Sex-specific determinants of HIV infection among injection drug users in Montreal

Research

Recherche

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Abstract

Background: Sex-specific issues have not been extensively addressed in studies of HIV prevalence, despite the strong implications of differences between men and women in the risk of HIV transmission. The objective of this study was to examine sex-specific behaviours associated with HIV infection among injection drug users in Montreal.

Methods: A total of 2741 active drug users (2209 [80.6%] men) were recruited between 1988 and 1998. Information was sought on sociodemographic characteristics, drug-related behaviour and sexual behaviour, and participants were tested for HIV antibodies. Sex-specific independent predictors of HIV prevalence were assessed by stepwise logistic regression.

Results: The overall prevalence of HIV among study subjects was 11.1%; the prevalence was 12.0% among men and 7.5% among women. In multivariate models, a history of sharing syringes with a known seropositive partner (odds ratio [OR] for men 2.44, 95% confidence interval [CI] 1.72–3.46; OR for women 3.03, 95% CI 1.29–7.13) and of sharing syringes in the past 6 months (OR for men 0.61, 95% CI 0.44–0.85; OR for women 0.32, 95% CI 0.14–0.73) were independently associated with HIV infection. Other variables associated with HIV infection were homosexual or bisexual orientation, cocaine rather than heroin as drug of choice, frequency of injection drug use, and obtaining needles at a pharmacy or through needle exchange programs (for men only) and obtaining needles at shooting galleries and being out of treatment (for women only).

Interpretation: These results support the hypothesis that risk factors for HIV seropositivity differ between men and women. These sex-related differences should be taken into account in the development of preventive and clinical interventions.

During the past decade, injection drug use has been recognized as one of the major routes of HIV transmission in Canada. For example, approximately half of the estimated 3000 to 5000 new HIV infections identified in Canada in 1996 occurred in injection drug users.[1] Among women, the proportion of reported AIDS cases attributed to injection drug use has increased dramatically, from 6.4% in 1990 to 38.9% in 1998.[2]

Many cross-sectional studies[3–20] have identified factors associated with HIV infection among injection drug users. Several studies have found a high risk of HIV infection among those who inject primarily cocaine,[3–5] those who inject frequently[6–10] and those who attend shooting galleries.[5,7,10–13] Injection drug users also engage in high-risk sexual behaviours, such as sex with multiple partners, inconsistent use of condoms and prostitution, but these behaviours have not been consistently associated with HIV infection.[14–16] Characteristics of a disorganized lifestyle, such as unstable housing,[8,17] injecting outdoors[18,19] and being imprisoned,[6,20] were independently associated with a higher risk of HIV infection.

Sex-specific issues have not been extensively addressed in prevalence studies, despite the strong implications of a differential between men and women in the

risk of HIV transmission. Several authors have reported differences between the sexes in the social settings of injection, perceptions of risk and protection mechanisms,[14,21,22] but not in relation to HIV prevalence. Female injection drug users reportedly often had regular sexual partners who inject drugs,[23,24] and those obtaining used equipment did so predominantly from a sexual partner.[25] The role of the family, particularly the spouse, in determining needle-sharing behaviour was more important among women than among men.[26]

In 1988 we began a longitudinal study in downtown Montreal to monitor risk factors associated with HIV infection among active injection drug users. This report, based on data from the study, examines sex-specific behavioural patterns associated with HIV infection among injection drug users.

Methods

Injection drug users who had injected in the past 6 months and were residing in the greater Montreal area were eligible to participate; all participants gave informed consent. Participants were recruited from several sources: by self-referral (64.2% of the men and 44.5% of the women), from the Saint-Luc Detoxification Unit (18.2% of the men and 42.9% of the women), from collaborating institutions (3.4% of the men and 2.8% of the women) and from other sources such as health care centres and private physicians (14.1% of the men and 10.0% of the women).

At study entry, a trained nurse interviewed the participants using a structured questionnaire. After pretest counselling, a 30-mL blood sample was obtained by venipuncture for HIV antibody testing. During each visit, for which a stipend of $10 was given, referrals were provided for universal medical care, HIV/AIDS care, drug and alcohol treatment, and counselling. Recruitment to the study has been stable since 1988, and on average 23 new subjects are enrolled each month. In this paper, we report results from the entry questionnaire for 2741 participants recruited from Sept. 15, 1988, to Oct. 1, 1998.

