

Females Experiencing Sexual and Drug Vulnerabilities Are at Elevated Risk for HIV Infection Among Youth Who Use Injection Drugs

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Objectives: To compare sociodemographic, drug-related, and sexual risk variables between young (13–24 years of age) and older (≥ 25 years of age) injection drug users (IDUs); and to determine HIV prevalence and associated risk factors for HIV infection among young IDUs.

Methods: Data were collected through the Vancouver Injection Drug Users Study (VIDUS). To date, over 1400 Vancouver area IDUs have been enrolled and observed during follow-up. Sociodemographic, drug-related, and sexual risk variables were compared between younger and older IDUs using nonparametric methods. Mantel-Haenszel and logistic regression methods were used to compare HIV-positive and HIV-negative female youth.

Results: Younger injectors ($N = 232$) were more likely to be female; work in the sex trade; report condom use; inject heroin daily; smoke crack cocaine daily; and need help injecting. HIV prevalence at baseline among the youth was 10%. HIV prevalence was associated with female gender; history of sexual abuse; engaging in survival sex; injecting heroin daily; injecting speedballs (a mixture of heroin and cocaine) daily; and having numerous lifetime sexual partners.

Conclusion: Our data show that HIV positivity among young IDUs is concentrated among females engaged in dual sexual and drug-related risk exposure categories. Over half the HIV-positive youth were Aboriginal (a classification used by the federal government in Canada to include native peoples of all ethnic groups). Targeted interventions that take into account sexual and drug risk for young female and Aboriginal peoples are urgently needed.

Key Words: Adolescence—HIV—Females—Injection drug use—Aboriginal—Risk factors.

Youth are of particular importance with respect to HIV/AIDS, not only because they are at risk for infection, but it is during this period of life when many behavior patterns are established that will affect their future risk of HIV infection (1). The HIV epidemic among

youth is well established and growing (2–4). The United Nations estimates there are 6,400,000 females and 3,900,000 males aged 15–24 living with HIV around the globe (5). In Canada, age at infection has decreased from age 32 before 1983 to 23 in 1990 (6), and in the United States rates of HIV infection among female adolescents have tripled between 1985 and 1999 (7).

Youth at higher risk for HIV infection include those who use injection drugs (IDUs) (1, 8). Some cohort studies of IDUs have reported that younger age and more recent initiation into injection are associated with increased risk for HIV (9–11). This is troubling, particu-

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larly in light of recent school-based surveys that suggest that between 3% and 9% of high school students report use of injection drugs (12,13). Other studies have found that young female IDUs were particularly vulnerable to HIV infection, likely because of sexual and drug-related risk factors(3,14).

We undertook this study to characterize sociodemographic characteristics and sexual and drug-risk factors among young IDUs in a city where an ongoing HIV epidemic among IDUs has occurred (15). The objectives were to determine sociodemographic, drug, and sexual differences between younger and older IDUs and to investigate risk factors for HIV infection among the younger IDUs.

METHODS

Data were collected within a prospective open cohort study of IDUs, The Vancouver Injection Drug Users Study (VIDUS). A description of this study has been previously published (15). VIDUS has recruited over 1400 IDUs from the Vancouver, British Columbia area in western Canada since May 1996. The study office is located in the Downtown Eastside (DTES) district of Vancouver. The DTES is Vancouver's poorest neighborhood and many of the city's IDUs reside in an area of approximately 10 city blocks where inexpensive housing in the form of hotels and single room occupancy residences (SROs) abound.

