SYMPOSIUM

Risky sexual behaviours among injection drugs users with high HIV prevalence: implications for STD control

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Injection drug use is inextricably linked to commercial sex work and the transmission of sexually transmitted disease (STD). In many communities prevention efforts have been stalled owing to the marginal existence of this community. This study describes the sexual activities, condom use, reported STDs, and commercial sex work in a large cohort of injection drug users. Seventy two per cent of male and 92% of female subjects in the cohort were sexually active. Among female subjects, 57% reported more than 100 lifetime partners. Condoms were generally not used with regular partners, used about half the time with casual partners, and used about 80% of the time with paying partners. Female sex workers were more likely to have unstable housing and to report incarceration in the previous six months. Reducing the transmission of STDs and HIV in drug using communities is a public health priority. While existing prevention programmes should be strengthened, innovative approaches to STD surveillance, diagnosis, and prevention are needed.

cited in national news media as Canada's poorest neighbourhood, Vancouver's DTES is plagued by unemployment, crime, mental illness, prostitution, and inadequate housing. HIV seroconversion rates and overdose deaths outstrip those of other North American cities, with statistics showing that from 1991–98 almost 25% of British Columbia's drug induced deaths occurred in the DTES.¹⁷ Although often described in isolation, the DTES is centrally located and borders on the city's financial district, an international seaport, and a popular tourist area. This has contributed to endemic rates of STD within the affected population and an ongoing focus of STD transmission for people from outside the community.

We assessed the sexual behaviours reported by a large cohort of injection drug users in this neighbourhood, with a focus on sexual relationships, sexual behaviours, STD rates, and reported condom use. This analysis illustrates the complex and dynamic nature of STD transmission in a drug using community and the importance of social network formation. It can be shown that phase appropriate strategies for prevention are critical within drug using communities and that evaluation of interventions should be a priority.

METHODS

Study population

The Vancouver injection drug users study (VIDUS) is a prospective study of over 1400 injection drug users that began in May 1996 during an explosive outbreak of HIV in Vancouver's DTES. The study established a storefront office, with participants coming to the study through local advertisements and word of mouth. For study enrolment participants had to give a history of injection drug use in the preceding month and provide written informed consent. Blood samples for HIV and hepatitis C antibody testing are collected, and each participant undergoes an interview administered questionnaire at the baseline visit and semi-annually thereafter. Participants are reimbursed Cdn\$20 for each study visit, at which time referrals are provided for medical care, HIV/AIDS care, drug and alcohol treatment, and counselling. Detailed information is collected on demographics, sexual behaviours, types of drugs injected, frequency of drug use, incarceration, housing, and the utilisation of health services such as emergency departments, clinics, and hospitals.

Statistical analysis

Univariate statistical techniques were applied to determine factors associated with female sex work. Categorical explanatory variables were

Sexually transmitted diseases (STDs) are endemic in communities with illicit drug use, perpetuated by the inextricable link between drug use and commercial sex work.^{1–5} In most drug using populations it is young women who are at the greatest risk of contracting STDs, including HIV.^{6–8} In particular, the use of injection cocaine and crack cocaine, widely available in Vancouver, has been closely associated with risky sexual practices and high rates of STD transmission.^{9–10} Prevention efforts targeted at injection drug users have focused primarily on the reduction of HIV through the provision of clean syringes. Sexual transmission of HIV and other STDs has not been a high priority.^{11–12} The establishment of social and sexual networks among drug users has important implications for risk behaviours and interventions.^{13–14}

The rapid and alarming spread of HIV and hepatitis C in Vancouver's downtown eastside (DTES) during the 1990s has drawn international attention to this troubled community.^{15–16} It is estimated that 4700 injection drug users reside in an area of 10 city blocks. Despite intensive community efforts, escalating government spending, expansion of primary health care, and numerous harm reducing initiatives, high rates of injection drug use and dismal health outcomes persist. Frequently

