

Community-Based Survey of HIV Transmission Modes Among Intravenous Drug Users in Sichuan, China

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Goal: The goal of this study was to investigate the prevalence and different transmission risk factors of HIV among intravenous drug users (IDUs) in the Liangshan Yizu Autonomous Region of Sichuan province, China.

Methods: From November 8, 2002, to November 29, 2002, a community-based survey was conducted to investigate demographic characteristics, sharing patterns of injection equipment, frequencies of injection equipment, and sexual behaviors in IDUs. Blood samples were also collected to test for HIV and syphilis infection. A total of 379 subjects were recruited for the study through community outreach and peer recruiting methods.

Results: Of 379 IDUs, HIV prevalence was 11.3% (43 of 379). Ethnicity, total times of shared injection equipment in the past 3 months, shared cotton in the past 3 months, and syphilis infection were associated with HIV infection after univariate analysis using the chi-squared test. Multivariate logistic regression analysis showed total times of sharing injection equipment in the past 3 months (odds ratio [OR], 2.28; 95% confidence interval [CI], 1.18–4.43) and syphilis infection (OR, 3.10; 95% CI, 1.48–6.48) in the final model were independently associated with HIV prevalence.

Conclusion: The results of this study suggested total times of sharing injection equipment in the past 3 months and syphilis infection were significantly associated with HIV infection. Further seroepidemiologic prospective cohort studies should be conducted to clarify the impact of syphilis and high-risk sexual behaviors on HIV transmission through unprotected sexual intercourse.

SINCE 1994, CHINA HAS experienced a rapid increase in the number of HIV/AIDS cases. The HIV epidemic in China is now in a phase of exponential growth. At the end of 2002, the cumulative number of reported HIV cases in China reached 40,560, which includes 2639 AIDS cases and 1047 AIDS-related deaths.¹ In 2003, according to a China CDC survey supported by the World Health Organization, UNAIDS, and U.S. Centers for Disease

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Control and Prevention, China has 840,000 people living with HIV/AIDS, among which 80,000 are AIDS patients. This number is projected to rise in the coming years.¹

The first reported case of an HIV-infected intravenous drug user (IDU) in China was reported in the southwestern province of Yunnan along the border with Burma (Myanmar) in 1989.² Since then, the spread of HIV in China has primarily been among IDUs and, later, among commercial sex workers (CSWs) and commercial plasma donors. By the end of 1998, confirmed cases of HIV infection were reported in all 31 of China's provinces, autonomous regions, and municipalities. There are significant regional variations of the HIV/AIDS epidemic in China. The provinces and autonomous regions hardest hit by the HIV/AIDS epidemic include Yunnan, Xinjiang, Guangxi, Sichuan, Guangdong, and Jiangxi provinces.³ The majority of reported HIV infections in China are among rural people living in the southwest and ethnic minorities.³ Of the total number of reported HIV cases in China, 71% is attributed to the sharing of injection equipment among IDUs and 6.8% to heterosexual transmission.³

Over the last 10 years, drug abuse has increasingly become a more serious problem in China. In 2002, the reported number of drug users was approximately 1 million, which is an annual increase rate of 11% based on the data for recent years.⁴ The spread of HIV in China is predominantly fueled by intravenous drug use, especially in the southwest areas.³ Qin et al.⁵ and Beyrer et al.⁶ both reported that the subtypes and sequences of the HIV virus found in Sichuan province were similar to those identified in Thailand, Myanmar, and the Yunnan province of China. Sichuan province is located along the drug transportation route that links both Yunnan and Guangxi to Xinjiang.

Several studies have described the different HIV transmission risk factors among IDUs based in detoxification and detention centers in China, mostly in Yunnan and Guangxi. However, there are few studies that used community-based recruitment of IDUs and were based in Sichuan province, China.

