



ELSEVIER

Journal of Substance Abuse 13 (2001) 45–58

**Journal of
Substance
Abuse**

Risk factors of HIV infection and needle sharing among injecting drug users in Ho Chi Minh City, Vietnam

Nguyen tran Hien^{a,*}, Le truong Giang^b, Phan nguyen Binh^c, Walter Devillé^d, Erik J.C. van Ameijden^e, Ivan Wolffers^d

^a*Faculty of Public Health, Head of Epidemiology Department, Hanoi Medical University,
1 Ton that Tung, Dong da, Hanoi, Vietnam*

^b*HCMC Health Service, Ho Chi Minh City, Vietnam*

^c*HCMC Rehabilitation, Ho Chi Minh City, Vietnam*

^d*Faculty of Medicine, Vrije Universiteit, Amsterdam, The Netherlands*

^e*Trimbos-Institute, Utrecht, The Netherlands*

Abstract

Objective: We sought to identify risk factors for needle sharing and HIV infection among injecting drug users (IDUs) in Ho Chi Minh City (HCMC), Vietnam. **Methods:** Three cross-sectional surveys among IDUs, both on the street (in 11 urban districts) and in the rehabilitation center for IDUs in HCMC, were carried out in April of 1995, 1997, and 1998. Outreach workers interviewed IDUs about socio-demographic characteristics, drug use and sexual practices, and HIV knowledge and perceptions. The IDUs were also tested for seropositivity to HIV. Independent predictors for HIV positivity and needle sharing were determined by univariate and multivariate logistic regression for the study sample within the rehabilitation center in 1997 and for that on the street in 1998. **Results:** The HIV prevalence in 1998 among IDUs was 44% for those on the street and 38.5% for those in the rehabilitation center. Independent predictors for HIV infection in IDUs were being injected by drug dealers (for the 1997 sample), injecting on the street, and sharing the drug pots (for the 1998 sample). The reported rate of needle sharing was low and decreased significantly from 20% in 1995 to 12% in 1998 for the sample of IDUs at the street. In the multivariate analysis, predictors for needle sharing for both study samples were injecting on the street, injecting at shooting galleries, and having shared needles in the past. Adequate and easy access to sterile needles and syringes, and a supportive environment of behavior change, especially

* Corresponding author. Tel.: +84-4-8524141; fax: +84-4-8523032.

E-mail address: mph.hmcvn@hn.vnn.vn (N. Hien).

in street and shooting gallery could reduce risks of virus transmission in the Vietnamese IDU community. © 2001 Elsevier Science Inc. All rights reserved.

Keywords: IDU; Risk factors; HIV infection; Needle sharing; Ho Chi Minh City; Vietnam

1. Introduction

At a global level, the mode of HIV-1 transmission through sexual contact is predominant (WHO/UNAIDS, 1998). However, shared use of injection equipment, identified as the primary causal link between drug injection and HIV infection (Schoenbaum et al., 1989), has played a critical role in fueling a number of local, national, and regional HIV epidemics. By 1996, HIV infection among injecting drug users (IDUs) had been reported in 83 countries. The HIV prevalence in the drug injecting population was high in southern Europe, the northeastern region of the United States, and parts of Asia and South America (Stimson & Choopanya, 1998). Vietnam belongs to a number of countries in Asia and the Pacific region, which have separate but explosive epidemics among their IDU populations, such as Thailand, Myanmar, India (Manipur), Malaysia, Nepal, and China (Dore, Brown, Tarantola, & Kaldor, 1998).

From all provinces in Vietnam, 29,116 HIV positive persons had been reported as of 18 January 2001 (Weekly HIV/AIDS Report of the Vietnam National Institute of Hygiene and Epidemiology, 20 January 2001). A majority of the total reported HIV (64%) and AIDS (77%) cases in the country were IDUs. The results of HIV sentinel surveillance also show that HIV infection in Vietnam is primarily associated with injecting drug use, but its extent is highly variable throughout the country. In 1998, HIV prevalence among IDUs was more than 10% in 11 of 20 sentinel provinces, with an aggregated prevalence rate of 13%. Other prevalence rates were 2.4% among female sex workers (FSWs); 0.7% among sexually transmitted disease (STD) patients and less than 0.15% among antenatal women and army conscripts (Hien et al., 1999). However, since 1997, there have been explosive increases in HIV prevalence among IDUs in many northern provinces, such as Lang son, Quang ninh, and Hai phong. It is clear that in Vietnam, HIV infection is rapidly and predominantly being transmitted among IDUs through sharing needles and syringes with an aggregated rate of 20.4% in 1999. In 2000, the HIV prevalence was very high in many provinces such as Binh Dinh (44.7%), Quang ninh (49.6%), Hai phong (70.4%), Da Nang (37.5%), Vung tau (54.7%), and Ho Chi Minh City (HCMC; 58.1%) (Ministry of Health, Vietnam, 2001). By the year 2000, the cumulative number of HIV infections in Vietnam is estimated to reach 135,000–160,000 cases. Among them, approximately 21,000 will be IDUs (WHO/WPRO, 1998).

