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Prevalence and Correlates of HIV Risk Behaviors among Drug Users in China

Xiushi Yang,[1,5] Carl Latkin,[2] David Celentano,[3] and Huasong Luo[4]

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This study examined the prevalence and correlates of HIV risk behaviors among 1,153 current drug users in China. Chi-squared tests of differences were used to test if drug users differed from non-users; logistic regression was used to identify behavior-specific risk factors. Results indicate that 60% of drug users injected drugs and more than one third shared needles. Compared to non-users, drug users had higher rates of risky sexual behavior and HIV/STDs. Among drug users, ethnic minorities and migrants were most vulnerable to unprotected casual sex and needle sharing. Drug users who experienced social isolation were associated with lower odds of risk behaviors; those who had experiences of anti-social behaviors and commercial sex, poor HIV knowledge, and perceived greater vulnerability were more prone to unprotected casual sex and needle sharing. Additional correlates of unprotected casual sex included being single, depression, and taking drugs/alcohol during sex. Additional risk factors of needle sharing included education and initiated drug use at younger ages. It is imperative that HIV interventions in China target drug users and address behavior-specific risk factors.

KEY WORDS: Drug users; HIV risk behaviors; HIV/STDs; China

INTRODUCTION

By mid 2003, China officially reported a cumulative total of 45,092 confirmed HIV infections with the actual number of people infected with the AIDS virus estimated to be 840,000 (China MOH and UNAIDS, 2003). High prevalence of HIV among blood donors in central China has captured media and public health attention; reported cases of HIV among other risk population groups such as commercial sex workers have also been on the rise (China MOH and UNAIDS, 2003; Qu *et al.*, 2002; Yu *et al.*, 2003; Zhang *et al.*, 1999). But the AIDS epidemic in China has so far been spreading mainly among drug users (Grusky *et al.*, 2002; Lau *et al.*, 2005; Xu, 2001; Yu *et al.*, 1996; Zheng, 2001). Reported HIV prevalence rates among drug users have been climbing rapidly and reached alarming levels in southwestern China (China MOH and UNAIDS, 2003; Lai *et al.*, 2001; WHO, 2001; Xia *et al.*, 1994; Yu *et al.*, 1999; Zhang *et al.*, 2002; Zheng *et al.*, 1994; Zhou *et al.*, 2001).

The sweeping HIV epidemic among drug users has taken place in the context of growing drug consumption and spread of HIV risky drug using and sexual behaviors in contemporary China. The number of registered drug users has been increasing rapidly since the 1980s, reaching one million in 2002; the actual number of drug addicts being probably many times higher (CCTV, 2003). While very few in the country injected drugs before 1990, a number of studies have reported sharp increases in the proportion of drug users who inject; among injecting drug

[1]Department of Sociology and Criminal Justice, Old Dominion University, Norfolk,, Virginia.
[2]Department of Health Policy and Management, Johns Hopkins University, Baltimore,, Maryland.
[3]Department of Epidemiology, Johns Hopkins University, Baltimore,, Maryland.
[4]Department of Geography, Yunnan Normal University, Kunming, Yunnan,, China.
[5]Correspondence should be directed to Xiushi Yang, Department of Sociology and Criminal Justice, Old Dominion University, Norfolk,, Virginia, 23529; e-mail: xyang@odu.edu.

users, a growing number share used needles without appropriately cleaning them first (Garten *et al.*, 2004; Lai *et al.*, 2000; Yang *et al.*, 2001; Zheng *et al.*, 1994; Zhu *et al.*, 2001). In addition, unprotected sex with multiple partners is common among drug users (Lau *et al.*, 2005; Li *et al.*, 2000; Yang *et al.*, 2001; Yu *et al.*, 2003; Zhou *et al.*, 2001; Zhu *et al.*, 2001). The intermingling of risky drug using and sexual behaviors greatly increases drug users' vulnerability to HIV and also makes them an important source and a critical bridging population in the spread of the AIDS virus to the general population through sexual transmission (Lau *et al.*, 2005).

