

Risk Factors for Acquiring Human Immunodeficiency Virus (HIV) Infection among Injection Drug Users

Shu-Yun Hsu¹, Jiun-Yi Wang², Donald Dah-Shyong Jiang³,
Hsin-Tien YANG⁴, Hung-En Liao², Chieh-min Lin⁵, Kun-Yue Kao¹

1. Yunlin County Health Bureau, 2. Department of Healthcare Administration, Asia University, Taichung, Taiwan, R.O.C, 3. Field Epidemiology Training Program, Taiwan CDC, 4. Centers for Disease, Third Branch Control, R.O.C., 5. Department of Health Services Administration, China medical University, Taichung, Taiwan, R.O.C

From Chinese version, pp,549-560

Abstract

Between 1977 and 2002, there were only 84 cases of HIV infection through intravenous drug use reported to the AIDS surveillance system of the Centers for Disease Control, Department of Health. By the end of April 2007, the number of HIV infections from injection drug users (IDUs) has reached 5368. In view of the increasing HIV infections among IDUs, it is essential to have an overall understanding on the relationships between HIV infections and the sources of transmission, such as sexual behavior, methods of drug injection, and the sharing of needles, diluents or containers among drug users.

The subjects for this study were male IDUs in Tai-Chung Prison, Yun-Lin Rehabilitation Institution and Chia-Yi Rehabilitation Institution. A structured questionnaire containing questions on demographics, use of illicit drugs, needle sharing and sexual behavior was used to collect data. The results indicate that

Received: June 14, 2007; Accepted: July 23, 2007.

Correspondence author: Donald Dah-Shyong Jiang; Address: 5th F1, No.9, Sec.1, Zhongxiao E.Rd., Taipei City, Taiwan, R.O.C.

E-mail: djiang@cdc.gov.tw

there is a 2.98 times increase in the risk of contracting HIV infections is 2.98 times higher in those who do not always use (i.e. seldom, often or never use) condoms during sexual intercourse compared with those who always do. (95% confidence interval [CI] = 1.53-5.80). Sharing needles or syringes increases the risk of contracting HIV by 33.40 times (95% CI = 14.98-74.48); sharing diluents or containers increases the risk by 30.86 times (95% CI = 14.25-66.85); and concomitant use of shared needles, syringes, diluents and containers increases the risk by 45.14 times (95% CI = 20.20-100.90).

To increase the efficacy of “harm reduction programs”, the government should publicize and promote the “human immunodeficiency virus infection prevention and patient rights regulation” to help IDUs and law enforcement personnel understand the needle exchange and methadone maintenance programs, hence increasing the participation rate by IDUs without fear of criminal charges. In addition, health education may also intervene to increase awareness of HIV infection among high risk groups. IDUs may be recruited for such programs. Increasing access to counseling services and screening blood tests is also essential. Furthermore, by cooperation with non-government organizations, information on prevention of HIV transmission and methadone maintenance programs may be provided. A multidimensional approach to promoting the “harm reduction programs” is an integral part of the effort to bring HIV/AIDS under effective control.

Key words: intravenous drug users, AIDS, HIV, needle sharing, syringe sharing, drug diluents, containers

Introduction

According to the World Health Organization (WHO), AIDS is one of the top four causes of mortality in the world. In 2004, there were approximately 13 million injection drug users (IDUs) in the world. Of these, more than 5 million

were infected with Human Immunodeficiency Virus (HIV) [1]. Eastern European and central Asian countries have the highest proportion of IDUs infected with HIV (67.0%) [2-5]. According to the AIDS surveillance system of the Centers for Disease Control, Department of Health, there were only 84 cases of HIV infection through intravenous drug use reported between 1977 and 2002. However, by the end of April 2007, the case number of HIV infections amongst injection drug users (IDUs) has reached 5368, accounting for 39.1% of all HIV infections. In 2004 alone, 624 new HIV infections were reported, which is a 7.6 times rise compared to 2003. Of the 2,942 new cases of HIV infections reported in 2006, 60.4% were IDUs. All these data show that HIV is spreading quickly among IDUs.

Apart from transmission via sexual contact, the sharing of needles, syringes and diluents among IDUs has been the most important route of HIV transmission in Taiwan [6, 7]. Chen found that sharing needles and syringes or diluents and cookers increased the risk of HIV transmission in IDUs [8]. In addition, IDUs have little knowledge about the danger of sharing diluents and cookers. Prior to year 2002, promotion of HIV prevention tended to focus more on sex behavior, blood transmission, and mother to child vertical transmission. It is only after the sharp increase in HIV infection rates among IDUs in 2003 that the prevention focus has been shifted to dealing with the risk of needle sharing and promoting the importance of screening. On the other hand, the transmission risks from sharing diluents and cookers have been relatively overlooked thus far. As a result, it is necessary to have a full understanding on the relationships between HIV infections and the sources of transmission such as sexual behavior, methods of drug injection, and the shared use of needles, diluents and containers.