HCMC reported the highest number of HIV infection. It accounts for 16.8% of total reported cases in the country. By risk category, the vast majority of HIV infections in HCMC were among IDUs. The HIV epidemic in Vietnam first started in HCMC. The HIV prevalence rate among IDUs rose rapidly from 3% in 1992 to 33% in 1994 and 44% in 1996. In response to the increased epidemic, many prevention efforts in the city since 1995 continue to be active

among IDUs. These include the IEC AIDS prevention campaign, outreach and education programs, peer education, a telephone hotline, home care and counseling, and pilot needle and syringes provision (Lindan et al., 1997).

In Thailand, HIV transmission among IDUs and from IDUs to the rest of the population was experienced in four epidemic waves over just a few years: the first wave among IDUs, the second among FSWs, the third among male STD patients, and the fourth among nonprostitute women, infants, and others (Weniger et al., 1991). The challenge facing Vietnam is to prevent a similar development of the epidemic.

Despite the rapid spread of HIV infection among IDUs in Vietnam, little is known about their drug injecting and sexual behaviors, which are arguably the major risk factors for HIV transmission. The main objective of this study was to identify risk factors for both needle sharing and HIV infection among those IDUs in HCMC, where the HIV epidemic among IDUs started earlier and spread rapidly, with significant implications for HIV prevention among IDUs in Vietnam.

2. Methods

2.1. Recruitment of study participants

Three cross-sectional surveys among IDUs in HCMC were carried out in April 1995, 1997, and 1998. For each year, our study recruitment goal was about 300 participants from the street and 300 from the city's rehabilitation center. The actual number of IDUs recruited by year and recruitment site is presented in Table 1. The inclusion criterion for the IDUs in the study was that they were current injectors, i.e., having injected drugs in the last 6 months at the time of interview for IDUs on the street or before IDUs entering the rehabilitation center. As the number and characteristics of the total population of IDUs is not known, it is impossible to establish a representative random sample. IDUs on the street or in the community were contacted by outreach workers or peer educators from the city's HIV/AIDS program in 11 out of the 17 urban districts where IDUs were more visible.

For the IDU sample in the rehabilitation center, in order to have information on recent behaviour patterns, only those who had been admitted during the 3 months prior to the interviews were interviewed. During 1998, the center accepted mainly young heroin smokers, so that only 78 IDUs staying at the rehabilitation center were recruited to the study in that year.

The city's rehabilitation center was established in 1975 to provide drug detoxification, physical exercise, education, information, and job training for drug users in the city. It is a center that offers drug addicts a variety of therapies combining many different methods. These include psychological treatment, general health improvement, acupuncture, physical therapies such as massage, cold water therapy, traditional herbs, and physical exercise. The center does not offer methadone treatment. Recently, the center also implemented community-based addiction treatment with the participation of outreach workers, families, friends, and organizations such as the Women's Union and Youth Union. Community education and

counseling on drug use and HIV prevention were strengthened using mass media, mobile teams, and outreach groups. This is the largest center for rehabilitation of drug users in Vietnam. In 1996, the center admitted approximately 1600 drug users; about half of them on a legal basis after their arrest by the police. For the entire HCMC in 1997, sources estimated

Table 1

General demographic characteristics and main outcomes variables of sampled injecting drug users in Ho Chi Minh City, Vietnam, 1995, 1997, and 1998

	IDUs in the rehabilitation center				IDUs in the street			
	1995, <i>n</i> (%)	1997, <i>n</i> (%)	1998, <i>n</i> (%)	Total	1995, <i>n</i> (%)	1997, <i>n</i> (%)	1998, <i>n</i> (%)	Total
Number of interviewees	286	300	78	664	309	328	218	855
Mean age in years (range)								
Age groups	38.3	38.6	36.6 (40)	38.3	38.6	40.5	39.7	39.6
<30	(47)	(34)	22 (28.2)	(53)	(39)	(54)	(57)	(61)
30–39	27 (9.4)	31 (10.3)	19 (24.4)	80 (12.0)	22 (7.1)	15 (4.6)	22 (10.1)	59 (6.9)
40+	138 (48.3)	121 (40.3)	37 (47.4)	278 (41.9)	127 (41.1)	97 (29.6)	72 (33.0)	296 (34.6)
Gender	121 (42.3)	148 (49.3)		306 (46.1)	160 (51.8)	216 (65.9)	124 (56.9)	500 (58.5)
Male			69 (88.5)					
Female	248 (86.7)	275 (91.7)	9 (11.5)	592 (89.2)	271 (87.7)	304 (92.7)	203 (93.1)	778 (1.0)
Education	38 (13.3)	25 (8.3)		72 (10.8)	38 (12.3)	24 (7.3)	15 (6.9)	77 (9.0)
Primary			18 (23.1)					
Secondary or higher	103 (36.0)	63 (21.0)	60 (76.9)	184 (27.7)	113 (36.6)	91 (27.7)	80 (36.7)	284 (33.2)
Marital status	183 (64.0)	237 (79.0)		480 (72.3)	196 (63.4)	237 (72.3)	138 (63.3)	571 (66.8)
Married								
Single			39 (50.0)					
Divorced or separated	111 (38.9)	86 (28.7)	34 (43.6)	236 (35.6)	120 (38.8)	113 (34.5)	67 (30.9)	300 (35.1)
Occupation	103 (36.1)	169 (56.3)	5 (6.4)	306 (46.2)	124 (40.1)	140 (42.7)	93 (42.9)	357 (41.8)
Employed	71 (24.9)	45 (15.0)		121 (18.3)	65 (21.0)	75 (22.9)	57 (26.3)	197 (23.1)
Unemployed			20 (25.6)					
Sharing in the last 6 months	68 (23.8)	38 (12.7)	58 (74.4)	126 (19.0)	59 (19.1)	89 (27.1)	33 (15.5)	181 (21.3)
Yes	218 (76.2)	262 (87.3)		538 (81.0)	250 (80.9)	239 (72.9)	180 (84.5)	669 (78.7)
No								
HIV seropositive			14 (18.2)					
Yes	50 (17.7)	40 (13.3)	63 (81.8)	104 (15.8) ^a	62 (20.1)	48 (14.6)	26 (12.0)	136 (15.9) ^b
No	233 (82.3)	260 (86.7)		556 (84.2)	247 (79.9)	280 (85.4)	191 (88.0)	718 (84.1)
			30 (38.5)					
		76 (27.2)	48 (61.5)	106 (29.7)			96 (44.0)	96 (44.0)
		203 (72.8)		251 (70.3)			122 (56.0)	122 (56.0)