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Table 1 Demographic characteristics of the Vancouver injection drug users study (VIDUS) cohort stratified by sex

Characteristic	Male (n=932)	Female (n=505)
Age (mean (range)) (years)	35.3 (16 to 58)	31.4 (14 to 58)
Time injecting (mean (range)) (years)	14.3 (0.1 to 44)	11.8 (0.1 to 40)
Married/common law	154 (17)	188 (37)
Ethnicity		
White	582 (62)	283 (56)
Aboriginal	168 (18)	194 (38)
Hispanic	78 (8)	4 (1)
Asian	58 (6)	9 (2)
Other	46 (5)	15 (3)
Welfare/disability recipient	659 (71)	347 (69)
Education (at least elementary)	708 (76)	406 (80)
Housing		
Hotel (single room occupancy)	432 (46)	212 (42)
Apartment	292 (31)	172 (34)
Boarding house/hostel	67 (7)	32 (6)
Other*	141 (16)	89 (18)
Jail (ever)	736 (79)	355 (70)
HIV positive	241 (26)	178 (35)
Hepatitis C positive	797 (86)	439 (87)

Values are n (%) unless specified.

*Other includes jail/recovery/transition house/squats/street/no fixed address.

analysed using Pearson's χ^2 test, and the Wilcoxon rank-sum test was used for continuous variables. For this comparison, we identified 234 female sex workers, defined as those who were sexually active and reported selling sex in the six months before study enrolment. The condom use and sex partner information in table 3 was taken from the questionnaire administered at the most recent follow up visit (June to December 2000) and identified 163 women actively engaged in commercial sex work. Drug use and other behavioural variables referred to activities in the past six months.

RESULTS

Demographics

The demographic characteristics of the VIDUS cohort are shown in table 1. Male participants are older and have longer injection careers than female participants. The ethnic make-up of the cohort generally reflects the community, with a disproportionate number of female subjects among the Canadian aboriginal participants. The majority of the Hispanic population is male. The most common housing arrangements are single occupancy hotel rooms that are rented by the month. Seventy per cent of the participants receive government welfare payments for housing and other support. The prevalence of HIV-1 is higher among women (35% v 26%) and the prevalence of hepatitis C is similar among women and men.

Sexual activity and reported condom use

Table 2 summarises the reported sexual activity collected from baseline questionnaires. During the six months before enrolment, 72% of men and 92% of women reported some sexual activity. The majority reported heterosexual partners, although same sex partners were not uncommon. Among male subjects, 39% reported fewer than 20 lifetime sex partners, while 78% reported fewer than 100. In contrast, 26% of female subjects reported fewer than 20 lifetime partners and 43% reported less than 100. The high proportion of women involved in the sex trade was reflected in the observation that 57% of women reported at least 100 lifetime partners.

Table 2 Sexual activity of the Vancouver injection drug users study (VIDUS) cohort stratified by sex

Sexual activity	Male (n=932)	Female (n=505)	p Value
Age at first sex (mean (range)) (years)	14.7 (11 to 24)	14.9 (9 to 22)	0.02
Any sexual activity (past 6 months)	669 (72)	464 (92)	0.001
Of those having sex:			
opposite sex only	583 (87)	385 (83)	
same sex only	49 (7)	16 (4)	
same and opposite sex	37 (6)	63 (13)	0.001
Number of lifetime partners			
5 or less	130 (14)	55 (11)	
6–19	229 (25)	75 (15)	
20–99	370 (40)	87 (17)	
100–499	161 (17)	93 (18)	
500 or more	42 (4)	195 (39)	0.001

Values are n (%) unless specified.