The baseline questionnaire elicited detailed information for periods of the past month, the previous 6 months and the person's lifetime. Specifically, it covered sociodemographic characteristics, history of drug use, current drug use, injection behaviour, acquisition of syringes, sexual behaviour, utilization of health and addiction treatment services, previous HIV testing and reported results, and medical history. For the purposes of this study, sharing syringes was defined as reuse of blood-contaminated syringes.

Serological screening for HIV antibodies was performed in the microbiology laboratory at Saint-Luc Hospital, Centre hospitalier de l'Université de Montréal, with an enzyme-linked immunosorbent assay (ELISA). All samples that tested positive were retested by ELISA, and such results were confirmed by the Western blot technique, performed at the Laboratoire de santé publique du Québec in Montreal.

Data for men and women were analyzed separately. Sociodemographic, drug consumption and sexual behaviour variables were compared according to the serostatus of participants at enrolment. Logistic regression was used to calculate crude odds ratios (ORs) and 95% confidence intervals (CIs) for categories of each variable. For ordinal variables, a dose–response trend test was based on the Wald statistic.

For each sex, independent factors associated with HIV prevalence at baseline were assessed by stepwise logistic regression. Only the most informative variables were used at this stage, as determined by substantive knowledge, preliminary univariate analysis and assessment of collinearity. Although no correlation coefficient greater than 0.6 was found, time since first injection was the only time-related variable considered in the stepwise procedure for both models. We used p values of 0.10 and 0.15 for inclusion and removal of variables respectively. To account for potential historical trends, we assessed all interactions between entry period (3 categories) and each variable in the final models.

Results

From Sept. 15, 1988, to Oct. 1, 1998, 2741 subjects (2209 men and 532 women) consented to participate in the study, completed the baseline questionnaire and provided a venous sample for HIV testing. Median age at entry was 32 (range 14–63) years; the median age for women was lower than that for men (30 v. 34 years). French was the mother tongue for 2189 (79.9%) of the participants; English was the mother tongue for another 378 (13.8%). Most participants were single (2299 [83.9%]) and unemployed (2518 [91.9%]), and 1572 (57.4%) had less than 12 years of education. Mean duration of injection drug use was 9.8 years. Of the 304 participants who tested positive for HIV, 176 (57.9%) had been previously tested, and 84 (27.6%) were aware of their seropositive status before the enrolment interview. The prevalence of HIV antibody was 11.1% (95% CI 10.0% to 12.3%) for all subjects, 12.0% (95% CI 10.7% to 13.4%) for men, and 7.5% (95% CI 5.6% to 10.1%) for women.

Table 1 shows the crude ORs for HIV seropositivity at entry and the variables independently associated with HIV infection for men. Male subjects who were seropositive at study entry were older than those who were seronegative at entry, were more likely to have French as their mother tongue and were more likely to have less than high school education. Cocaine rather than heroin as the drug of choice was strongly associated with seropositivity at entry. Reported sharing of syringes (for both lifetime and over the past 6 months) was high among both HIV-positive and HIV-negative subjects, and 1594 (72.2%) of the male subjects reported sharing at least once in the past 6 months. After adjustment for other factors, male injection drug users who had shared syringes in the previous 6 months were at lower risk of being HIV positive (OR 0.61, 95% CI 0.44–0.85 [Table 1]). However, in a reanalysis excluding the 76 HIV-positive subjects who were aware of their seropositive status at the time of recruitment, there was no relation between sharing syringes and HIV seropositivity (OR 0.82, 95% CI 0.57–1.21).

Analyses to identify changes in the effects of variables over time showed that the period when the subject entered the study affected the relation between use of a pharmacy for obtaining syringes and seropositive status. The OR for HIV-positive status given use of a pharmacy was 16.3 (95%

CI 2.1–126.0) for the subset of injection drug users recruited between September 1988 and December 1991, whereas the same OR for subjects recruited between January 1992 and October 1998 was 1.24 (95% CI 0.80–1.88).