^a $P > .05$ (chi-square test for trends).

^b $P < .05$ (chi-square test for trends).

25,000 drug users, of whom approximately 90% were thought to be IDUs (Long, Hien, & Chi, 1997).

2.2. *Data collection and laboratory tests*

As in most countries, drug use is illegal in Vietnam, so extra care was taken to guarantee that the research would in no way harm those who participated in the study. Interviewees were informed verbally about the objectives of the study and that the results would be kept confidential, then asked whether they wanted to provide information. The study only asked questions and took one blood sample for HIV testing, and most of the interviewees did not find this invasive. After verbal informed consent had been obtained, trained outreach workers or peer educators of the HIV/AIDS program interviewed respondents face-to-face. The interviewers had been participating as peer educators among IDUs in an HIV/AIDS prevention program of the city. For this study, they received a 3-day training course on data collection using a structured questionnaire, which was based on a WHO questionnaire for IDUs. The topics in the questionnaire included the main socio-demographic characteristics, drug use practices including type, frequency and duration of injection drug use, sexual activities and a history of STDs, and knowledge and perception about HIV/AIDS. Needle sharing was defined as either borrowing or lending used needles and syringes, including used needles and syringes provided by drug dealers.

Blood samples of IDUs were taken for HIV testing from each participant in the rehabilitation center in 1997 and from IDUs both in and outside the rehabilitation center in 1998. In both years, HIV antibodies were assessed using the HIV testing strategy II recommended by World Health Organisation (WHO, 1992). This strategy considers a sample positive if it is positive in each of two screening tests of different types. All collected blood samples were tested at the same time for practical reasons. They were tested first by ELISA (GENELAVIA MIX, Sanofi Pasteur Diagnostics, France or VIRONOSTIKA, Organon, The Netherlands), and then reactive samples were tested again in an agglutination test (SERO-DIA HIV, Fujirebio, Japan).

Because the contact and explanation about the study for IDUs on the street was more difficult, the refusal rate among street IDUs was higher than those in the rehabilitation center (18% vs. 2%). It is possible that street IDUs may not have understood the purpose of the study, leading to refusal to participate. All participation was voluntary, both in the street sample and the rehabilitation center sample.

2.3. *Statistical analysis*

2.3.1. *Risk factor analysis*

Surveys were conducted in different years (1995, 1997, or 1998) and in different recruitment places (on the street and in the rehabilitation center). Data showed that the study populations differed between years and between recruitment places. Therefore, data of three cross-sectional studies were not merged, and only two data sets from two study samples were selected for

separate risk factor analysis: one in the rehabilitation center in 1997 and the other in the street in 1998. The association between dependent variables (sharing of injection equipment in the last 6 months and HIV seropositivity) and potential risk factors was assessed univariately by chi-square tests. Multivariate logistic regression was used to determine independent predictors for HIV prevalence and needle sharing, to adjust for confounding, and to check interaction. All variables exhibiting a univariate *P* value of $<.20$ were eligible for inclusion in multivariate models. Variable selection was based on forward stepwise elimination. The following sets of variables were considered: socio-demographic variables, drug use behaviors, sexual behaviors,

Table 2
Risk factors for HIV infection among IDUs in Ho Chi Minh City (1997–1998)