Table 3 summarises the reported frequency of sexual activity, the type of sexual activity, and condom use, stratified by regular partners, casual partners, and paid partners. Of participants who reported any sexual activity in the past six months, 593 (56%) reported having a regular sex partner of the opposite sex, defined as "someone you have had a sexual relationship with for more than three months." Women were more likely to report having a regular sex partner than men (63% v 51%, $p < 0.001$). Vaginal sex was reported by 99% of male and female participants. The reported frequency of vaginal intercourse was at least one to three times a week by 79% of men and 74% of women. Overall, 65% of participants never used condoms during vaginal intercourse with their regular partner. Seventy six per cent of participants had engaged in oral sex in the past six months. Condom use during oral sex with a regular partner was very uncommon. Anal sex with a regular partner was reported by 20% of participants but was practiced infrequently.

One or more casual sex partners of the opposite sex were reported by 471 (45%) of participants. Although vaginal intercourse was reported by 95% of respondents, 63% reported this activity less than once a week. Condoms were "always" used during vaginal sex with casual partners by about half of the participants. Oral sex was reported by 53% of this group but was also relatively infrequent. Condoms were generally not used during oral sex with casual partners. Ten per cent of male participants and only 5% of female participants reported anal sex with casual partners.

Nine per cent of men reported sex with other men in past six months. Oral sex was reported by 95% of this group, with receptive and insertive anal intercourse reported by 32%. For oral sex, condoms were "always" used with paying partners by 60%. Of the men who reported anal sex with paid contacts, 71% reported "always" using condoms. Of the 182 female participants who reported commercial sex work in the past six months, 163 (90%) had paying heterosexual partners or "tricks". Vaginal sex was practiced by 90%, with 92% reporting a frequency of at least one to three times a week. Condom use was relatively high, with 82% reporting that they "always" used a condom. Oral sex was reported by 99%, with 94% having at least one to three contacts a day. Seventy five per cent reported that they "always" used a condom during oral sex. Anal sex was relatively uncommon and infrequent among female sex workers.

Female sex workers

Table 4 compares the baseline demographic and drug use characteristics of female sex workers with other women in the cohort. Female sex workers were less likely to have a

Table 3 Reported sexual practices and condom use with regular, casual, and paying partners stratified by sex

Sexual practices	Regular partners		Casual partners		Paid partners	
	Male (n=317)	Female (n=283)	Male (n=352)	Female (n=121)	Male (n=64)	Female (n=163)
<i>Vaginal sex</i>	315 (99)	279 (99)	334 (95)	117 (97)	NA	148 (90)
Frequency:						
Less than weekly	66 (21)	74 (26)	213 (64)	83 (71)	NA	10 (6)
1–3 times a week	143 (45)	130 (47)	84 (25)	25 (21)	NA	51 (35)
Once a day or more	106 (34)	75 (27)	33 (10)	9 (8)	NA	87 (59)
Condoms:						
Always	69 (22)	48 (17)	178 (53)	58 (50)	NA	121 (82)
Sometimes	59 (19)	26 (9)	73 (22)	23 (20)	NA	24 (16)
Never	187 (59)	205 (74)	83 (25)	36 (31)	NA	3 (2)
<i>Oral sex on partner</i>	226 (71)	230 (81)	172 (49)	79 (65)	61 (95)	161 (99)
Frequency:						
Less than weekly	87 (39)	89 (39)	125 (73)	57 (73)	16 (27)	10 (6)
1–3 times a week	98 (43)	108 (47)	31 (18)	17 (22)	11 (19)	23 (14)
Once a day or more	41 (18)	33 (14)	16 (9)	5 (6)	32 (54)	128 (80)
Condoms:						
Always	7 (3)	38 (16)	20 (12)	26 (33)	37 (60)	121 (75)
Sometimes	10 (4)	15 (7)	8 (5)	10 (13)	15 (25)	36 (21)
Never	209 (93)	177 (77)	144 (83)	43 (54)	9 (15)	6 (4)
<i>Anal sex</i>	68 (21)	51 (18)	35 (10)	6 (5)	21 (32)	21 (13)
Frequency:						
Less than weekly	46 (68)	42 (83)	23 (65)	6 (100)	10 (48)	18 (86)
1–3 times a week	17 (26)	7 (14)	11 (31)	0 (0)	9 (43)	3 (14)
Once a day or more	5 (7)	2 (4)	1 (3)	0 (0)	2 (9)	0 (0)
Condoms:						
Always	15 (22)	9 (18)	14 (40)	3 (50)	15 (71)	17 (81)
Sometimes	10 (15)	1 (2)	4 (11)	0 (0)	4 (19)	1 (9)
Never	43 (63)	41 (80)	17 (49)	3 (50)	2 (10)	2 (10)