While the HIV risk among drug users as a group has been well documented, not all drug users engage in HIV risk behaviors to the same extent and are at the same risk of acquiring or transmitting HIV. In a study of heroin users in Guangxi province, Lai and colleagues found that more recent, male, and non-ethnic minority users were at increased risk of injecting drugs (Lai *et al.*, 2000). Age and age at initiation of drug use were also important predictors of injection drug use (Lai *et al.*, 2000; Li *et al.*, 2000; Zheng *et al.* 1994) and HIV seropositivity (Lai *et al.*, 2001; Zhang *et al.*, 2002; Zheng *et al.*, 1994). Further, drug users who injected and/or shared needles were more likely to have had multiple sexual partners and never used a condom (Lau *et al.*, 2005; Li *et al.*, 2000). Among female drug users, exchange of sex for drugs or money was significantly associated with HIV risk behaviors (Wang and Lin, 2003). Economic difficulties in sustaining drug habit may also force some drug users to exchange sex for drug/money (Qu *et al.*, 2002; Wang and Lin, 2003; Xia, 2001) and to share needles and other injection equipments (Hammett *et al.*, 2005; Lai *et al.*, 2000; Yap *et al.*, 2002).

Although more limited, research in China has suggested the important influence of family and peers in risky drug using behaviors. For example, Lai *et al.* (2000) found that having heroin using family member and/or friends was a significant and independent predictor of injection drug use. The encouragement from friends to try drugs was the strongest predictor of the initiation of drug use (Wu *et al.*, 1996a, 1996b). A study in southwestern China among the general population, too, suggested that having family members or friends who used drugs or had risky sexual behaviors was a significant predictor of HIV risk behavior (Yang, in press). More studies in western societies have documented the importance of social influence of family and peers (Hoffmann *et al.*, 1997; Latkin *et al.*, 1996, 2001) and psychological wellbeing (Compton *et al.*, 1995; Kelley and Petry, 2000) in influencing drug users' risky drug using and sexual behaviors.

More systematic research and better understanding of the social and behavioral correlates of drug users' HIV risk behaviors are critical for designing effective behavioral prevention interventions among drug users in China (Yu *et al.*, 1999). However, such studies are still limited in China (Lau *et al.*, 2005). Further, prior studies of risky behaviors among drug users in China were largely based on convenient non-probability samples of largely institutionalized drug users; few had looked at the impact of drug users' social and psychological wellbeing on their HIV risk behavior. The purpose of this paper is to examine the prevalence and risk factors of HIV risk behaviors among a random probability sample of 1,153 current drug users both in and outside drug rehabilitation institutions in southwestern China. Specifically, we address: which drug users are particularly vulnerable to unprotected casual sex and needle sharing and to what extent these HIV risk behaviors were predicted independently by demographic characteristics, measures of economic and psychosocial wellbeing, behavior-specific characteristics and social influence, and HIV-related knowledge and perceived vulnerability.

METHODS

Participants

Data used in the analysis were from a large and population-based survey conducted in 2003, covering an entire province in southwestern China. The survey was part of a project on the link between migration, HIV risk behavior, and HIV/AIDS. In total, a population-based and probability sample of 5,499 individuals 18 to 55 years of age was successfully recruited, who consented to participate and completed a face-to-face interview. In the analysis that follows, all participants will be included in the comparative analysis of prevalence of HIV risk behaviors and HIV/STDs between drug users and non-users. However, only the sub-sample of 1,153 current drug users, which included probability samples of both current drug users enrolled in drug rehabilitation institutions and those lived in communities at the time of the survey will be included in the analysis of risk factors of unprotected casual sex and needle sharing among drug users.

Sampling Procedures

Sample selection followed a three-stage stratified sampling procedure with special care taken to secure sufficient numbers of the rare populations of people living with HIV/AIDS and drug addicts. Briefly, first, eight counties were selected, considering HIV and drug use prevalence and geographic representation of the province. Second, five townships/neighborhoods were selected from each of the eight counties selected in the first stage, giving preference to places with higher concentration of HIV/AIDS cases and drug users and considering geographic coverage of the county. This resulted in a total of 40 townships and neighborhoods as the primary sampling units (PSUs). Finally, in each PSU, all individuals between the ages of 18 and 55 were ordered in sequence in one of four mutually exclusive categories: HIV positive, drug users, migrants, and non-migrants. Target random samples of 20 HIV positive, 30 drug users, 40 migrants, and 60 non-migrants were selected from the corresponding categories in each PSU via disproportionate probability sampling (Bilsborrow *et al.*, 1997; Kalton, 1993). Because not every PSU had the target number of subjects in all categories, the actual sample size in a category varied across PSUs.