	IDUs in the rehabilitation center (1997), <i>N</i> =300			IDUs in the street (1998), <i>N</i> =218		
	HIV, <i>n</i> (%) ^a	Univariate OR (95% CI)	Multivariate OR (95% CI)	HIV, <i>n</i> (%)	Univariate OR (95% CI)	Multivariate OR (95% CI)
Marital status						
Single/married	59 (24.0)	1		64 (40.0)	1	
Divorced/separated	17 (40.5)	2.05 (1.4–4.06)		32 (56.1)	1.92 (1.04–3.54)	
Injecting duration						
1–4	8 (21.6)	1		15 (41.7)	1	
5–9	14 (31.8)	1.69 (0.62–4.63)		20 (69.0)	3.11 (1.11–8.70)	
10+	54 (27.3)	1.35 (0.58–3.15)		59 (39.6)	0.92 (0.43–1.92)	
Sharing in the past						
No	41 (22.5)	1		34 (36.2)	1	
Yes	35 (36.1)	1.94 (1.13–3.33)		62 (50.4)	1.79 (1.04–3.11)	
Injecting on the street						
No	62 (25.4)	1		69 (40.8)	1	
Yes	14 (40.0)	1.96 (0.94–4.08)		27 (55.1)	1.78 (0.94–3.38)	2.07 (1.04–4.17)
Injecting by drug dealers						
No	51 (23.1)	1		78 (43.3)	1	
Yes			2.90 (1.54–5.46)			
Sharing drug pots						
No	25 (43.1)	2.52 (1.38–4.63)		18 (47.4)	1.17 (0.58–2.37)	
Yes	No data	–		40 (34.5)	1	
				56 (54.9)	2.31 (1.34–4.00)	2.20 (1.23–3.92)

^a *n*: number of HIV positive among those who have a certain behavior.

knowledge, and perception of HIV infection. Data were entered into EPI-INFO, version 6.04, then analyzed with SPSS version 7.0.

2.3.2. *For trends of risk behaviors*

Chi-square test for trends and odds ratios (ORs) was used to examine the relationship between potential predictor variables and HIV risk behavior outcomes. The unadjusted and adjusted trends in risk behaviors were calculated by entering the survey periods continuously into logistic regression models in two ways: (1) unadjusted (bivariately) and adjusted for age, sex, education, marital status, and occupation. The α level was set at .05 and ORs are presented with 95% confidence interval.

3. Results

3.1. *General characteristics of the participants*

All together, 1519 IDUs were interviewed between 1995 and 1998. Table 1 presents the general characteristics of the study participants for each year of data collection by places of recruitment. On average, 44% of the IDUs interviewed were recruited in the rehabilitation center; of these, just over half (57%) had been arrested and forced to enter the center. The majority were male and more than 30 years old, with the mean age of 39 years (S.E. = 0.17). About one-third had received less than 6 years of schooling. Only one-third were married. About 80% were unemployed and had been in the center at least one time.

3.2. *Injecting and sexual behaviors*

Black-water opium was the most frequently injected drug among IDUs in HCMC. Of the subjects, 78.7% used drugs for more than 10 years. A total of 34.9% was injected at shooting galleries (among those, 31.2% were injected by dealers) and 12.9% was injected on the street. A very high proportion, 78%, injected two times or more daily. The reported rate of sharing needles in the last 6 months was relatively low, less than 20%. Of the interviewed IDUs, 49% reported that they always cleaned needles and syringes. Among those who reported ever cleaning needles and syringes, only 4.8% of them cleaned by boiling and 10.4% by bleach. The rest were rinsing with boiled water (78.7%) or wiping by cotton (6%). Concerning sexual habits, 72.3% of the interviewees reported having had their first sexual intercourse when they were less than 20 years old. Among IDUs who were recruited on the street, 44% had had sexual intercourse in the last 4 weeks and 59% in the last 6 months. Half (53%) had ever had sex with a FSW, but, of these, only 47% used condoms. Relatively few (20%) of the IDUs reported that they had ever had a STD. Results from focus group discussions suggested that although drug use and sex were not allowed in the rehabilitation center, it still occurred.

A majority (88%) of the IDUs in our study reported that they had changed their risk behavior to avoid getting HIV infection. The changes in risk behaviors they reported included

stopping sharing needles and cleaning needles and syringes (83%). Only 41% of the respondents reported using condoms.

3.3. Risk factors for HIV infection

As shown in Table 1, the HIV prevalence in 1998 among IDUs on the street was higher than that among IDUs in the rehabilitation center (44% vs. 38.5%). Associations between HIV seropositivity and possible risk factors are shown in Table 2. No significant association was found between the presence of HIV antibody and the factors: years in the city, age, sex, age starting sex, ever had sex with FSWs, ever had a STD, and use of condoms. In the univariate analysis of risk behaviors among IDUs recruited in the rehabilitation center in 1997, the following variables were significantly associated with the presence of HIV antibodies: divorced or separated, injected by drug dealers, and sharing needles in the past. However, among the IDUs recruited on the street in 1998, being divorced or separated, sharing in the past, injecting for 5–9 years, and ever sharing drug pots were associated with seropositivity. In the multivariate analysis, the following variables remained in the model and were considered as predictors for HIV infection: being divorced or separated and being injected by drug dealers (for the IDU sample in the rehabilitation center), injecting on the street, and sharing drug pots (for the IDU sample on the street).