Setting

Sichuan province is located in southwest China (see Fig. 1) and is along a major drug transportation route linking Yunnan and

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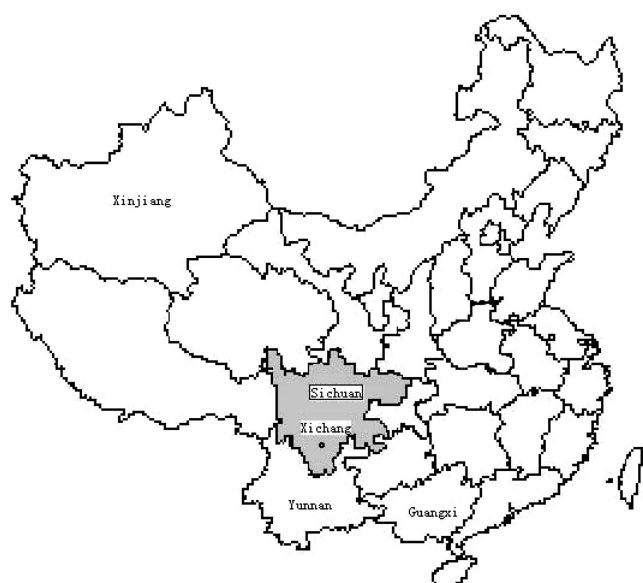


Figure 1. Map of China.

Guangxi with Xinjiang.⁶ The province is divided into 5 districts, 3 autonomous prefectures, 13 cities, and 142 counties. The total population of Sichuan is approximately 83 million. Xichang county is located in the Liangshan Yizu Autonomous Prefecture of southwest Sichuan. The total population of Xichang county is approximately 617,000 and 10% of the population belongs to the Yi minority. Xichang county has the highest reported rates of drug use and HIV infection in the Sichuan province of China⁷ and was therefore selected for the study.

Methods

Study Design and Study Population

The aim of this study was to identify the specific risk factors associated with HIV infection among IDUs living in Xichang County. Between November 8 and 29, 2002, 382 IDUs were recruited and screened by the Xichang Center for STD and Leprosy Control to take part in this 2-year prospective cohort study. Follow-up visits are conducted every 6 months. Of the total 382 persons screened, 1 person refused participation and 2 persons did not meet eligibility criteria. The total number of enrolled participants was 379 persons. The data presented in this article is from participants' baseline visits.

Study participants were primarily recruited using community-based outreach. Outreach workers distributed study-related information in the community. Known IDUs in the community were contacted directly by outreach workers and indirectly through word of mouth to invite them to join the study. Snowball sampling was also used as a recruitment strategy. A small financial incentive was given to participants who successfully referred peers to the study.

Eligibility criteria required that participants be at least 18 years old and have injected drugs at least 1 time in the last 3 months. The interview, counseling, and blood collection were all performed at the Xichang Center for STD and Leprosy Control. Study protocol and informed consent were approved by the Institutional Review Board (IRB) of the National Center for AIDS/STD Control and Prevention of the China Center for Disease Control and Preven-

tion. Written informed consent was obtained from all study participants before being interviewed. After providing written informed consent, study participation eligibility was assessed with a screening interview. Those who met the screening criteria then completed an HIV risk assessment interview, received HIV pretest and risk reduction counseling, and had blood drawn to test for HIV and syphilis antibodies. Participants were given HIV posttesting counseling when they returned for their test results.

Data Collection

Data were collected using an interviewer-administered questionnaire. Each study participant was assigned a unique and confidential identifier number that was used as the coded identifier for questionnaire and serum specimens. The questionnaire included demographic characteristics, drug use, drug injection behavior, condom use, and sexual behavior. Major demographic variables were age, gender, ethnicity, education, employment, current marital status, and owning their own home. Questions pertaining to drug use investigated the frequency of drug use and drug injection in the past 3 months and the frequency of sharing injection equipment in the past 3 months, including total times of shared injection equipment, sharing of needles or syringes, cookers, cotton, rinse water, and using front- or backloading. Sexual history questions included sex with a primary or nonprimary sex partner in the past 6 months, condom use in the last month, whether the participant gave or received money for sex in the last 6 months, and whether the participant had any new sex partners in the last 6 months.