Table 1: Sociodemographic, drug consumption and sexual behaviour variables associated with HIV seropositivity at study entry among 2209 male injection drug users in Montreal

Variable	No. of subjects	No. (and %) HIV positive		Crude analysis, OR (and 95% CI)		Multivariate analysis, OR (and 95% CI)	
Sociodemographic characteristics							
Period of entry into study							
Sept. 1988 to Dec. 1991	527	58	(11.0)	1.0		1.0	
Jan. 1992 to June 1995	860	108	(12.6)	1.16	(0.83–1.63)	0.86	(0.58–1.29)
July 1995 to Oct. 1998	822	98	(11.9)	1.09	(0.78–1.55)	0.54	(0.34–0.85)
Trend test				$p = 0.69$			
Language (mother tongue)							
French	1768	235	(13.3)	1.0		1.0	
English	295	26	(8.8)	0.63	(0.41–0.96)	0.72	(0.45–1.15)
Other	146	3	(2.1)	0.14	(0.04–0.43)	0.24	(0.07–0.78)
HIV-positive acquaintances							
0	984	60	(6.1)	1.0		1.0	
≥1	1225	205	(16.7)	3.08	(2.28–4.16)	2.19	(1.53–3.13)
Drug-related behaviour							
Drug of choice							
Heroin	437	16	(3.7)	1.0		1.0	
Cocaine	1467	222	(15.1)	4.69	(2.79–7.89)	4.41	(2.40–7.14)
Other	305	26	(8.5)	2.45	(1.29–4.65)	3.27	(1.64–6.52)
Time since first injected drugs, yr							
< 3	552	46	(8.3)	1.0		1.0	
3–7	525	68	(13.0)	1.64	(1.10–2.43)	1.30	(0.84–2.01)
8–15	530	72	(13.6)	1.73	(1.17–2.56)	1.37	(0.89–2.12)
≥ 16	602	78	(13.0)	1.64	(1.11–2.40)	1.24	(0.80–1.92)
Trend test				$p = 0.02$		$p = 0.40$	
No. of injections in past month							
0	435	28	(6.4)	1.0		1.0	
1–29	687	75	(10.9)	1.78	(1.13–2.80)	1.82	(1.12–2.94)
30–100	610	84	(13.8)	2.32	(1.48–3.63)	2.12	(1.28–3.50)
> 100	477	77	(16.1)	2.80	(1.78–4.40)	2.26	(1.35–3.78)
Trend test				$p < 0.001$		$p = 0.004$	
Shared syringes in past 6 mo*							
No	615	80	(13.0)	1.0		1.0	
Yes	1594	183	(11.5)	0.87	(0.66–1.16)	0.61	(0.44–0.85)
Ever shared syringes outside Montreal							
No	1718	215	(12.5)	1.0		1.0	
Yes	491	49	(10.0)	0.78	(0.56–1.08)	0.58	(0.40–0.84)
Ever shared syringes with HIV-positive person							
No or don't know	1910	182	(9.5)	1.0		1.0	
Yes	295	82	(27.8)	3.66	(2.72–4.93)	2.44	(1.72–3.46)
Obtained syringes at pharmacy in past 6 mo							
No	473	37	(7.8)	1.0		1.0	
Yes	1736	227	(13.1)	1.77	(1.23–2.55)	1.48	(0.99–2.20)
Obtained syringes from NEP in past 6 mo							
No	1094	75	(6.9)	1.0		1.0	
Yes	1115	190	(17.0)	2.77	(2.09–3.68)	2.12	(1.56–2.89)
History of drug consumption in prison							
Never imprisoned	546	39	(7.1)	1.0		1.0	
Imprisoned but never injected drugs	1484	194	(13.1)	1.97	(1.37–2.82)	1.61	(1.08–2.40)
Imprisoned and injected drugs with or without sharing syringes	179	30	(16.8)	2.62	(1.57–4.36)	2.52	(1.40–4.52)
Sexual behaviour							
Sexual orientation							
Heterosexual	2003	208	(10.4)	1.0		1.0	
Homosexual or bisexual	206	56	(27.2)	3.22	(2.30–4.52)	2.46	(1.64–3.71)
No. of sex partners in past 6 mo							
0	929	126	(13.6)	1.0		1.0	
1	457	49	(10.7)	0.77	(0.54–1.09)	0.69	(0.45–1.07)
≥ 2	823	89	(10.8)	0.77	(0.58–1.03)	0.51	(0.35–0.73)
Ever been a prostitute							
No	1806	179	(9.9)	1.0		1.0	
Yes	398	85	(21.4)	2.48	(1.86–3.29)	1.53	(1.08–2.17)