3.4. Risk factors for current needle sharing

Table 3 shows the result of the univariate analysis of the relation between needle sharing in the last 6 months and independent variables. For IDUs in both study samples, current needle sharing was significantly associated with the following variables: injecting on the street, injecting at shooting galleries, being injected by drug dealers, and sharing in the past. IDUs recruited from the rehabilitation center that reported ever having had a STD were more likely to be sharing needles than IDUs recruited on the street. In the multivariate analysis, the following variables were considered as predictors for needle sharing: injecting on the street, injecting at shooting galleries, and having shared needles in the past. There was no association between knowledge of HIV serostatus and needle sharing.

3.5. Trends of outcome variables

The HIV prevalence among IDUs from the rehabilitation center increased from 27.2% in 1997 to 38.5% in 1998. In 1998, HIV prevalence among IDUs on the street was higher than among IDUs in the rehabilitation center (44% vs. 38.5%). In total, the rates of sharing needles reported by IDUs recruited on the street decreased significantly from 20% in 1995 to 17.7% in 1997 and 12% in 1998 ($P = .011$ for chi-square test). However, broken down by each study recruitment site, the decreased trend is not significant among the IDU sample from the rehabilitation center ($P = .399$). The ORs in Table 4 reflect the increase of injecting on the street and self-injection and the decrease of current needle sharing (except for IDUs recruited in the rehabilitation center) and injecting at shooting galleries and being injected by drug

Table 3
Risk factors for needle sharing among injecting drug users in Ho Chi Minh City (1997–1998)

	IDUs in the rehabilitation center (1997)			IDUs in the street (1998)		
	Needle sharing, <i>n</i> (%)	Univariate OR (95% CI)	Multivariate OR (95% CI)	Needle sharing, <i>n</i> (%)	Univariate OR (95% CI)	Multivariate OR (95% CI)
Injecting on the street						
No	25 (9.5)	1		14 (8.3)	1	
Yes			10.52 (2.86–38.78)			
Injecting at shooting galleries	14 (40.5)	6.49 (2.99–14.10)		12 (25.0)	3.69 (1.57–8.65)	6.53 (1.75–24.39)
No	15 (6.3)			16 (9.3)		
Yes		1			1	
Injected by dealers	25 (39.7)	9.74 (4.71–20.14)	11.94 (4.07–34.99)	10 (22.2)	2.79 (1.97–6.66)	4.03 (1.02–15.94)
No	10 (4.3)			16 (8.9)		
Yes		1			1	
Sharing needles in the past	30 (45.5)	18.67 (8.41–41.44)		10 (26.3)	3.64 (1.50–8.83)	
No	2 (1.1)	1		3 (2.4)	1	
Yes			53.65 (6.91–416.12)			10.9 (2.99–39.92)
Ever got any STDs	38 (34.5)	49.66 (11.66–210.99)		23 (24.7)	13.25 (3.84–45.73)	
No	33 (12)	1		20 (10.8)	1	
Yes	7 (28)	2.85 (1.11–7.34)		6 (19.4)	1.99 (0.73–5.44)	

Table 4
Unadjusted and adjusted trends (1995–1998) in injecting risk behaviors among IDUs in HCMC

	IDUs in the rehabilitation center		IDUs in the street	
	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Injecting on the street	2.15 (1.45–3.18)	2.16 (1.44–3.22)	2.13 (1.66–2.73)	2.12 (1.65–2.73)
Injecting at shooting galleries				
Sharing in the last six months	0.53 (0.41–0.70)	0.58 (0.44–0.76)	0.46 (0.38–0.56)	0.45 (0.37–0.55)
Self-injected	0.91 (0.67–1.25)	1.01 (0.72–1.40)	0.73 (0.57–0.93)	0.73 (0.57–0.93)
Injected by dealers	1.76 (1.37–2.25)	1.74 (1.35–2.26)	1.48 (1.24–1.76)	1.48 (1.23–1.77)
	0.48 (0.36–0.64)	0.54 (0.40–0.72)	0.46 (0.38–0.56)	0.46 (0.37–0.56)

Adjusted for age, sex, education, marital status, occupation.

dealers. The ORs for trends over the 3 years of data collection were not changed after adjustment for age, sex, education, marital status, and occupation. The decrease in high-risk injecting behavior was, therefore, probably not caused by selective participation over time. There was no significant difference of sexual risk behaviors such as use of condom, having sex with FSWs, or ever having STDs over the time of the study.