Laboratory Analyses

All participants provided a blood specimen that was tested for both HIV and syphilis antibodies. Blood specimens were tested for the HIV antibody by enzyme-linked immunosorbent assay (ELISA) (Beijing Wantai Biologic Medicine Co., China). Reactive ELISA specimens were confirmed by an HIV-1/2 Western Blot immune assay (HIV Blot 2.2 WB; Genelabs Diagnostics, Singapore). Samples testing positive in both tests were considered HIV-positive. Syphilis antibodies were detected by ELISA (Beijing Jinhao Biologic Production Co., China). Reactive specimens were confirmed by a passive particle agglutination test for detection of antibodies to *Treponema pallidum* (TPPA, Fujirebio Inc., Japan).

Statistical Analysis

Questionnaire data were double-entered and compared with EpiData software (EpiData 2.1 for Windows; The EpiData Association Odense, Denmark). After corrections, data were then converted and analyzed using Statistical Analysis System (SAS 8.2 for Windows; SAS Institute Inc., NC).

The data were analyzed using unadjusted odds ratios with a test for significance according to chi-squared testing or Fisher exact test, which provided both *P* values and 95% confidence intervals for the odds ratio point estimates. A multivariate logistic regression model was constructed to select independent risk factors for HIV infection and also to control for confounding among other risk factors.

Results

Sociodemographic Characteristics and HIV Prevalence

Of the 379 study participants, 82.6% were males; the average age of the participants was 28.8 (standard deviation \pm 5.4) years, with a range from 44.3 to 18.3 years; 64.1% was Han, a majority ethnicity, and 30.9% was Yi, a minority ethnicity in China. A total

Table 1. Sociodemographic Characteristics and HIV Seroprevalence Among IDUs in Xichang County, Sichuan Province, China

Factor	Number Tested	% HIV Positive (N)	Odds Ratio (95% CI)	P-value
Total	379	11.3 (43)		
Gender				
Male	313	12.1 (38)		
Female	66	7.6 (5)	0.59 (0.22–1.57)	0.288
Age				
< 28 y	177	11.3 (20)		
≥ 28 y	202	11.4 (23)	1.01 (0.53–1.91)	0.979
Ethnicity				
Han	243	8.2 (20)		
Other	136	16.9 (23)	2.27 (1.20–4.31)	0.011
Years of education				
≤ 6	158	13.9 (22)		
> 6	221	9.5 (21)	0.65 (0.34–1.23)	0.181
Employed				
Yes	167	12.0 (20)		
No	212	10.9 (23)	0.89 (0.47–1.69)	0.731
Marital status				
Not married right now	266	10.2 (27)		
Married	113	14.2 (16)	1.46 (0.75–2.83)	0.260
Own home				
No	247	9.3 (23)		
Yes	132	15.2 (20)	1.74 (0.92–3.30)	0.088

of 28.5% and 42.7% had an education level of primary school (6 years) and junior high school (9 years), respectively. A total of 55.9% was unemployed and 26.4% was farmers. A total of 46.2% participants were single, 29.8% were married, and 15.0% were divorced. A total of 34.8% owned a home and 46.2% did not own their houses and lived with their parents.

As shown in Table 1, the only sociodemographic factor significantly associated with HIV infection was ethnicity (odds ratio [OR], 2.27; 95% confidence interval [CI], 1.20–4.31). No other demographic factors (gender, age, years of education, employed, marital status, and owning his or her own home) were significantly associated (*P* value >0.05) with HIV infection. HIV prevalence among participants screened was 11.3% (43 of 379).

Risk Factors for HIV Prevalence

Table 2 presents the chi-squared analysis for all drug use and injection behavior risk factors. HIV prevalence was associated with sharing injection equipment ≥3 times in the past 3 months (OR, 2.07; 95% CI, 1.08–3.95) and sharing cotton in the last 3 months (OR, 3.07; 95% CI, 1.22–7.76). There were no other reported drug use or injection risk behavior factors significantly associated with HIV infection.

