Am J Epidemiol 2001;154(suppl 12):S70–S77. [PubMed: 11744532]

26. Schechter MT, Strathdee SA, Cornelisse PG, et al. Do needle exchange programmes increase the spread of HIV among injection drug users?: an investigation of the Vancouver outbreak. AIDS 1999;13(6):F45–F51. [PubMed: 10397556]

27. Bluthenthal RN, Ridgeway G, Schell T, et al. Examination of the association between syringe exchange program (SEP) dispensation policy and SEP client-level syringe coverage among injection drug users. Addiction 2007;102(4):638–646. [PubMed: 17286637]

28. Safaeian M, Brookmeyer R, Vlahov D, et al. Validity of self-reported needle exchange attendance among injection drug users: implications for program evaluation. Am J Epidemiol 2002;155(2):169–175. [PubMed: 11790681]

29. Hedlund J. Risky business: safety regulations, risk compensation, and individual behavior. Inj Prev 2000;6(2):82–90. [PubMed: 10875661]

30. Mensch BS, Kandel DB. Underreporting of substance use in a national longitudinal youth cohort, individual and interviewer effects. Public Opin Q 1988;52(1):100–124.

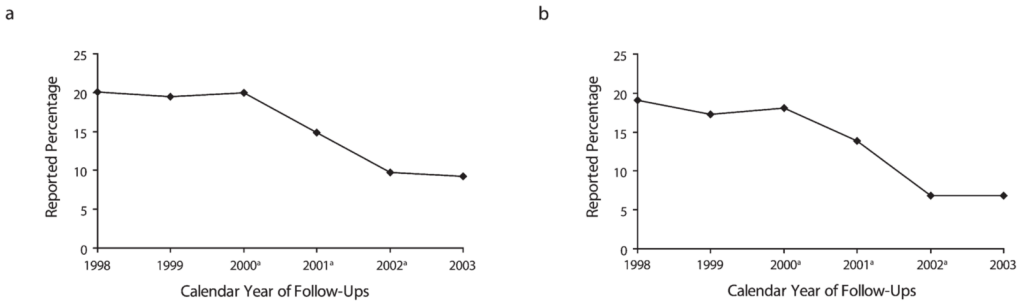

FIGURE 1. Proportion of VIDUS participants reporting (a) syringe borrowing and (b) syringe lending: Vancouver, British Columbia, 1998–2003

Note. VIDUS = Vancouver Injection Drug Users Study.

[a]Years of policy change.

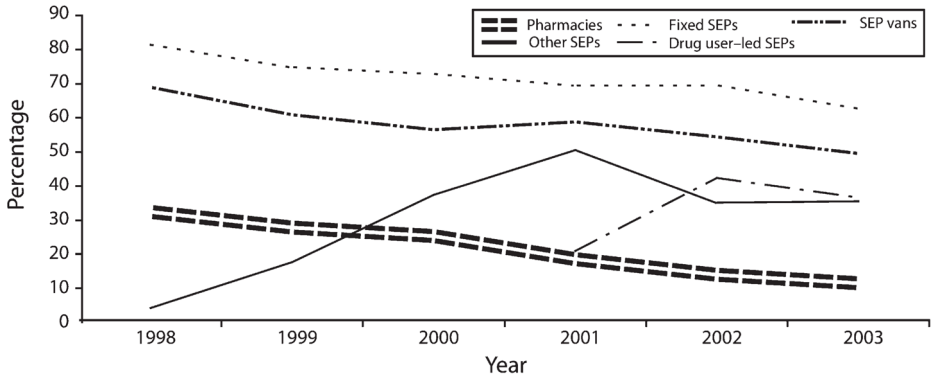

FIGURE 2. Proportion of VIDUS participants reporting access to various syringe distribution sources: Vancouver, British Columbia, 1998–2003

Note. SEP = syringe exchange program; VIDUS = Vancouver Injection Drug Users Study. "Other SEPs" refers to street nurses, hotel-based SEPs, health clinics, and the "Health Van"; drug user–led SEPs were implemented for the first time in 2001.

TABLE 1

Multivariate Generalized Estimating Equation of Factors Associated With Syringe Borrowing: Vancouver Injection Drug Users Study, Vancouver, British Columbia, 1998–2003

Characteristic	AOR (95% CI)	*P*
Age	0.97 (0.96, 0.98)	<.001
Gender (male vs female)	1.14 (0.92, 1.42)	.241
Aboriginal ancestry (yes vs no)	0.64 (0.50, 0.81)	<.001
Daily heroin injection (yes vs no)	1.31 (1.13, 1.52)	<.001
Daily cocaine injection (yes vs no)	1.34 (1.16, 1.54)	<.001
HIV-positive serostatus (yes vs no)	0.70 (0.56, 0.87)	.002
Period of interest (after 2001)	0.57 (0.49, 0.65)	<.001

Notes: AOR = adjusted odds ratio; CI = confidence interval.

TABLE 2

Multivariate Generalized Estimating Equation of Factors Associated With Syringe Lending: Vancouver Injection Drug Users Study, Vancouver, British Columbia, 1998–2003

Characteristic	AOR (95% CI)	*P*
Age	0.97 (0.96, 0.98)	<.001
Gender (male vs female)	1.63 (1.32, 2.03)	<.001
Aboriginal ancestry (yes vs no)	0.62 (0.49, 0.79)	<.001
Daily heroin injection (yes vs no)	1.53 (1.32, 1.79)	<.001
Daily cocaine injection (yes vs no)	1.20 (1.03, 1.41)	.021
HIV positive serostatus (yes vs no)	0.49 (0.39, 0.62)	<.001
Period of interest (after 2001)	0.52 (0.45, 0.60)	<.001

Notes: AOR = adjusted odds ratio; CI = confidence interval.

TABLE 3

Multivariate Cox Proportional Hazards Regression of Factors Associated With HIV Incidence: Vancouver Injection Drug Users Study, Vancouver, British Columbia, 1998–2003

Characteristic	AHR (95% CI)	*P*
Age	0.99 (0.97, 1.00)	.129
Gender (male vs female)	1.12 (0.77, 1.62)	.561
Aboriginal ancestry (yes vs no)	1.71 (1.19, 2.46)	.004
Daily heroin injection (yes vs no)	1.10 (0.76, 1.58)	.626
Daily cocaine injection (yes vs no)	3.19 (2.22, 4.57)	<.001
Unprotected sex[a] (yes vs no)	0.84 (0.57, 1.20)	.307
Period of interest (after vs before 2001)	0.13 (0.06, 0.31)	<.001

Notes: AHR = adjusted hazard ratio; CI = confidence interval.

[a]Unprotected vaginal or anal intercourse.