Values are n (%).
NA, not applicable.

regular sex partner. There was no statistically significant ethnic difference among women involved in sex work, although aboriginal women tended to be less involved. Female sex workers were more likely to live in the DTES, to have unstable housing arrangements, and to report incarceration in the previous six months. Regular heroin use was marginally higher among female sex workers, although frequent injection cocaine and crack cocaine use was much more com-

mon in this group. The HIV prevalence was higher among women who sold sex. At baseline, HIV prevalence was 32% among female sex workers and 21% among non-sex-workers. HIV seroconversion during follow up was documented in 10% of active female sex workers and 7% of the other female participants. The reported occurrence of an STD was relatively uncommon overall, although marginally higher among female sex workers.

Table 4 Demographic and drug using characteristics of female sex workers versus female non-sex-workers

Characteristics	FSW (n=234)	Non-FSW (n=271)	Odds ratio (95% CI)	p Value
Age (mean (range)) (years)	29.9 (15 to 52)	32.6 (14 to 58)	–	0.001
Time injecting (mean (range)) (years)	10.2 (0.5 to 30)	11.5 (0.5 to 40)	–	0.43
Regular partner (yes/no)	106 (45)	177 (65)	0.44 (0.31 to 0.63)	0.001
Ethnicity				
White	140 (60)	143 (53)	–	
Aboriginal	78 (33)	116 (43)	–	
Other*	16 (7)	12 (4)	–	0.07
Jail in past 6 months	84 (36)	65 (24)	1.78 (1.21 to 2.61)	0.003
Resident of DTES	166 (71)	143 (53)	2.19 (1.51 to 3.54)	0.001
Unstable housing†	166 (71)	132 (49)	2.57 (1.78 to 3.71)	0.001
Drug use past 6 months				
Heroin (>weekly)	126 (54)	121 (45)	1.45 (1.02 to 2.06)	0.04
Cocaine (>weekly)	145 (62)	106 (39)	2.54 (1.78 to 3.62)	0.001
Crack (>weekly)	52 (22)	19 (7)	3.79 (2.22 to 6.56)	0.001
Alcohol (>weekly)	86 (37)	111 (41)	0.84 (0.59 to 1.20)	0.33
Runs or binges (yes/no)	107 (46)	116 (43)	1.13 (0.79 to 1.60)	0.51
HIV positive	74 (32)	56 (21)	1.78 (1.19 to 2.65)	0.005
Hepatitis C positive	197 (89)	193 (77)	2.42 (1.46 to 4.02)	0.001
STD past 6 months	16 (7)	7 (3)	2.77 (1.16 to 6.63)	0.02

Values are n (%) unless specified.

*Includes Black African, Latino, Chinese, South Asian; †includes no fixed address, single room occupancy hotels, shelters, and recovery houses.

CI, confidence interval; DTES, downtown eastside area of Vancouver; FSW, female sex worker; STD, sexually transmitted disease.

Table 5 History of reported lifetime sexually transmitted diseases (non-ulcerative and ulcerative), stratified by sex

Characteristic	Male (n=932)	Female (n=505)	p Value
Any STD ever	395 (42)	290 (57)	0.001
gonorrhea/chlamydia ever	282 (30)	215 (43)	0.001
syphilis/herpes ever	128 (14)	96 (19)	0.008
Any STD past 6 months	11 (1)	23 (5)	0.001
gonorrhea/chlamydia ever	3 (<1)	6 (1)	0.05
syphilis/herpes ever	5 (<1)	13 (3)	0.001

Values are n (%).