Eligibility criteria for the study included residing in the city of Vancouver and surrounding municipalities and having injected drugs in the previous month. There were no age restrictions. Participants were administered a questionnaire by trained nurse-interviewers and were eligible to return for follow-up every 6 months. At each visit, eligible participants were tested for HIV and hepatitis C virus infection through venous blood sampling. This analysis is based on data from the enrollment questionnaire, administered between May 1996 and November

2000. This study was approved by the St.Paul's Hospital Committee on Human Experimentation.

For the purposes of this study, young IDUs were defined as those aged 24 or younger at the time of recruitment. Younger and older injectors were compared using contingency table analysis. Similarly, HIV-positive younger and older participants and HIV-positive and HIV-negative young female injectors were compared to determine risk factors for HIV positivity among the youth. All risk factor variables refer to behaviors and circumstance in the 6 months before the questionnaire. Selected variables of interest are defined as follows: *survival sex* refers to trading sex for money drugs or shelter; *condom use* is always; *help injecting* is any; and *sexual abuse* is ever. χ^2 and Fisher exact tests were used to compare categorical variables, whereas Wilcoxon rank-sum tests were used to compare continuous variables. Logistic regression models were used to identify independent predictors of HIV-positivity among the young female IDUs. Forward stepwise regression was used involving all variables that were significant ($p < .10$) in bivariate analyses. Those significant at $p < .05$ were retained in the final model. All reported p values are two-sided.

RESULTS

In total, 1437 participants eligible for this analysis. Of them, 232 were aged 13 to 24 years (median age, 21) and 1205 were older than 24 years (median age, 36) at baseline. As would be expected, the duration of injection career was much shorter in the young injectors compared with the older injectors (median 3 years vs. 13 years; $p < .001$). Age at first injection was also much lower among the youth (median age, 17 vs. 20; $p < .001$). The baseline prevalence of HIV at baseline was also lower in the young injectors (10.0% vs. 23.5%).

The variables in Table 1 compare baseline sociodemographic, sexual, and drug-risk variables between the young and older VIDUS participants. Young injectors

TABLE 1. A comparison of sociodemographic and sexual and drug risk variables between young injection drug users (IDUs) (≤ 24 years) and older IDUs (> 24 years) in the VIDUS cohort

	Younger IDUs, n (%)	Older IDUs, n (%)	Odds ratios ^a (95% CI)	<i>p</i> value ^b
Totals	232 (16)	1205 (84)		
Female	117 (50)	388 (32)	2.1 (1.6–2.8)	.001
Aboriginal	56 (24)	306 (25)	0.9 (0.7–1.3)	.686
Incarceration	72 (31)	407 (34)	0.9 (0.7–1.2)	.417
Any high school	162 (70)	1006 (83)	0.5 (0.3–0.6)	.001
Sex trade	96 (41)	292 (24)	2.2 (1.7–2.9)	.001
Casual sexual partners	106 (46)	363 (30)	2.0 (1.5–2.6)	.001
Condom use with casual partners	61 (26)	186 (15)	2.0 (1.4–2.7)	.001
>20 Lifetime sexual partners	140 (60)	808 (67)	0.7 (0.6–1.0)	.048
Sexual abuse	89 (38)	429 (36)	1.1 (0.8–1.5)	.423
Heroin use ≥ 1 /day	119 (51)	478 (40)	1.6 (1.2–2.1)	.001
Cocaine use ≥ 1 /day	77 (33)	559 (46)	0.6 (0.4–0.8)	.001
Speedball use ≥ 1 /day	33 (14)	205 (17)	0.8 (0.5–1.2)	.295
Crack cocaine use ≥ 1 /day	40 (17)	115 (10)	2.0 (1.3–2.9)	.001
Needle borrowing	97 (42)	454 (38)	1.2 (0.9–1.6)	.236
Needle lending	85 (37)	440 (37)	1.0 (0.8–1.3)	.971
Help injecting	123 (53)	470 (39)	1.8 (1.3–2.3)	.001

^a Mantel-Haenszel method.

^b All reported p values are two-sided.

were more likely to be female; engage in commercial sex work; have casual sexual partners; report using condoms with casual sexual partners; inject heroin daily; use crack cocaine daily; and require help when injecting. Young injectors were less likely to have any high school education, to have >20 lifetime sexual partners, and to inject cocaine on a daily basis. There was no statistical difference between the young and older participants with respect to being Aboriginal (see abstract); having a history of incarceration; injecting speedballs daily; needle-sharing behaviors; and having a history of sexual abuse.