4. Discussion

As has been found in a number of other studies, the majority of IDUs in our study were male, resident in the city, unemployed, and living alone, either single, divorced, or separated. However, the participants in this study were older and less educated than those reported in other studies (WHO, 1994a, 1994b). They appear to belong to a socially marginalised group who are not socially competent and have few resources for behavior change. Their marginalisation may partly be the result of social discrimination and law enforcement activities. The high and increasing HIV prevalence among IDUs in HCMC indicates that new infections may occur at a high rate. This suggests that the preventative measures already implemented have been either ineffective or insufficient or both. IDUs on the street in HCMC who had been injecting for 5–9 years were at higher risk for HIV infection, while those who had injected for 10 years or more carried a lower risk. This result is different from other studies, where a dose–effect relationship indicated cumulative exposure (Van Ameijden, van den Hoek, van, & Coutinho, 1992). It may be explained by the more recent introduction of HIV in Vietnam than in other countries. One study on risk factors for HIV seropositivity in a sample of IDUs in drug treatment in HCMC shows that a history of previous treatment for drug abuse and a longer history of injecting drugs were associated with HIV seropositivity (Tran, Williams, Truong, & Do, 1998).

Injecting at shooting galleries where drug dealers provide drugs and also act as professional injectors may explain the high prevalence of HIV infection among IDUs in HCMC, as shown in several studies (Chaisson, Moss, Onishi, Osmond, & Carlson, 1987; Follezou et al., 1999; Hien, Giang, Binh, & Wolffers, 2000; Marmor et al., 1987). In these places, IDUs share syringes and needles as well as the same independent containers of opium solution and rinse water, any or all of which may have been contaminated through contact with an infected needle. IDUs who injected at shooting galleries and on the street had a higher likelihood of needle sharing, suggesting that less access to injecting equipment and a nonsupportive environment for safer practices contribute to continued needle sharing. The lower risk of HIV infection among IDUs who did not visit shooting galleries, but injected at a friend's house or self-injected at home, substantiates the presumed role of shooting galleries in facilitating the spread of the HIV epidemic among IDUs in HCMC. Due to law enforcement and police campaigns, many IDUs are reluctant to carry needles and syringes, which might get them arrested on charges of engaging in illegal activities. In addition, results from focus group discussions among IDUs indicate that IDUs and drug dealers have no time for sterilizing and cleaning needles and syringes. Even when needles and syringes were provided by an exchange program, they did not dare to use them. This social context probably

facilitates higher risk injection behavior among IDUs. Previous studies showed that HIV testing and counseling could be an effective intervention to reduce HIV risk behaviors (Colon, Roble, Marrero, Reyes, & Sahai, 1996). Lack of association between the knowledge of HIV serostatus and needle sharing in our study indicates, however, that testing and counseling for IDUs is underutilized. In many cases, voluntary pre- and posttest counseling was not provided. Many tested IDUs were not informed about their HIV status until they were prepared to know about it.

During the study period (1995–1998), there was a significant decreasing trend in reported needle sharing among IDUs in HCMC, which is consistent with the findings of other studies (Des Jarlais et al., 1994; Des Jarlais, Friedman, Hagan, & Friedman, 1996). The frequency of current needle sharing in our study is lower than those reported in the literature, where frequencies range from 30% to 80% (Des Jarlais, Friedman, et al., 1995; Des Jarlais, Hagan, et al., 1995). This may be explained in two ways. First, IDUs in the study area may have experienced HIV/AIDS intervention programs. IDUs seem to be increasingly aware of the drug-related risk factors for HIV transmission and seem increasingly to change their behavior. Second, needle sharing may have been under-reported or denied in our study. More than 40% of the IDUs were injected by another person, so they may not have known whether the injecting equipment used had been used by or for someone else.

Studies in the USA showed that heterosexual intercourse is a significant predictor of HIV seropositivity among IDUs (Nicolosi, Leite, Musicco, Molinari, & Lazzarin, 1992; Solomon et al., 1993). However, our study found no significant association between sexual variables and HIV infection, concurring with a report from Thailand (Choopanya et al., 1991). The finding may be explained by the low frequency of sexual intercourse among IDUs who inject opiates, as it is widely believed that drug users who take depressants (such as opiates and tranquilizers) practice less sexual intercourse than the norm (Winick, 1992). Other explanations may involve the older age and long-term drug use profile of the study participants. However, lack of any association between sexual behavior and HIV seropositivity does not necessarily mean that injecting behavior is the only way HIV is transmitted in this population. Vietnam is still in the early phase of the HIV epidemic. In some Asian countries such as India (Manipur), IDUs subsequently accelerated the spread the HIV infection to the population at large through sexual activity (Sarkar et al., 1993). Among IDUs, HIV may first spread rapidly via needle sharing. When the majority of high-risk injectors are already infected, the relative importance of sexual transmission to the larger population begins to increase. Among IDUs who were sexually active, condom use was low, especially during sex with FSWs. The association between contracting an STD and sharing needles may indicate that there are IDUs with a higher risk-taking personality, or perhaps IDUs who live in an environment that puts them at increased risk for both injecting and sexual behavior. Thus, there may be potential for further heterosexual spread from the IDU population to others in HCMC.