Among study participants, 44.9% (170 of 379) and 36.4% (138 of 379) reported having heterosexual sex with a primary and nonprimary sex partner, respectively, in the past 6 months. The majority of participants reported never using a condom with a primary sex partner (88.2%, 105 of 119) and with nonprimary sex partners (62.9%, 56 of 89) in the last month. In bivariate analysis of sexual behavior (Table 3), only syphilis infection was associated with HIV seropositivity (OR 2.80; 95% CI, 1.36–5.77). No other sexual behavior risk factors were significantly associated with HIV infection. Homosexual behavior was not reported by any study participants.

Factors of initial multivariate model were considered to be ethnicity, owning a home, total times of sharing injection equipment in the past 3 months, sharing cotton in the past 3 months, any

new sex partner(s) in the last 6 months, and syphilis infection before final model of logistic regression was established. In the final model, total times of sharing injection equipment in the past 3 months (OR, 2.28; 95% CI, 1.18–4.43) and syphilis infection (OR, 3.10; 95% CI, 1.48–6.48) were independently associated with HIV prevalence (see Table 4).

Discussion

This study used baseline data from a prospective cohort study of IDUs to investigate HIV transmission modes among IDUs in Xichang county of Sichuan province, China.

HIV prevalence among study participants at baseline was 11.3% (43 of 379). Unlike other research done in Sichuan province, which recruited participants directly from detoxification centers and/or reeducation centers, participants from this study were recruited from the community only. Research by Yang et al.⁷ reported that in 1998–1999, HIV prevalence among IDUs in the Xichang detoxification center was 5.1% (9 of 177). Our study showed a higher prevalence than Yang's study but was similar as the national HIV sentinel surveillance data in 2003 in Sichuan Province (11.4%). The majority of the subjects in the national surveillance sentinel came from detoxification centers. Our study is the first community-based study in this area to evaluate the HIV prevalence among drug users.

As the HIV/AIDS epicenters in China, Yunnan, and Guangxi had higher HIV prevalence than in Sichuan. The first HIV outbreak among drug users in China was reported in Yunnan in 1989. HIV prevalence among drug users has increased rapidly since then.³ The overall prevalence of HIV was 71.9% among drug users from detoxification centers in Honghe and Wenshan prefectures of Yunnan province in 2000.⁸ Five of 15 prefectures in Yunnan now report high prevalence of HIV infection among IDUs (range, 48.9–75%).⁹ In Guangxi province, Lai et al. investigated 318 heroin users from Pingxiang county in 1998. Approximately 87.4% reported injecting drugs and 60% reported sharing needles. HIV prevalence was 15.4%.¹⁰

TABLE 2. Drug Use and Injection Behavior Associated With HIV Prevalence Among IDUs in Xichang County, Sichuan Province, China

Factor	Number Tested	% HIV Positive (N)	Odds Ratio (95% CI)	P-value
Drug injection past 3 mo				
< 6 times/wk	79	7.6 (6)		
≥ 6 times/wk	300	12.3 (37)	1.72 (0.70–4.21)	0.237
Heroin use past 3 mo				
< 6 times/wk	228	10.5 (24)		
≥ 6 times/wk	151	12.6 (19)	1.22 (0.64–2.32)	0.537
Used heroin plus another drug past 3 mo				
< 6 times/wk	181	9.9 (18)		
≥ 6 times/wk	198	12.6 (25)	1.31 (0.69–2.49)	0.411
Shared injection equipment past 3 mo				
< 3 times	267	9.0 (24)		
≥ 3 times	112	17.0 (19)	2.07 (1.08–3.95)	0.030
Shared needle and syringe past 3 mo				
No	223	9.4 (21)		
Yes	156	14.1 (22)	1.58 (0.84–2.98)	0.157
Shared rinse water past 3 mo				
No	265	9.8 (26)		
Yes	114	14.9 (17)	1.61 (0.84–3.10)	0.151
Shared a cooker past 3 mo				
No	269	10.8 (29)		
Yes	110	12.7 (14)	1.21 (0.61–2.38)	0.588
Shared cotton past 3 mo				
No	352	10.2 (36)		
Yes	27	25.9 (7)	3.07 (1.22–7.76)	0.023
Front/backloading past 3 mo				
No	364	11.0 (40)		
Yes	15	20.0 (3)	2.03 (0.55–7.48)	0.236