Table 2 compares sociodemographic and risk variables between young and older VIDUS participants who were HIV positive at the baseline questionnaire. As would be expected, the median age between the younger and older HIV-positive participants differed (median 22 vs. 35; $p < .001$), as did the number of years injecting (median 7 vs. 13; $p < .001$), and age at first injection (median, 16 vs. 20; $p < .001$). Young seropositive participants were more likely to be female, to work in the commercial sex trade, to have experienced sexual abuse, to have had more than 20 lifetime sexual partners, to inject heroin and speedballs at least daily, and to use crack cocaine at least daily. Young participants were marginally more likely to be Aboriginal and less likely to be married or living in common law relationships. There was no difference between the two groups with respect to casual sexual partners; condom use with casual sexual partners; daily cocaine injection; requiring help to inject; and needle sharing. In a multivariate model (data not shown) young injectors were significantly more likely to

be female and to inject speedballs on an at least daily basis.

Of the 232 young injectors, 23 were HIV positive at baseline and 209 were HIV negative. Of the 23 seropositive youth, 20 (87%) were female. Owing to the very high proportion of females affected and to control for collinearity, Table 3 compares risk factors between young HIV-positive and HIV-negative females. HIV-positive young females were older (median, 22 vs. 20; $p < .001$), had a greater number of years injecting (median 6.5 vs. 2; $p < .001$); however, age at first injection did not differ (median 16 vs. 16; $p < .213$). The HIV-positive female youth were more likely to work in commercial sex trade, to have had more than 20 lifetime partners, and to inject speedballs daily. HIV-positive female youth were less likely to have a regular sexual partner and to always use condoms with casual sexual partners. They were marginally less likely to have casual sexual partners. There was no statistical difference between the two groups with respect to using condoms with casual sexual partners, injecting heroin daily, and smoking crack at least daily.

Table 4 presents the results of our logistic regression modeling for independent predictors of seropositivity among the young female injectors. The final model shows that increased age, injecting for a longer period of time, and daily speedball injection were independently associated with HIV positivity. Having a regular sexual partner was a protective factor among the young females.

Finally, Table 5 presents a profile of the 23 (10%) HIV-positive youth, including sociodemographic, sex-

TABLE 2. A comparison of sociodemographic and risk variables between HIV-positive younger and older VIDUS participants

	HIV-positive Young IDUS, n (%)	HIV-positive older IDUs, n (%)	Odds ratios ^a (95% CI)	<i>p</i> value ^b
Totals	23 (10)	285 (24)		
Female gender	20 (87)	111 (39)	10.5 (3.7–29.2)	.001
Aboriginal	12 (52)	94 (33)	2.2 (0.9–5.1)	.062
Married	1 (4)	76 (27)	0.1 (0.0–0.7)	.017
Sex trade	20 (87)	98 (34)	12.7 (4.7–34.6)	.001
Sexual abuse	16 (70)	116 (41)	3.3 (1.4–8.0)	.007
Casual sexual partners	7 (30)	79 (28)	1.1 (0.5–2.9)	.780
Condom w/casual sex partners	3 (13)	58 (28)	0.4 (0.1–1.3)	.128
>20 lifetime sexual partners	22 (96)	177 (62)	13.4 (2.8–64.9)	.001
Heroin use frequency	12 (52)	85 (30)	2.6 (1.1–5.9)	.026
Cocaine use frequency	13 (57)	161 (56)	1.0 (0.4–2.4)	.998
Speedball use frequency	11 (48)	65 (23)	3.1 (1.4–7.1)	.007
Crack cocaine use frequency	6 (26)	28 (10)	3.2 (1.2–8.5)	.017
Needle borrowing	8 (35)	109 (38)	0.9 (0.4–2.1)	.742
Needle lending	8 (35)	93 (33)	1.1 (0.5–2.7)	.833
Help injecting	13 (57)	115 (40)	1.9 (0.8–4.5)	.130

^a Mantel-Haenszel method.