Materials and Methods

Subjects

The subjects for this study were IDUs from Tai-Chung Prison, Yun-Lin Rehabilitation Institution and Chia-Yi Rehabilitation Institution. Only males were chosen in this study due to the fact that IDUs who contracted HIV through injection drug use in Taiwan were mostly men

Instrument

A structured questionnaire with questions about demographics, use of illicit drugs, needle sharing practice and sexual behavior was used for data collection. The questionnaire was first tested on few IDUs whose highest education level was elementary school. The results from the pre-test were assessed by eight experts in the field to help refine the questionnaire. Between February and March 2006, 1,332 subjects selected using random sampling were surveyed. During the survey, security personnel were there to accompany the researchers who explained the content of the survey in person to the subjects. Responses to the survey were kept confidential from the personnel of the prison. Informed consent was obtained from all subjects.

Data collection and analysis

SPSS 10.0 was used for data analysis. Descriptive statistics, such as case numbers and percentages, were used to present information demographics, injection behavior, sexual behavior, type of drug used, needle sharing, source of drug paraphernalia, frequency of daily drug use and cost for both HIV positive and negative cases. For analytic statistics, a chi-square test followed by multivariable logistic regression was used to explore the association between HIV infection and each variable. Adjusted odds ratio was used to express the association between HIV infection and each variable. Association was considered statistically significant if the 95% confidence limit did not include 1.0.

Results

Of the 1,332 surveys distributed, 1,206 (90.5%) were returned. There were 179 HIV positive subjects and 1027 HIV negative subjects. The average age of the subjects was 35.1 years. The age at first drug injection ranged from 10 to 67 years. Table 1 shows that the age distribution for HIV positive subjects differs significantly from that for HIV negative subjects ($p < 0.01$). Among the HIV positive subjects, 20-29 years was the largest age group (58.6%), followed by those aged ≤ 19 years (26.6%); As for the HIV negative subjects, 20-29 years was the largest age group (53.9%), followed by those aged 30-39 years (22.2%). There was also a significant difference ($p < 0.05$) on the level of education between HIV positive and HIV negative subjects; The highest education level was junior high school for both groups (57.9% and 54.1%, respectively), followed by high school or technical school (32.0% and 27.2%, respectively). HIV positive and HIV negative cases also have different marital status distribution ($p < 0.05$). The majority were never married (69.8% and 58.2%, respectively), with married subjects constituting 11.2% and 17.7% of the sample groups respectively. There was no difference in occupation prior to imprisonment between HIV positive and HIV negative subjects ($p > 0.05$), with the majority being laborers (34.5% and 34.7%, respectively). Table II illustrates that the most frequently used drug was heroin, followed by amphetamine. Only 6.0% of the HIV positive subjects and 11.2% of the HIV negative subjects had family members who also used drugs. The difference was statistically significant ($p < 0.05$). The relationship between the source of drug paraphernalia and HIV infection was also statistically significant ($p < 0.05$). Statistically significance was also found in the frequencies of disinfection using alcohol or bleach between HIV positive and HIV negative subjects ($p < 0.01$). Needle sharing practice was also different between HIV positive and HIV negative subjects ($p < 0.01$). Significance of condom use in association with HIV infection was borderline ($p = 0.055$). On the other hand, the

relationships between HIV infection on the one hand and average daily drug expense, frequency of daily drug use, sex partner, and the presence of other sexually transmitted diseases on the other were found to be statistically insignificant ($p > 0.05$).

Logistic regression analysis showed that condom use and needle sharing remained as statistically significant risk factors for contracting HIV. However, having family members who are also IDUs poses a protective factor (Table 3). Subjects who sometimes/frequently/never used condoms during sexual intercourse in the year prior to imprisonment have a risk of contracting HIV that is 2.98 higher compared to subjects who always used condoms (95% CI: 1.53-5.80). Compared to persons who never shared needles or diluents, sharing needles increases the risk of contracting HIV by 33.40 times (95% CI: 14.98-74.48); sharing diluents and cooker increases the risk by 30.86 times (95% CI: 14.25-66.85); and sharing needles, syringes, diluents, and cooker in combination increases the risk by 45.14 times (95% CI: 20.20-100.90). The risk of contracting HIV is 0.42 times (95% CI: 0.19-0.92) higher for persons with family members who are also IDUs. In other words, having family members who are IDUs is a protective factor for HIV infection.