This study had 2 major findings. After controlling for sociodemographic factors, the total times of sharing injection equipment in the past 3 months were found to be associated with HIV infection. However, other injection-sharing behaviors in the past 3 months, eg, sharing rinse water, cookers, and front-/backloading, were not statistically significant. This suggests that the frequency of sharing injection equipment is a more sensitive index variable to predict HIV infection among IDUs in low HIV prevalence settings. Univariate analysis showed that sharing cotton in the last 3 months was also associated with HIV infection. Other studies showed that

the indirect sharing of injection equipment is often a significant risk factor for HIV infection among IDUs. This includes sharing cottons, rinse water, and cookers.^{11,12} However, our study failed to give the conclusion. Sharing cotton was associated with HIV prevalence in univariate analysis but was not after controlling for other factors. Drug users in China often use cotton to stop bleeding after injecting drugs, and sharing cotton may increase the risk of HIV infection. If sample size increases, sharing cotton may become an independent risk factor.

The other major finding was that syphilis infection is indepen-

TABLE 3. Sexual Behavior and HIV Prevalence Among IDUs in Xichang County, Sichuan Province, China

Factor	Number Tested	% HIV Positive (N)	Odds Ratio (95% CI)	P-value
Any unprotected sex with primary sex partner in last month				
No	269	12.3 (33)		
Yes	110	9.1 (10)	0.72 (0.34–1.51)	0.376
Any unprotected sex with non-primary sex partner in last month				
No	303	11.9 (36)		
Yes	76	9.2 (7)	0.75 (0.32–1.76)	0.512
Gave money for sex past 6 mo				
No	303	10.6 (32)		
Yes	76	14.5 (11)	1.43 (0.69–2.99)	0.336
Received money for sex past 6 mo				
No	334	11.7 (39)		
Yes	45	8.9 (4)	0.74 (0.25–2.17)	0.580
Any new sex partner (s) in the last 6 mo				
No	264	9.5 (25)		
Yes	115	15.7 (18)	1.77 (0.93–3.40)	0.081
Current syphilis infection				
No	321	9.4 (30)		
Yes	58	22.4 (13)	2.80 (1.36–5.77)	0.004

Table 4. Final Logistic Regression Analysis of the Factors Associated With HIV Prevalence in IDUs in Xichang County, Sichuan Province, China

Factor	OR (95% CI)	P-value
Total times of shared injection equipment in the past 3 mo	2.28 (1.18–4.43)	0.0148
Syphilis infection	3.10 (1.48–6.48)	0.0027

dently associated with HIV infection in both the chi-squared testing and in the final multilogistic regression model, especially adjusting for other risk factors in the final mode, respectively. Lai et al.¹⁰ reported that history of sexually transmitted diseases (STDs) is independently associated with HIV infection in the Guangxi province of China. Also, other studies have also reported that syphilis infection can be associated with HIV infection.^{13–16} This study has provided the first set of data showing the association between HIV and syphilis in China. Syphilis incidence in 2002 in China was approximately 6 per 100,000 populations and ranked fourth place among 8 reportable STDs (including HIV).³ As an ulceric STD, syphilis has been proved to facilitate HIV transmission in other countries. This study confirmed the relationship between syphilis and HIV infection, and suggested that preventing and treating syphilis should be included as a part of AIDS control efforts.

Limitations of this study include having a relatively small sample size and possible recall bias, and selected participant bias. We would not say that the HIV prevalence in our study represents the rate among all IDUs in this community, because our subject recruitment efforts might not reach all IDUs, and the participation was voluntary and must meet some criteria. Although multivariate analysis showed syphilis to be positively associated with HIV infection, we do not know if participants were infected with syphilis before or after becoming infected with HIV.

Other research has shown there is a relationship between syphilis and HIV infection. However, most of this research was performed using cross-sectional studies only. Through this seroincidence prospective cohort study, we hope to learn more about the relationship between syphilis and HIV infection and to provide better evidence regarding HIV transmission patterns and syphilis coinfection in Sichuan province, China.

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