Note: OR = odds ratio, CI = confidence interval, NEP = needle exchange program.
*Reused a syringe already used by someone else.

Table 2 shows the crude ORs of HIV seropositivity at entry and the variables independently associated with HIV infection for women. In unadjusted analyses, female subjects who acquired syringes through needle exchange programs had a higher risk of being HIV seropositive (crude OR 1.93, 95% CI 1.00–3.75). This was also true for women who acquired their syringes at shooting galleries (crude OR 3.07, 95% CI 1.32–7.15), although women who obtained their syringes from pharmacies and dealers were not at increased risk of HIV seropositivity. In the adjusted model, only acquisition of syringes at a shooting gallery was associated with a higher risk of HIV seropositivity, although this finding was of borderline significance (Table 2; OR 2.51, 95% CI 0.88–7.19, $p = 0.09$).

According to multivariate analyses, sharing syringes with a known seropositive partner was the only variable positively associated with HIV infection for both men and women. Sharing syringes in the past 6 months was negatively associated with prevalence of HIV for both sexes.

Interpretation

In our study, HIV seroprevalence was higher among men (12.0%, 95% CI 10.7% to 13.4%) than among women (7.5%, 95% CI 5.6% to 10.1%). We postulate that this difference might be due to differential self-selection

Table 2: Sociodemographic, drug consumption and sexual behaviour variables associated with risk of HIV seropositivity at study entry among 532 female injection drug users in Montreal

Variable	No. of subjects	No. (and %) HIV positive	Crude analysis, OR (and 95% CI)	Multivariate analysis, OR (and 95% CI)
Sociodemographic characteristics				
Period of entry into study				
Sept. 1988 to Dec. 1991	145	15 (10.3)	1.0	1.0
Jan. 1992 to June 1995	196	8 (4.1)	0.37 (0.15–0.90)	0.32 (0.11–0.90)
July 1995 to Oct. 98	191	17 (8.9)	0.85 (0.41–1.76)	0.51 (0.21–1.29)
Trend test			$p = 0.76$	$p = 0.25$
Drug-related behaviour				
Drug of choice				
Heroin	216	9 (4.2)	1.0	1.0
Cocaine	261	28 (10.7)	2.77 (1.27–5.99)	1.94 (0.81–4.62)
Other	55	3 (5.5)	1.33 (0.35–5.08)	0.63 (0.13–3.02)
Time since first injected drugs, yr				
< 3	204	4 (2.0)	1.0	1.0
3–7	130	8 (6.2)	3.27 (0.97–11.1)	3.54 (0.97–12.9)
8–15	133	20 (15.0)	8.84 (2.95–26.5)	7.38 (2.14–25.4)
≥ 16	65	8 (12.3)	7.00 (2.04–24.1)	4.56 (1.14–18.3)
Trend test			$p < 0.001$	$p = 0.008$
Shared syringes in past 6 mo				
No	131	14 (10.7)	1.0	1.0
Yes	401	26 (6.5)	0.58 (0.29–1.15)	0.32 (0.14–0.73)
Ever shared syringes with HIV-positive person				
No or don't know	462	26 (5.6)	1.0	1.0
Yes	69	14 (20.3)	4.27 (2.11–8.68)	3.03 (1.29–7.13)
Obtained syringes in shooting gallery in past 6 mo				
No	487	32 (6.6)	1.0	1.0
Yes	45	8 (17.8)	3.07 (1.32–7.15)	2.51 (0.88–7.19)
Currently out of treatment				
No	330	21 (6.4)	1.0	1.0
Yes	202	19 (9.4)	1.54 (0.80–2.92)	2.94 (1.30–6.66)
History of drug consumption in prison				
Never imprisoned	320	10 (3.1)	1.0	1.0
Imprisoned but never injected drugs	207	28 (13.5)	4.85 (2.30–10.2)	1.94 (0.81–4.64)
Imprisoned and injected drugs with or without sharing syringes	5	2 (40.0)	20.70 (3.10–137.30)	4.44 (0.39–50.3)
Sexual behaviour				
Sexual intercourse in prison				
No or not applicable*	510	33 (6.5)	1.0	1.0
Yes	22	7 (31.8)	6.74 (2.57–17.7)	3.23 (0.98–10.7)