Like several other studies among IDUs, a number of limitations to this study should be considered. The results were based on self-reports that may have been affected by social desirability or denial of recent risk behavior. Our study found evidence that IDUs have high levels of accurate knowledge concerning the transmission of HIV. They would be aware that they are not supposed to share injecting equipment or have sex without condoms, and thus,

have a tendency to give desirable answers to the interviewer, especially when they were interviewed by peer educators. There also may be increases over time in socially desirable responses. In addition, respondents were not randomly selected. They were individuals who were easy to reach on the streets or who were in the rehabilitation centers after “street cleaning” campaigns by the police, and had increased exposure to HIV/AIDS education programs. Therefore, the results of this study should be carefully interpreted before they are used to make decisions about interventions. The self-reported rate of needle sharing may be an underestimation of the real situation.

Despite these potential biases, the findings from this study provide some insight into the rapid spread of HIV among IDUs in HCMC and have implications for prevention of further spread. First, HIV infection and needle sharing were associated with injecting at shooting galleries or on the street, and with sharing drug pots. Intervention programs need to involve not only IDUs but also drug dealers, with special effort to convince them to clean and to use clean needles and syringes on their premises. In addition, a policy shift is required from law enforcement and in public health strategies to create supportive environments for behavioural change. Apart from information and education campaigns about how to hygienically self-inject, access to clean needles and syringes has to be improved and legalization of the possession of injecting equipment could remove barriers to safer injecting practices. Legal and economic barriers could be reduced by including needle exchange programs in a comprehensive HIV prevention program among IDUs (Des Jarlais, Friedman, et al., 1995; Des Jarlais, Hagan, et al., 1995; Peak, Rana, Maharjan, Jolley, & Croft, 1995). Drug treatment such as methadone and other maintenance therapies could be introduced and assessed in Vietnam. A larger and more population-based study, especially among young IDUs, is recommended in order to determine current risk and generate generalizable data for policy, planning, and prevention efforts.

Acknowledgments

The authors would like to thank outreach workers and collaborators of the AIDS Program in HCMC for helping us in collecting data. We sincerely express our thanks to SCF UK for partial funding of the surveys. We are grateful to Dr. P. Wright for kindly reviewing the manuscript.

References

- Chaisson, R. E., Moss, A. R., Onishi, R., Osmond, D., & Carlson, J. R. (1987). HIV infection in heterosexual intravenous drug users in San Francisco. *American Journal of Public Health*, 77, 169–172.
- Choopanya, K., Vanichseni, S., Des Jarlais, D. C., Pangsringarm, K., Sonchai, W., Carballo, M., Friedmann, P., & Friedman, S. R. (1991). Risk factors and HIV seropositivity among injecting drug users in Bangkok. *AIDS*, 5, 1509–1513.
- Colon, H. M., Roble, R. R., Marrero, C. A., Reyes, J. C., & Sahai, H. (1996). Behavioral effects of receiving HIV test results among injecting drug users in Puerto Rico. *AIDS*, 10, 1163–1168.