^b All reported *p* values are two-sided.
IDU, injection drug user; CI, confidence interval.

TABLE 3. A comparison of sociodemographic and risk variables between HIV-positive and HIV-negative young female VIDUS participants

	HIV-positive young female IDUs, n (%)	HIV-negative young female IDUs, n (%)	Odds ratios ^a (95% CI)	p value ^b
Totals	20 (17)	97 (83)		
Aboriginal	9 (45)	29 (30)	1.9 (0.7, 5.1)	.189
Sex trade	19 (95)	57 (59)	13.3 (2.6, 69.3)	.002
Sexual abuse	15 (75)	58 (60)	2.0 (0.7, 5.9)	.201
Any high school	11 (55)	67 (69)	0.5 (0.2, 1.5)	.224
Regular sexual partner	6 (30)	58 (60)	0.3 (0.1, 0.8)	.015
Casual sexual partners	4 (20)	42 (43)	0.3 (0.1, 1.0)	.052
Condom w/casual sexual partners	1 (5)	25 (26)	0.2 (0.0, 0.9)	.042
>20 Lifetime sexual partners	20 (100)	64 (66)	21.3 (1.2, 363.1)	.002
Heroin use frequency	11 (55)	57 (59)	0.9 (0.3, 2.3)	.756
Cocaine use frequency	10 (50)	32 (33)	2.0 (0.8, 5.3)	.149
Speedball use frequency	10 (50)	10 (10)	8.7 (3.2, 23.5)	.001
Crack cocaine use frequency	6 (30)	17 (18)	2.0 (0.7, 5.9)	.201
Needle borrowing	7 (35)	42 (43)	0.7 (0.3, 1.9)	.493
Needle lending	8 (40)	38 (39)	1.0 (0.4, 2.8)	.945
Help injecting	13 (65)	64 (66)	1.0 (0.3, 2.6)	.933

^a Mantel-Haenszel method.

^b All reported *p* values are two-sided.

ual, and drug risk factors. This profile shows the highest burden of infection is in young females. The three young males who were seropositive at baseline were all Aboriginal; these three all injected cocaine daily, and one of them engaged in commercial sex work. Most of the youth engaged in multidrug use on a daily basis, including heroin and cocaine injection and, in some cases, speedballs and crack. A low proportion of the youth reported always using condoms with regular and casual sexual partnerships, but, interestingly, many of the youth reported always using a condom with clients.

DISCUSSION

Among young IDUs in Vancouver, female youth are at highest risk for HIV infection. Typically, in IDU cohorts, the ratio of females to males is approximately one third to two thirds (15–17). However, among VIDUS youth, the split is about 50% between females and males. Another study of young IDUs, the REACH cohort in Bal-

timore Maryland, had a similar ratio of young female and male participants (10). Whether these findings reflect a selection bias or are indicative of young females becoming IDUs earlier than their male counterparts requires further investigation.

In our study, we found the HIV baseline prevalence was much higher among young females than young males (17 vs. 3). Doherty et al. (18) also found higher baseline HIV prevalence, although not significant (17 vs. 11), among young female participants in the REACH cohort (10). In both cases, the female IDUs had unique risk profiles of combined sexual and drug related risk (18). Other studies of young IDUs have similarly found that female IDUs have higher risk profiles (19,20). These findings have important implications for prevention and addiction treatment of young IDUs and warrant further explorations into the unique characteristics and risk factors for young female IDUs.