*Not applicable indicates that subject was never imprisoned.

bias: recruited women were younger than men, a greater proportion of women than men reported heroin as their drug of choice (39.2% v. 19.5%), and a greater proportion of women than men were in treatment (62.0% v. 37.2%).

Duration of injection drug use was associated with HIV prevalence among women but not men in the multivariate model. Use of cocaine (rather than heroin) was independently associated with HIV prevalence among men, a finding that corroborated previous findings.[5,7,9] We therefore hypothesized that heavy cocaine users may become infected earlier in the course of their injection history. Cocaine use as an independent risk factor for HIV infection cannot be explained solely by related risk behaviours and might be attributable to unmeasured factors, such as patterns of drug use and high-risk behaviours during cocaine binges. Users who inject cocaine often describe losing both insight and control while on binges, which could lead them to inject more of the drug and to take greater sexual risks. Such behaviours might not have been captured by our structured questionnaire.

Injection drug users in Montreal have access to sterile equipment without prescription through pharmacies, needle exchange programs and other sources. Despite the fact that reuse of syringes was not associated with prevalence of HIV, sharing syringes was reported frequently by both HIV-positive and HIV-negative subjects, an unexpected finding in a setting where needles and syringes are legally accessible. Aside from misclassification, this finding may reflect the persistence of high-risk behaviour among injection drug users in a setting where low-cost cocaine is readily accessible. This is especially likely during sporadic periods when needles are unavailable from needle exchange programs. In this study, sharing syringes in the past 6 months was negatively associated with HIV prevalence among both sexes. This finding can be partially explained by the fact that knowledge of HIV status influences equipment-sharing behaviour. In analyses excluding subjects who knew that they were HIV positive, there was no significant risk associated with sharing needles and syringes (OR including all subjects 0.61, 95% CI 0.44–0.85; OR excluding 76 HIV-positive subjects who knew their HIV status 0.82, 95% CI 0.57–1.21).

HIV-positive men were more likely than HIV-negative men to report obtaining their syringes at a pharmacy or from needle exchange programs. In addition, HIV-positive men entering the study before 1991 (the early days of needle exchange programs) were more likely to obtain syringes from a pharmacy than those entering the study in the later entry periods. This self-selection of high-risk and seropositive individuals at needle exchange programs has also been observed in San Francisco,[27] Vancouver[28] and Baltimore.[29] It has been interpreted as showing the positive public health impact of such programs in reaching marginalized injection drug users. HIV-positive women were more likely to obtain syringes from shooting galleries than were HIV-negative women. This finding is consistent with results of a study showing that HIV-positive women tend to adopt behaviours that protect their partners more frequently than they adopt behaviours that protect themselves.[30]

Sexual risk behaviours are difficult to assess in HIV prevalence studies because of their association with high-risk injection behaviours and because of their sex-specific characteristics. Because of the relatively small number of women in our study, we were able to address these issues to only a limited extent. This limitation might account for the fact that some sexual behaviour variables, such as prostitution, appeared to be significant predictors of HIV seropositivity only among men.

Men who reported more than one sexual partner in the previous 6 months were less likely to be seropositive than those reporting no sexual partners. There may be several reasons for this finding, including loss of libido with heavy use of injection drugs and poor general health related directly or indirectly to HIV status. This raises the issue of partner notification and support for HIV-discordant couples, given injection drug use by one or both partners.