Discussion

In this study, the age at first drug use ranged from 20 to 29 years, which was similar to another study conducted in Taiwan [14]. Highest education level being junior high school was also similar to other studies in Taiwan [10, 11]. As a result, more emphasis should be placed on educating junior high school students about the danger of illicit drug use. In terms of marital status, most IDUs were never married; this was similar to previous studies in Taiwan [11, 12]. It could be the consequence of inability to maintain relationships due to social isolation and increased psychological problems amongst drug users [13].

The most frequently abused drug was heroin, which was consistent with findings from a number of domestic and overseas studies [6, 9, 14-15]. However, cocaine and morphine were the major drugs of abuse [17, 18] in Pakistan and the United States. Average frequency of daily drug injection among IDUs in this study (2-5 times/day) was similar to a study conducted by Chen (3-5times/day) [6], but higher than the study carried out by Grigoryan (1-2times/day) [16]. With regard to the source of drug paraphernalia, 80.4% obtained the drug from pharmacy, compared with 98.3% from another study in Taiwan [6]. In this study, 44% of the IDUs shared needles or diluents, which was higher than the 29% and 40% found in other countries such as Pakistan [16, 20], but lower than the findings in Gaskin et al (90% and 66%) [15, 21]. This study together with previous studies in Taiwan and other countries demonstrate that sharing needles, cookers and diluents is a high risk behavior for contracting HIV infection among IDUs.

In this study, only 52.8% of IDUs had a single regular sexual partner, which was lower than the 90.7% found by Chen [6] and the 55.4% and 88.0% found by scholars in other countries [19, 21]. Prior to prison, only 8.8% used condom during sexual intercourse. During the 12 months prior prison, 97.5% of the subjects were found to be free of sexually transmitted diseases. Due to the fact that sexually transmitted disease is related to the number of sex partners and also the frequency of condom use, IDUs are advised to use condoms properly for all sexual intercourse, to avoid multiple sex partners, and to actively participate in screening for STDs to prevent transmission of these infections.

Sharing needles or syringes was found to increase the risk of contracting HIV by 33.40 times (95% CI: 14.98-74.48), which was higher than Chen's findings (OR = 8.2, CI: 3.3-20.2) [8]. Another study conducted by Y. A. Chen among jailed IDUs showed that compared to those who never shared needles, syringes or

diluents, the risk of HIV infection was increased by 23.5 times as a result of sharing needles, by 8.2 times as a result of sharing diluents, and by 51.7 times as a result of sharing both needles and diluents. These studies demonstrate that sharing needles, syringes, diluents and cooker increases the risk of HIV infection; and with concomitant sharing of needles, syringes, diluents, and cookers, there is a multiplicative effect on risk. The risk of contracting HIV among IDUs whose family members were also IDUs was lower compared to those having no family members who were IDUs. This might be due to the fact that when family members are also IDUs, sharing needles tends to happen among family members, which in turn decreases the chance of sharing needles with people outside the home. As a result, the risk of contracting HIV is reduced.

Recommendations

In order to prevent HIV infection, we must focus on promoting the current regulations first. Participation in the "harm reduction programs" has slowed down due to the fact that IDUs and workers in such program are concerned about breaking the 4th item in Drug Prevention and Control Act, which states that "persons involved in production, transportation, or selling drug paraphernalia may be imprisoned between one and seven years in addition to a fine of up to NT\$1,000,000". Recently, the Statute on AIDS Prevention was revised and became the Statute for HIV Infection Prevention and Protection of the Rights of Persons Living with HIV. The statute clearly states that persons participating in some type of harm reduction program, such as needle exchange program or methadone maintenance program, will not be prosecuted. Information on the implementation of this statute should be distributed to IDUs and law enforcement officers. Effective operation of the needle exchange services that results in decreased transmission of HIV can only be achieved through increased cooperation among different agencies.

In addition, health education is needed to increase the awareness among

those involved in high risk behavior. There is an urgent need for IDUs to understand that sharing needles increases the risk of HIV transmission. IDUs and patients who contracted HIV/AIDS through injection drug will require more than just medical attention. Resolution of their complex social and psychological problems requires collaboration between government agencies and citizens. In addition, government agencies may also work with non-government organizations to conduct community outreaches, to educate the community about route of HIV transmission (especially the risk of HIV infection through sharing needles, diluents, and cookers) and the importance of using clean needles, and to inform the public about methadone maintenance therapy. These activities will help IDUs understand the importance of preventing AIDS and offer them ways to seek further assistance. Multi-focal health education is required to target different population groups, with particular emphases placed on the importance of condom use throughout sexual intercourse, the prevention of HIV transmission to women, and the related prevention of vertical transmission to children that has become another infection source for HIV in Taiwan.