We found similar proportions of Aboriginal youth compared with older IDUs in VIDUS; however, Aboriginal people are far overrepresented among the IDU population in the VIDUS cohort and across Canada (21). Half the HIV-positive female youth and all of the young males were Aboriginal participants. Aboriginal populations in North America have shouldered the burden of increased rates of morbidity and mortality, and HIV/AIDS has devastating potential in these communities. The respective national centers for disease control in Canada and the United States have identified the Aboriginal and Amerindian/Native American nations as increasingly vulnerable to the epidemic; collaborative research in these populations is urgently needed to stem the tide of new infections (22, 23).

TABLE 4. Logistic regression analysis in which the outcome was HIV positivity among the female youth (≤ 24 years of age)

	Unadjusted odds ratios (95% CI)	Adjusted odds ratios (95% CI)
Increased age		
Per year	7.7 (2.6–22.8)	1.7 (1.3–2.3)
Speedball		
$\geq 1/\text{day}$	1.3 (1.1–1.6)	7.5 (1.9–30.0)
Regular sexual partner		
Yes vs. no	7.8 (3.4–17.9)	0.2 (0.0–0.6)
Education		
Yes vs. no	1.3 (1.2–1.5)	0.3 (0.1–0.9)

CI, confidence interval.

TABLE 5. Profile of sociodemographic, sexual, and drug risk factors among the youth (≤24 years of age)

	Gender	Ethnicity	Age (years)	Sex trade	>20 lifetime sexual partners	Daily heroin use	Daily cocaine use	Daily speedball use ^a	Daily crack cocaine use	Condom with regular sexual partner	Condom with casual sexual partner	Condom with commercial sex clients
1	F	O	22	Y	Y	Y	Y	N	Y	N	Y	Y
2	F	O	22	Y	Y	N	Y	N	Y	N	N	Y
3	F	O	24	Y	Y	Y	Y	Y	N	Y	N	Y
4	F	O	20	Y	Y	Y	Y	Y	N	N	N	N
5	F	O	22	Y	Y	Y	Y	Y	Y	N	N	Y
6	F	O	21	Y	Y	Y	Y	Y	Y	N	N	N
7	F	O	17	Y	Y	Y	Y	Y	N	N	N	N
8	M	A	24	N	N	N	Y	N	Y	N	Y	N
9	F	O	21	Y	Y	Y	Y	N	Y	N	N	Y
10	F	A	24	Y	Y	Y	Y	Y	Y	N	N	Y
11	F	A	23	Y	Y	Y	Y	N	Y	N	N	Y
12	F	A	21	N	Y	N	Y	N	Y	N	N	N
13	M	A	23	N	Y	Y	Y	N	Y	N	N	N
14	F	O	22	Y	Y	Y	Y	Y	Y	N	N	Y
15	F	O	23	Y	Y	Y	N	N	N	Y	N	Y
16	F	A	22	Y	Y	Y	Y	Y	Y	N	N	Y
17	F	O	24	Y	Y	N	N	Y	N	N	N	Y
18	F	A	24	Y	Y	Y	Y	Y	Y	N	N	N
19	F	A	21	Y	Y	N	Y	N	Y	N	N	Y
20	F	A	24	Y	Y	Y	Y	Y	Y	N	N	Y
21	F	A	20	Y	Y	N	N	Y	N	N	N	Y
22	F	A	22	Y	Y	Y	Y	Y	Y	N	N	Y
23	M	A	19	Y	Y	Y	Y	Y	N	N	Y	N

^a “speedball” is a street term for an injected mixture of heroin and cocaine
O, other; A, aboriginal.

When we considered sexual risk variables, we found that the youth were significantly more likely to engage in survival sex when compared with older participants. Furthermore, there was an overwhelming association between HIV positivity and survival sex among the female youth when compared with older HIV-positive participants and HIV-negative female youth. Commercial sex trade work has been shown to increase both risk for HIV infection and vulnerability to increased drug use and violence (24–26). The high number of female youth and the strong relationship between survival sex and HIV positivity suggest an urgent need for further research and intervention programs among young females engaged in survival sex (27). Overall rates of condom use fell <30% and the youth engaged in more frequent sexual activity through survival sex and with casual sexual partners. The risks posed by the sexual transmission of HIV among young females in this cohort cannot be ruled out.