- Des Jarlais, D. C., Choopanya, K., Vanichseni, S., Plangsringarm, K., Sonchai W., Carballo, M., Friedman, O., & Friedman, S. R. (1994). AIDS risk reduction and reduced HIV seroconversion among drug users in Bangkok. *American Journal of Public Health, 84*, 452–455.
- Des Jarlais, D. C., Friedmann, P., Hagan, H., & Friedman, S. R. (1996). The protective effect of AIDS-related behavior change among injection drug users: a cross-national study. *American Journal of Public Health, 86*, 1780–1785.
- Des Jarlais, D. C., Friedman, S. R., Friedmann, P., Wenston, J., Southeran, J. L., Choopanya, K., Vanichseni, S., Raltham, S., Goldberg, D., & Frischer, M. (1995). HIV/AIDS-related behavior change among injecting drug users in different national settings. *AIDS, 9*, 611–617.
- Des Jarlais, D. C., Hagan, H., Friedman, S. R., Friedmann, P., Goldberg, D., Frischer, M., Green, S., Tunving, K., Ljungberg, B., Wodak, A., et al (1995). Maintaining low seroprevalence in population of IDUs. *JAMA, Journal of the American Medical Association, 274*, 1226–1231.
- Dore, G. J., Brown, T., Tarantola, D., & Kaldor, J. M. (1998). HIV/AIDS in the Asia–Pacific region: an epidemiological overview. *AIDS, 12* (Suppl. B), 1–10.
- Follezou, J. Y., Lan, N. Y., Lien, T. X., Lafon, M. E., Tram, L. T., Hung, P. V., Akinine, X., Lowenstein, W., Nguyen, N. V., Theodorou, I., et al (1999). Clinical and biological characteristics of human immunodeficiency virus infected and uninfected intravenous drug users in Ho Chi Minh City Vietnam. *American Journal of Tropical Medicine and Hygiene, 61* (3), 420–424.
- Hien, N. T., Giang, L. T., Binh, P. N., & Wolffers, I. (2000). The social context of HIV risk behaviour by drug injectors in Ho Chi Minh City, Vietnam. *AIDS Care, 12* (4), 483–495.
- Hien, N. T., Long, H. T., Chi, P. K., Devillé, W., van Ameijden, E. J. C., & Wolffers, I. (1999). HIV monitoring in Vietnam: system methodology and results of sentinel surveillance. *Journal of Acquired Immune Deficiency Syndrome, 21* (4), 338–346.
- Lindan, C. P., Lieu, T. X., Giang, L. T., Lap, V. D., Thuc, N. V., Think, T., Lurie, P., & Mandel, J. S. (1997). Rising HIV infection rates in Ho Chi Minh City herald emerging AIDS epidemic in Vietnam. *AIDS, 11* (Suppl. 1), 5–13.
- Long, H. T., Hien, N. T., & Chi, P. K. (1997). Estimation and projection of HIV/AIDS in 1996–2000 in Vietnam, Hanoi, November, 45.
- Marmor, M., Des Jarlais, D. C., Cohen, H., Friedman, S. R., Beatrice, S. D., Dubin, N., el-Sadr, W., Mildvan, D., Yancovitz, S., Mathur, V., et al (1987). Risk factors for infection with HIV among intravenous drug abusers in New York City. *AIDS, 1*, 39–44.
- Ministry of Health. (2001). National Institute of Hygiene and Epidemiology: HIV/AIDS Surveillance, Estimation and projection, 2000–2005, Hanoi, January.
- Nicolosi, A., Leite, M. L. C., Musicco, M., Molinari, S., & Lazzarin, A. (1992). Parenteral and sexual transmission of human immunodeficiency virus in intravenous drug users: a study of seroconversion. The Northern Italian seronegative drug addicts (NISDA) study. *American Journal of Epidemiology, 135*, 225–233.
- Peak, A., Rana, S., Maharijan, S. H., Jolley, D., & Croft, N. (1995). Declining risk for HIV among injecting drug users in Kathmandu, Nepal: the impact of a harm reduction program. *AIDS, 9*, 1067–1070.
- Sarkar, S., Das, N., Panda, S., Naik, T. N., Sarkar, K., Singh, B. C., Ralte, J. M., Aier, S. M., & Tripathy, S. P. (1993). Rapid spread of HIV infection among injecting drug users in northeastern states of India. *Bulletin on Narcotics, XLV* (1), 91–105.
- Schoenbaum, E. E., Hartel, D., Selwyn, P. A., Klein, R. S., Davenny, K., Rogers, M., Feiner, C., & Friedland, G. (1989). Risk factors for HIV infection in intravenous drug users. *New England Journal of Medicine, 321*, 874–879.
- Solomon, L., Astemborski, J., Warren, D., Munoz, A., Cohn, S., Vlahov, D., & Nelson, K. E. (1993). Differences in risk factors for human immunodeficiency virus type 1 seroconversion among male and female intravenous drug users. *American Journal of Epidemiology, 137*, 892–898.
- Stimson, G. V., & Choopanya, K. (1998). Global perspectives on drug injecting. In: *Drug injecting and HIV infection* (pp. 1–21). London, UK: WHO UCL Press.
- Tran, S. D., Williams, A. B., Truong, H. T., & Do, N. H. (1998). Risk factors for HIV seropositivity in a sample of

- IDUs in drug treatment in HCMC, Vietnam. *Journal of Acquired Immune Deficiency Syndromes and Human Retrovirology*, 17, 283–287.
- Van Ameijden, E. J. C., van den Hoek, J. A. R., van Haastrecht, H. J. A., & Coutinho, R. A. (1992). The harm reduction approach and risk factors for human immunodeficiency virus (HIV) seroconversion in injecting drug users in Amsterdam. *American Journal of Epidemiology*, 136 (2), 236–243.
- Weniger, B. G., Limpakarnjanarat, K., Ungchusak, K., Thanprasertsuk, S., Choopanya, K., Vanichseni, S., Uneklabh, T., Thoncharoen, P., & Wasi, C. (1991). The epidemiology of HIV infection and AIDS in Thailand. *AIDS*, 5 (Suppl. 2), 71–85.
- WHO. (1992). Recommendation for selection and use of HIV antibody testing. *Weekly Epidemiological Record*, 20, 147–149.
- WHO. (1994a). Programme on substance abuse: multi-city study on drug injecting and risk of HIV infection. In: *A report prepared on behalf of the WHO International Collaborative Group*, (4, pp. 83–85). WHO/SPA/94. Geneva, Switzerland.
- WHO. (1994b). Program on substance abuse: multi-city study on drug injecting and risk of HIV infection. In: *A report prepared on behalf of the WHO International Collaborative Group*, (4, pp. 72–77). WHO/SPA/94. Geneva, Switzerland.
- WHO. (1998). UNAIDS: Report on the Global HIV/AIDS Epidemic, 67–69, June.
- WHO. (1998). Regional Office for the Western Pacific: STVI/HIV Consensus Report on STI, HIV AIDS Epidemiology, Vietnam.
- Winick, C. (1992). Substance use and abuse and sexual behaviour. In: J. H. Lowinson, P. Ruiz, & R. B., Millmun (Eds.), *Substance abuse: a comprehensive textbook*. Baltimore: Williams and Wilkins.