Among women, being out of addiction treatment was associated with seropositivity in the multivariate model. We interpreted this finding as suggestive of the difficulty faced by HIV-positive women in accessing addiction services. Overall, only 1152 (42.0%) of injection drug users were in addiction treatment at the time of recruitment into the study. Countries such as Switzerland have established policies to increase accessibility to a variety of programs and have increased the proportion of drug users in contact with treatment resources.[31] The duration of addiction treatment has been associated with a lower incidence of HIV infection,[32] and strategies to increase accessibility and retain high-risk injection drug users in the health system could improve prevention efforts.

Among men, a lifetime history of imprisonment was independently associated with HIV seropositivity, and the risk of infection among those who reported having injected drugs in prison was approximately 2.5 times greater than among those who did not report such activity. In a study conducted in a provincial prison setting, Hankins and associates[33] reported that 73% of men and 15% of women had taken drugs while in prison. In our study a greater proportion of seropositive women than seronegative women reported having had sexual intercourse while in prison. This difference was also observed in New York,[19] where sex with other women was associated with HIV seropositive status among female prison inmates.

As in other studies involving voluntary recruitment, our study has limited potential for generalization. Given the site of the study, it is likely that high-risk and older, long-term injection drug users were overrepresented. Women constituted only about 20% of the study group, as passive recruitment (by word of mouth) was less successful for women than for men. This difference meant that the proportion of women in addiction treatment at baseline was different from the proportion of men. In view of this differential selection, we took a conservative approach and chose not to directly compare men and women.

Another shortcoming is the validity and reliability of self-reported behavioural data among injection drug users, a concern raised in previous studies.[34,35] In the present study, all information was collected in a private room in face-to-face interviews by trained and experienced nurses, who sought to establish a rapport and to build the confidence of participants. To minimize the risk of false reporting of injection drug use, interviewers inspected skin tracks of injections and questioned participants about injection techniques before enrolment in the study.

Finally, this study, unlike incidence studies, should not be used to identify predictors of seroconversion. Rather, its findings present a picture of behaviours encountered in long-term injection drug users of both sexes in Montreal. This information may be useful in identifying the needs of these drug users and in planning interventions.

Injection drug use represents an important source of HIV transmission. Although clean syringes are theoretically accessible, it appears that needle distribution programs have partly failed to alter high-risk situations. Even with the implementation of comprehensive needle exchange programs and outreach work, health care and drug treatment programs have failed to attract and retain injection drug users.

Differences between female and male addicts in terms of interpersonal relationships, use of other substances, drug dealing, legal employment and criminal behaviours often parallel traditional role expectations of the sexes.[36] In this study, we could not directly compare men's and women's behaviours related to HIV infection. However, our data support the hypothesis that risk factors and processes related not only to sexual behaviours, but also to the social contexts of drug use and service utilization, might differ with regard to HIV prevalence among men and women.

Our results raise questions about potential barriers to accessibility for HIV-positive women at pharmacies, needle exchange programs and addiction treatment programs. Women have special needs and fears with regard to their children. Prevention policies for prison inmates, both men and women, should be adapted to specific needs. Finally, along with focused programs such as needle exchange programs, community agencies, outreach and addiction treatment, mainstream services must reach out to and welcome injection drug users and establish a continuum of care from street level to addiction treatment.

Competing interests: None declared.

Contributors: Dr. Bruneau oversaw the project. She was involved in the data analysis, drafted the paper and participated in revisions. Dr. Lamothe commented on the data analysis; he was involved in writing an early version of the paper and commented on the revisions. Dr. Soto worked on the analytical design, contributed to the interpretation of the results, and was involved in writing the initial version of the manuscript. Ms. Lachance performed most of the statistical analysis and commented on several versions of the manuscript. Dr. Vincelette was responsible for the laboratory testing of the cohort and contributed to the discussion of the results in the paper. Ms. Vassal coordinated the research of the Saint-Luc Cohort and commented on the manuscript. Dr. Franco provided advice at all stages of data analysis and manuscript preparation. He also contributed directly to the writing of the interpretation section.

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