We found high rates of sexual abuse in both younger and older VIDUS participants. However, sexual abuse among the young female participants was reported by a staggering 70% of the HIV-positive and 60% of the HIV-negative youth. Childhood sexual abuse has been linked to subsequent work in the commercial sex trade and a reduced ability to negotiate condom use (28,29). Furthermore, requiring help to inject was consistently reported more frequently among the young participants. The disempowerment associated with childhood sexual abuse, continued vulnerability to sexual predators through com-

mercial sex trade work, and requiring help to inject is undeniably fueling the epidemic, specifically among young women (30,31). People treating drug addiction will need to consider issues involved in lifetime sexual violence along with treatment of drug dependency, especially for young female IDUs. Issues about empowerment, self-care including safe injection practices, and condom use need to be addressed for young women who have a history of sexual abuse and commercial sex trade work, to protect them from HIV/AIDS.

Drug risk variables unique to the youth included greater use of daily heroin, whereas older participants were more likely to inject cocaine daily. The finding that daily heroin injection is greater among the young participants is counterintuitive to the image of drug use among youth as a party enhancer. Although the pharmacologic effects of cocaine have been linked to elevated self-esteem, heroin has been described as having a numbing effect (32). Increased heroin use may be explained by older contacts and drug use networks and/or by a lifetime characterized by violence through childhood sexual abuse, commercial sex trade work, and early entry into drug use and street life (30).

Members of the younger group were also more likely to smoke crack cocaine daily, a behavior that has previously been shown to increase risk for HIV infection among high-risk youth in Baltimore and San Francisco (10,33). Doherty et al. (10) suggested that the association between increased risk for HIV and daily crack use may

be linked to higher-risk sexual behaviors among young crack users. Our findings of higher proportions of female, survival sex, casual partners, low condom use, and daily crack use among the young IDUs suggest confirmation of this assertion.

The drug risk variable that was associated with HIV positivity among female youth, in univariate and multivariate analysis, was daily speedball use. The use of injection speedballs by IDUs has been similarly associated with increased risk for HIV in other cities such as Baltimore (9,10) and New York (34). However, speedball use among young IDUs, particularly females, warrants further investigation, particularly in light of the recent overdose deaths in Houston, Texas that were attributed to speedball use (35). Whether female youth are using speedballs for its combined effects of alleviating pain associated with heroin withdrawal and cocaine's fast-paced properties that may enable commercial sex trade work or because of drug use networks remains to be clarified. However, education around safe mixing and injection practices may help to prevent overdose deaths and HIV infection.

Although daily heroin and speedball injection appear to be characteristic of young female IDUs, daily cocaine injection occurred in the 3 young HIV-positive males, as shown in the profile in Table 5. The profile also illustrates the high rates of daily polydrug use in which most of the HIV-positive youth were engaged. Rather than focusing on one specific drug that may be increasing risk among the youth, it may be that the association between polydrug use and HIV seroprevalence is mediated by increased sex trade work and sexual activity, particularly for young females with histories of childhood sexual abuse (36).

When we compared the younger and older participants, we found the youth were more likely to require help when injecting in the preceding 6 months. This behavior, especially among youth, may increase vulnerability to both needle sharing and social networks and partnerships characterized by inequities in power (31). Needle borrowing and lending were not statistically different from older injectors; however, almost half the youth reported needle-sharing behaviors. This is cause for concern because the association between HIV positivity and needle-sharing behaviors has been well documented (9,37,38). The potential link between needle sharing and those who require help when injecting is something that requires further investigation and may shed some light on high-risk networks.