STD, sexually transmitted disease.

STD history

STD history among male and female participants is shown in table 5. Compared with the men, the women in the cohort are more likely to have had an STD in the past. This association is consistent for both non-ulcerative (gonorrhoea and chlamydia) and ulcerative infections (syphilis and herpes). For the 685 participants reporting a previous STD, the rate of HIV was marginally higher (53% v 46%; $p = 0.05$). This association was similar when stratified by sex.

Sexual networks

Figure 1 is a compartment model from the DTES with female sex workers as the core group. Although many of these women also use injection drugs, there is a sizeable minority who do not. Endemic rates of STDs are sustained among the female sex workers by sexual activity with males who reside in the DTES. These men can be classified into four general categories. Group 1 consists of regular male sex partners who use injection drugs and also reside in the DTES. The money generated by their female partner's sex work also helps to support their drug use. Group 2 consists of regular male sex partners who do not use injection drugs themselves. Some of these arrangements are based on the organised recruitment of women through drugs and intimidation. Group 3 consists of resident males who purchase sex and do not inject drugs. These are mainly older men who are long term residents of the community and are marginalised because of various physical and mental ailments. Group 4 consists of resident males who are injection drug users and purchase sex. As most men in the area do not have regular sex partners, much of their sexual activity occurs with paid partners. This may also include sex-for-drugs arrangements.

The bridging to populations outside the DTES occurs primarily through men who visit the DTES specifically for sex. The sex may occur within the hotel system in the DTES or by driving to locations outside the area. These men are usually non-injection drug users and have both casual and regular sex partners residing outside of the DTES. A second important bridging population is foreign visitors to the area, either tourists or ship workers stopping at the Vancouver port. This type of sexual contact has far reaching implications for the transmission of STDs/HIV to other cities. It is also a potential route for STD pathogens to be introduced into the community.

DISCUSSION

The complex interaction between illicit drug use and commercial sex work presents major challenges for STD prevention and policy.^{3,4} The DTES of Vancouver provides a graphic example of how an explosive outbreak of HIV infection occurred among a population of injection drug users despite a range of public health interventions including a legal needle exchange, methadone maintenance treatment, and free health care.¹⁵ The transmission of other STDs and the

contribution of sexual transmission to the HIV outbreak have received less attention. A recent outbreak of syphilis in the province of British Columbia, however, traced the epicentre of transmission to the DTES, leading to a syphilis mass treatment campaign in the neighbourhood.

The transmissibility of HIV through blood to blood contact, as occurs among injection drug users, is thought to be severalfold higher than through sexual transmission.¹⁸ Therefore the actual proportion of HIV resulting from sexual transmission in this population is difficult to determine. However, the concentration of female sex workers, the large numbers of sex partners, the complex networks that have evolved, and the relatively low rates of condom use create an environment where sexual transmission of HIV does occur.^{19,20} In addition, sexual relationships and intimacy are closely linked to drug using patterns and needle sharing.^{21,22} Rothenberg *et al* propose that the formation of social networks may act as a barrier or a facilitator for disease transmission and that the context for risk behaviours influences transmission dynamics.¹⁴ The geographical concentration of injection drug users in the DTES lends itself to these influences, and understanding these dynamics has implications for prevention strategies.

The relatively low uptake of condoms and the large number of sex partners documented in this cohort study are consistent with other injection drug user populations.^{4,23} Female injection drug users who also sell sex continue to put themselves at high risk, knowing they are in an environment with extremely high rates of HIV and other STDs. Drug addiction propels many women into sex work in order to provide the money needed to maintain their drug habits. As demonstrated in this cohort, women injection drug users who sold sex were more likely to be resident in the DTES and to have unstable housing situations, and were less likely to have regular sex partners. The intensity of drug use was also significantly higher in this group, compared with women who did not sell sex. Drugs impair judgement, making attempts to use condoms consistently or avoid high risk sexual behaviours difficult, even for the most motivated and well informed. As with other studies in drug using populations, we found that injection cocaine and crack cocaine were commonest among female sex workers.²⁴