Finally, peer networks among IDUs may be utilized to expand the reach of health counseling and screening services. At present, pharmacies, private laboratories, or even drug dealers have been involve in reaching IDUs to provide them with clean needles and condoms, to educate them about HIV prevention, and to offer a channel for health consultation. For example, it is important to promote the concept of safe injecting and disinfection methods so that IDUs become familiar with the idea of "harm reduction". Expanded services may include setting up needle vending machines and providing sharp containers for the disposal of used needles. Government agencies must place more emphasis on the concept of prevention when it comes to infectious diseases, and multifaceted collaborations are required to achieve effective HIV control.

Acknowledgment

The authors would like to thank the administrations of Tai-Chung Prison, Yun-Lin Rehabilitation Institution and Chia-Yi Rehabilitation Institution, as well as all respondents of the survey. The authors are especially grateful for the assistance and guidance of Po-Huang Lin, Director of the Yun-Lin County Public Health Bureau.

References

1. UNODC Campaign. Think: Taking drugs can lead to HIV/AIDS. 200511-19-0050. Ref Type: Internet Communication.
2. Chang MC. Exploring the context of drug use and HIV infection. M.S. diss, National Taiwan University, 1996
3. Ghys PD, Saidel T, Vu HT, et al. Growing in silence: selected regions and countries with expanding HIV/AIDS epidemics. *AIDS* 2003; 17: Suppl 4: S45-50.
4. Nguyen TH, Hoang TL, Pham KC, et al. HIV monitoring in Vietnam: system, methodology and results of sentinel surveillance. *J Acquir Immune Defic Syndr* 1999; 21: 338-46.
5. UNAIDS and WHO: AIDS Epidemic Update: December 2006: 5. UNAIDS, Geneva, 2006.
6. Chen CH. Risk factors of HIV infection among incarcerated male injection drug users in Tainan, Taiwan. M. S. diss, National Cheng-Kung University, 1996.
7. Taiwan CDC. AIDS statistics.
http://www.cdc.gov.tw/index_info_info.asp?data_id=1446 °
8. Chen AY. Conference on AIDS prevention and harm reduction. 2006.
9. Lin HC. A study to acceptance of intravenous drug users in taking rapid saliva test for HIV/AIDS. M. S. diss, Taipei Medical University, 1999.
10. Yu SK, Jiang DD, Chen KT. Drug abuse in Taiwan. *Taiwan Epidemiology*

Bulletin, 12: 164-170, 1996.

11. Yu WN, Lee CH. Analysis of population prone to drug abuse. Office of Controlled Substance Management, Department of Health. 1996.
12. Wang MH. The impact of the problem solving model on the drug abusers before discharging. M. S. diss, Tunghai University, 2004.
13. Kao CC. An exploratory study on drug using attitudes and mental health status heroin users. M. S. diss, Kao-Hsiung Medical University, 2004.
14. Wei HL. Short term effects of abstinence after using methadone maintenance treatment in heroin-dependent volunteers. M. S. diss, National Yang-Ming University, 2006.
15. Grigoryan S, Busel A, Papoyan A: Rapid assessment of the situation on spread of injection drug use and HIV Infection in Yerevan, Armenia. *Int J Drug Policy* 2002; 13: 433-6.
16. Magura S, Grossman JI, Lipton DS, et al: Determinants of needle sharing among intravenous drug users. *Am J Public Health* 1989; 79: 459-62.
17. Gaskin S, Brazil C, Pickering D: The sharing of injecting paraphernalia by intravenous drug users (IDUs) within a Worcestershire cohort, with specific reference to water and filters. *Int J Drug Policy* 2000; 11: 423-35.
18. Vanichseni S, Des Jarlais DC, Choopanya K, et al: Sexual risk reduction in a cohort of injecting drug users in Bangkok, Thailand. *J Acquir Immune Defic Synd* 2004; 37: 1170-9.
19. Magis-Rodriguez C, Brouwer KC, Morales S, et al. HIV prevalence and correlates of receptive needle sharing among injection drug users in the Mexican-U.S. border city of Tijuana. *J Psychoactive Drugs* 2005; 37: 333-9.
20. Perngmark P, Celentano DD, Kawichai S: Sexual risks among southern Thai drug injectors. *AIDS Behav* 2004; 8: 63-72.
21. Strathdee SA, Zafar T, Brahmabhatt H, et al: Rise in needle sharing among injection drug users in Pakistan during the Afghanistan war. *Drug Alcohol Depend* 2003; 71: 17-24.