There are several limitations with respect to this study. There may be sampling bias with respect to generalizability to other young injectors. As in most studies of

IDUs, our study was based on self-reported behaviors and caution should be exercised in the interpretation of such data. However, other studies of IDUs have found that socially desirable responses had only a negligible effect on the responses concerning risk behaviors for HIV infection (39). Another limitation is the risk behaviors identified in this study were cross-sectional in nature and did not take into account subsequent changes in behaviors. Nevertheless, these data provide information on a vulnerable population in which there has been little previous research conducted.

In summary, targeted interventions are required among young female and Aboriginal injectors. In our study, among the youth, females with multifactorial drug and sexual vulnerabilities were at highest risk for HIV. Furthermore, we found that >50% of the HIV-positive youth were Aboriginal. There is an urgent need to develop youth specific programs that are gender and culturally appropriate and incorporate lifetime sexual violence survived through childhood sexual abuse and commercial sex trade work.

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REFERENCES

1. Health Canada HAEU. *HIV and AIDS among youth in Canada*. Ottawa: Population and Public Health Branch, Health Canada, 2000.
2. Hein K, Dell R, Futterman D, et al. Comparison of HIV⁺ and HIV⁻ adolescents: risk factors and psychosocial determinants. *Pediatrics* 1995;95:96-104.
3. Fennema JS, Van Ameijden EJ, Van Den Hoek A, et al. Young and recent-onset injecting drug users are at higher risk for HIV. *Addiction* 1997;92:1457-65.
4. Futterman D, Chabon B, Hoffman ND. HIV and AIDS in adolescents. *Pediatr Clin North Am* 2000;47:171-88.
5. UNICEF. *Progress of nations*. Geneva: United Nations Joint Programme on AIDS (UNAIDS), 2000.
6. Control LCfD: Age of Canadians infected with HIV dropping. *Can Med Assoc J* 1997;156:755.
7. U.S. Centers for Disease Control and Prevention. HIV/AIDS Among US women: minority and young women at continuing risk. Atlanta: Centers for Disease Control and Prevention, 2001.
8. U.S. Centers for Disease Control and Prevention. *CDC Fact Sheet: young people at risk*. Atlanta: Centers for Disease Control and Prevention, 2000.
9. Garfein RS, Doherty MC, Monterroso ER, et al. Prevalence and incidence of hepatitis C virus infection among young adult injection drug users. *J Acquir Immune Defic Syndr Hum Retrovirol* 1998;18(Suppl 1):S11-19.
10. Doherty MC, Garfein RS, Monterroso E, et al. Correlates of HIV infection among young adult short-term injection drug users. *AIDS* 2000;14:717-26.
11. Nelson KE, Vlahov D, Solomon L, et al. Temporal trends of incident human immunodeficiency virus infection in a cohort of injecting drug users in Baltimore, Md. *Arch Intern Med* 1995;155:1305-11.