Several interventions designed to reduce sexual risk behaviours among injection drug users have been developed. Outreach and community based programmes that promote safer sexual practices can be successful in some situations.²⁵ Further, it has been shown that those in drug treatment programmes are less likely to engage in high risk sexual activities than those out of treatment.²⁶ Methadone maintenance treatment participants have also been shown to have fewer sexual

Figure 1 Compartment model for female sex workers in downtown eastside (DTES) of Vancouver.

partners and in some cases are able to disengage from commercial sex work.²⁷ Certainly these initiatives need to be expanded and applied to other communities.

In the dynamic topology of STD epidemics described by Wasserheit and Aral,²⁸ the population in the DTES has the characteristics consistent with phase IV epidemics. This includes a geographically concentrated subpopulation with high rates of partner change and little contact with the health care system. Further, external factors such as poverty, low levels of education, and illicit drug use serve to sustain the epidemic in this community. The VIDUS cohort illustrates how these factors can converge to push individuals to the margins of society where interventions are more difficult to initiate.

Strategies that primarily target "spread networks" have been a priority in this community. In a phase IV epidemic environment this would include targeted health promotion activities. In the DTES there has been a wide range of targeted health promotion initiatives including safe sex posters and pamphlets distributed by health clinics and community groups, peer risk reduction counselling delivered through support groups for sex workers and injection drug users, and an active street nurse programme that delivers information directly to individuals who engage in high risk behaviours. The introduction of partner notification is particularly difficult in this community. There is a general reluctance to cooperate with health officials in divulging names and addresses, as such people are perceived to be associated with the criminal justice system. Many of the highest risk individuals have previous drug related convictions and fear arrest and conviction on illicit drug charges.

As the epidemic progresses through phases, the subpopulations become characterised by progressively higher rates of partner change, less effective contact with the health care system, and lower educational and social status.²⁸ This is very characteristic of injection drug user populations, when drug users spend increasing resources on illegal drugs and are driven further away from social support systems. The large proportion of individuals who receive a criminal conviction for drug related offences (more than 70% in our cohort) may also limit the future potential for housing and employment.

Intervention research is imperative to help better define optimal approaches to STD control in this population. This is important not only to reduce the sexual transmission of HIV within the community but also to prevent transmission of infections to the bridging populations. As illustrated in fig 1, the central location of this community allows contacts with a range of non-residents. The open illicit drug markets, as well as the commercial sex trade, draw people to this neighbourhood. As described by Wasserheit and Aral, research on bridge populations is crucial as this group serves to maintain transmission to other populations.

This study has some limitations inherent to prospective cohort studies. Although follow up exceeds 80%, there is a loss to follow up that may introduce bias. It is probable that the higher risk participants are less likely to return, and therefore high risk behaviours are underestimated. Further, we rely on participants identifying themselves to the study and this may attract higher risk individuals and limit the extent to which the results can be generalised to the injection community as a whole. Self reporting drug use and sexual behaviours may be prone to socially desirable responses and poor recall. However, there is some evidence that the validity of self reported drug use behaviours is not seriously compromised in this population.²⁹ In any case this would be likely to lead to an overreporting of condom use and an underreporting of high risk sexual activities, making the study observations even more compelling. Finally, we did not routinely perform diagnostic STD testing and could not determine with certainty the pathogen specific phases of the epidemic.

The transmission of STDs in drug using communities requires urgent study. It is clear that female drug users who

also sell sex are a population in need of intensive STD prevention interventions. While providing condoms, free diagnostic testing, and antimicrobial treatment are important components of prevention, they have not been sufficient. Existing programmes should be strengthened, but innovative approaches to STD surveillance, diagnosis, and prevention are needed. One approach would be to form closer links between STD prevention and existing harm reduction initiatives. Reducing STD transmission among injection drug users has far reaching implications for STD control in general and remains a major public health challenge.

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