During the fieldwork, trained interviewers visited the sampled individuals, explained to them the purpose of the study, their right to refuse, and compensation for their time, and invited them to participate. If the respondent was absent, a second visit was scheduled. If a respondent could not be reached the second time or refused to participate, a replacement was selected randomly from the original sampling list containing the absent or refused respondent unless there was no one left on the list.

Measures

The main outcome variables were self-reported lifetime and 30-day measures of HIV risk drug using and sexual behaviors, namely, unprotected casual sex and needle sharing while injecting. Independent variables included individual demographic characteristics, economic and psychosocial wellbeing, behavior-specific characteristics and influence, and HIV-related knowledge and perceived vulnerability. Individual demographic and most behavior-specific characteristics are self-explanatory.

Economic and psychosocial wellbeing was measured by four composite scales, indicating the extent of economic marginalization, social isolation, and lax social control. The economic marginalization scale was constructed by first dichotomizing answers to 15 questions on employment, industry, occupation, income, perceived working conditions, and employment related benefits and then summing the 0/1 answers. The higher the score, the more economically marginalized the individual. Cronbach's alpha for the summative composite score was 0.86.

Social isolation was measured by a modified version of the UCLA Loneliness Scale (Russell and Cutrona, 1988) and the Center for Epidemiologic Studies Depression Scale (Radloff, 1977). For the former, survey respondents reported on a four-point scale how lonely they felt on each of 20 statements, while the latter was based on ratings of 20 statements on a four-point scale on the frequency of depressive symptoms experienced in the week prior to the interview. Answers to the 20 statements of the two scales were summed to form a "loneliness" scale and a "depression" scale, respectively. The higher the scales, the more lonely or depressed the respondent felt. Cronbach's alphas for the two scales are 0.80 and 0.84.

Lax social control was measured by a modified version of the Attitudes toward Authority Scale (Emler, 1999). Study respondents reported yes or no on their personal experience with respect to nine events indicating anti-social behaviors or use of "deviant" ways to achieve personal ends. Answers were then summed to create a lax social control scale. The higher the scale, the more likely the respondent had behaved in anti-social or deviant ways. Cronbach's alpha for the scale is 0.71.

Behavior-specific social influence was measured by respondents' self-report of having family members or peers with HIV risk behaviors. For sexual behavior influence, respondents reported separately on whether they knew if parents, siblings, relatives, and friends had multiple sexual partners, homosexual behavior, and exchanged sex for money or drugs. The 12 member-behavior pair wise answers were summed to form a "sexual behavior influence" index. For drug influence, respondents answered separately whether they had parents, siblings, relatives, and friends known to have ever used drugs. The four dichotomous answers were then summed to form a "drug use influence" index.

Finally, HIV-related knowledge was measured by respondents' number of correct answers to a set of 11 questions on the transmission of HIV and a dichotomous variable indicating whether respondents

had discussed condom use with peers. Perceived HIV vulnerability was based on respondent's self-assessment of the likelihood that they would be infected with HIV, $0 = 0\%, 1 = 25\%, 2 = 50\%, 3 = 75\%$, and $4 = 100\%$.

Missing Values

A hot-deck imputation (Korn and Graubard, 1999) was used to replace missing values for any variable with more than 20 of the 1,153 cases missing. First, the entire sample was classified into 160 cells, 40 PSUs by four groups (HIV positive, drug users, migrants, and non-migrants). Respondents within each cell were then randomly sorted into a sequence. Missing values of respondents within a cell were replaced by the corresponding values of a randomly selected respondent (donor) from the same cell. If the initial donor happened to also have missing values, the next respondent from the cell was chosen. The process continued until a donor with non-missing values was found within the cell and used to replace the missing values.

The validity of the hot-deck imputation is premised on the assumption that, if they had responded, study participants who had missing values would have had the same distribution of responses as the one by participants who had non-missing values on the question. In other words, if respondents who had missing values and those who had non-missing values were very different in what the variable was designed to measure, the imputation method would produce biases. However, for most questions for which imputation was applied, the number of cases with missing value was small, ranging between 20 and 50. Potential biases, if any, introduced by the imputation, would likely be small.