12. U.S. Centers for Disease Control and Prevention. Youth risk behavior surveillance system. Atlanta: Centers for Disease Control and Prevention, 1998.
13. CanadaHealth. *Canada's drug strategy*. Ottawa: The Office of Alcohol, Drugs and Dependency Issues, 1998.
14. Levine OS, Vlahov D, Brookmeyer R, et al. Differences in the incidence of hepatitis B and human immunodeficiency virus infections among injecting drug users. *J Infect Dis* 1996;173:579-83.
15. Strathdee SA, Patrick DM, Currie SL, et al. Needle exchange is not enough: lessons from the Vancouver injecting drug use study. *AIDS* 1997;11:F59-65.
16. Van Ameijden EJ, Langendam MW, Notenboom J, et al. Continuing injecting risk behaviour: results from the Amsterdam Cohort Study of drug users. *Addiction* 1999;94:1051-61.
17. Hagan H, McGough JP, Thiede H, et al. Syringe exchange and risk of infection with hepatitis B and C viruses. *Am J Epidemiol* 1999;149:203-13.
18. Doherty MC, Garfein RS, Monterroso E, et al. Gender differences in the initiation of injection drug use among young adults. *J Urban Health* 2000;77:396-414.
19. Mullen L, Barry J. An analysis of 15-19-year-old first attenders at the Dublin Needle Exchange, 1990-97. *Addiction* 2001;96:251-8.
20. Rosenberg PS, Biggar RJ. Trends in HIV incidence among young adults in the United States. *JAMA* 1998;279:1894-9.
21. Network CAAL. *Discrimination, HIV/AIDS and aboriginal people*. Montreal: The Canadian Aboriginal AIDS Network, 1999.
22. U.S. Centers for Disease Control and Prevention. Surgeon general calls for action on HIV/AIDS crisis in American Indian and Alaska Native communities. Centers for Disease Control and Prevention, 2000.
23. HealthCanada. *HIV and AIDS among aboriginal people in Canada*. Ottawa: Bureau of HIV/AIDS, STD and TB, 2000.
24. Spittal PM, Schechter MT. Injection drug use and despair through the lens of gender. *Can Med Assoc J* 2001;164:802-3.
25. Nemoto T, Brown LS, Jr., Foster K, et al. Behavioral risk factors of human immunodeficiency virus infection among intravenous drug users and implications for preventive interventions. *AIDS Educ Prev* 1990;2:116-26.
26. Potterat JJ, Rothenberg RB, Muth SQ, et al. Pathways to prostitution: The chronology of sexual and drug abuse milestones. *J Sex Res* 1998;35:333-40.
27. Tortu S, Beardsley M, Deren S, et al. HIV infection and patterns of risk among women drug injectors and crack users in low and high sero-prevalence sites. *AIDS Care* 2000;12:65-76.
28. Brannigan A, Van Brunschot EG. Youthful prostitution and child sexual trauma. *Int J Law Psychiatry* 1997;20:337-54.
29. Spatz Widom C, Kuhns JB. Childhood victimization and subsequent risk for promiscuity, prostitution, and teenage pregnancy: a prospective study. *Am J Public Health* 1996;86:1607-12.
30. Miller M. A model to explain the relationship between sexual abuse and HIV risk among women. *AIDS Care* 1999;11:3-20.
31. Kral AH, Bluthenthal RN, Erringer EA, et al. Risk factors among IDUs who give injections to or receive injections from other drug users. *Addiction* 1999;94:675-83.
32. Heffernan K, Cloitre M, Tardiff K, et al. Childhood trauma as a correlate of lifetime opiate use in psychiatric patients. *Addict Behav* 2000;25:797-803.
33. Des Jarlais DC, Abdul-Quader A, Minkoff H, et al. Crack use and multiple AIDS risk behaviors. *J Acquir Immune Defic Syndr Hum Retrovirol* 1991;4:446-7.
34. Futterman D, Hein K, Reuben N, et al. Human immunodeficiency virus-infected adolescents: the first 50 patients in a New York City program. *Pediatrics* 1993;91:730-5.
35. Yardley J. Up to 18 may have died of overdoses in Houston. *New York Times* 2001;August 15, 2001:14.
36. Spittal P, Tyndall M, Li K, et al. Risk factors for HIV seroconversion among female and male injectors. *Can J Infect Dis* 2001;12(Suppl. B):54B.
37. Kral AH, Lorvick J, Edlin . Sex- and drug-related risk among populations of younger and older injection drug users in adjacent neighborhoods in San Francisco. *J Acquir Immune Defic Syndr* 2000;24:162-7.
38. Bluthenthal RN, Kral AH, Gee L, et al. The effect of syringe exchange use on high-risk injection drug users: a cohort study. *AIDS* 2000;14:605-11.
39. Latkin CA, Vlahov D, Anthony JC. Socially desirable responding and self-reported HIV infection risk behaviors among intravenous drug users. *Addiction* 1993;88:517-26.