Table 1. Demographics of HIV positive and HIV negative subjects at Tai-Chung Prison, Yun-Lin Rehabilitation Institution, and Chia-Yi Rehabilitation Institution.

Variable	HIV -		HIV +		p-value
	n	%	n	%	
Age at first injection drug use (years)*	905		169		0.007
≤ 19	180	19.9	45	26.6	
20~29	488	53.9	99	58.6	
30~39	201	22.2	19	11.2	
≥ 40	36	4	6	3.6	
Level of education *	993		178		0.03
Elementary school	155	15.6	13	7.3	
Junior high school	537	54.1	103	57.9	
Senior high schools	270	27.2	57	32.0	
Technical school/University/Graduate school	31	3.1	5	2.8	
Marital status*	989		179		0.012
Never married	576	58.2	125	69.8	
Married	175	17.7	20	11.2	
Divorced/separated/widowed	238	24.1	34	19	
Occupation	998		174		0.626
Military/civil service	30	3.0	3	1.7	
Trade/service/transportation	323	32.4	52	29.9	
Labor	346	34.7	60	34.5	
Farming/fishery	59	5.9	9	5.2	
Freelance/students/unemployed/other	240	24.0	50	28.7	

Table 2. Risk factors of HIV positive subjects at Tai-Chung Prison, Yun-Lin Rehabilitation Institution, and Chia-Yi Rehabilitation Institution.

Variable	HIV -		HIV +		p value
	n	%	n	%	
Type of drug used (Not mutually exclusive)					
Heroin	959	96.2	169	95.5	
Amphetamine	506	50.7	84	47.7	
Morphine	85	8.5	16	9.0	
Methadone	24	2.4	4	2.3	
Cocaine	20	2.0	2	1.1	
Family members use drugs *	947		168		0.040
Yes	106	11.2	10	6.0	
No	841	88.8	158	94.0	
Average daily spending on drugs	956		174		0.962
≤ NT\$ 999	131	13.7	22	12.6	
NT\$1,000~1,999	270	28.2	52	29.9	
NT\$2,000~2,999	207	21.7	38	21.8	
≥ NT\$ 3,000	348	36.4	62	35.6	
Source of injection paraphernalia*	988		175		0.014
Friends/spouse/sex partner	116	11.7	33	18.9	
Dealer/private source	72	7.3	7	4	
Pharmacy	800	81.0	135	77.1	
Used alcohol or bleach for disinfection *	964		176		0.000
All the time	194	20.1	13	7.4	
Frequently	154	16.0	16	9.1	
Sometimes	193	20.0	31	17.6	
Never	423	43.9	116	65.9	
Frequency of daily drug use	976		172		0.089
≤ 1	140	14.3	28	16.3	
2~5	546	55.9	107	62.2	
≥ 6	290	29.7	37	21.5	
Sharing needles and diluents *	951		165		0.000
Never shared needles or diluents	617	64.9	9	5.5	
Shared needles and syringes	110	11.6	42	25.5	
Shared diluents and cookers	139	14.6	61	37.0	
Shared needles, syringes, diluents, and cookers	85	8.9	53	32.1	
Sex partners	943		169		0.758
None/single fixed partner	696	73.8	129	76.4	
Multiple fixed partners	136	14.4	23	13.6	
Multiple non-fixed partners	111	11.8	17	10.1	
Condom use**	947		165		0.055
All the time	77	8.1	21	12.7	
Never/sometimes/frequently	870	91.9	144	87.3	
History of other sexually transmitted diseases	980		173		0.555
Yes	25	2.6	4	2.3	
No	955	97.4	169	97.7	

* Statistical significance set at $\alpha=0.05$; ** Borderline statistical significance.

Table 3. Multivariate analysis of risk factors of HIV positive subjects at Tai-Chung Prison, Yun-Lin Rehabilitation Institution, and Chia-Yi Rehabilitation Institution.

Variable	Adjusted OR	95% CI
Condom use*		
All the time	1.00	
Never/sometimes/frequently	2.98	1.53~5.80
Sharing needles and diluents *		
Never shared needles or diluents	1.00	
Shared needles and syringes	33.40	14.98~74.48
Shared diluents and cookers	30.86	14.25~66.85
Shared needles, syringes, diluents, and cooker	45.14	20.20~100.90
Family members also use drugs *		
Yes	1.00	
No	0.42	0.19~0.92

* Statistical significance shown if 95% CL does not include 1.0.