Statistical Analysis

Statistical analyses were divided into two parts. In the first part, Chi-squared test of difference in proportions was used to test if drug users differ from non-users in prevalence of HIV risk sexual behaviors as well as STDs and HIV. The second part of the analysis then focused on the sub-sample of 1,153 current drug users. Chi-squared test of difference in proportions and *t*-test of difference in means were first used to test bivariate relationship between each independent variable and the likelihood of having unprotected casual sex and needle sharing while injecting in the 30 days prior to the survey. Logistic regression analysis was then conducted to identify if and to what extent the four groups of factors predict independently the odds of having unprotected casual sex and needle sharing while injecting in the 30 days prior to the survey. All analyses used survey design-based "svy" methods in STATA software (StataCorp, 2001) to adjust for population weights and PSU design effects.

RESULTS

Drug User and Non-User Comparisons

Overall, current drug users were predominantly men (82%). By comparison, men accounted for only 51% of the non-users. Compared to non-users, current drug users were on average younger (mean age of 30.3 vs. 32.7 years) and less educated (93% vs. 76% receiving no more than a junior high school education). They were also more likely to be single than non-users (49% vs. 18%). In contrast to what is commonly believed, drug users in this study were statistically no more likely to be ethnic minorities than the non-users (37% vs. 32%).

Table I presents the population weighted prevalence rates of HIV risk sexual behaviors and HIV/STDs by drug using status. Both lifetime measures and measures within the 30 days prior to the survey indicate that current drug users had a sex life that was significantly HIV riskier than their non-drug using counterparts. More than half of the drug users reported casual sexual encounters and close to 37% of them had had unprotected sex with non stable sexual partners in their lifetime. By comparison, less than 10% of the non-users reported ever having sex with non stable partners and only a little over 5% had ever had unprotected casual sex. Drug users were also significantly more likely to have been involved in commercial sex than non-users. Similarly, during the month before the survey, close to 15% of drug users had casual sex and more than 7% of them had unprotected casual sex. The corresponding figures for non-users were 4 and 2%, respectively. Further, one in four drug users had taken drugs or alcohols while having sex. But less than 10% of the non-users did so in the 30 days prior to the survey.

The difference in prevalence rates of HIV was large and highly significant between drug users and non-users. Close to 11% of current drug users

Table I. Population Weighted Prevalence Rates of HIV Risky Sexual Behaviors and HIV/STDs between Current Drug Users and Non-Users

Sexual Behavior and HIV/STDs	Drug Users	Non-Users	$F_{1,40}$[a]
Lifetime Sexual Behavior			
Ever had casual sex	54.31	9.83	94.91***
N[b]	1,341	3,920	
Ever had unprotected casual sex	36.83	5.42	99.25***
N	832	3,800	
Ever buying or selling sex	16.56	2.65	65.95***
N	472	4,179	
30 Days Sexual Behavior			
Had casual sex	14.84	4.18	17.80***
N	466	4,733	
Had unprotected casual sex	7.47	2.16	10.86**
N	213	4,986	
Taking drugs/alcohols during sex	25.51	9.68	27.64***
N	683	3,678	
HIV/STDs			
Ever had STDs	14.77	8.73	3.49*
N	548	4,819	
HIV positive	10.73	0.04	1,317.54***
N	1,153	4,214	
HIV positive[c]	28.26	0.53	465.18***
N	521	123	

[a]Significance tests are population-weighted and survey design-based *F* tests of differences between drug users and non-users.
[b]The *N*'s are unweighted sample sizes.
[c]Results were based only on those who have actually tested for HIV.
*$p<0.1$; **$p<0.01$; ***$p<0.001$.

reported that they were HIV positive as compared to only 0.04% of the non-users. Among the 644 participants who have actually been tested, more than 28% of current drug users and 0.5% of non-users were HIV positive. After controlling for possible differences in the rate of HIV testing, the likelihood of being HIV positive for a current drug user remained to be more than 50 times that of a non-drug user.

Correlates of Risk Behaviors among Drug Users

Table II presents the results comparing individual demographic characteristics, economic and psychosocial wellbeing, behavior-specific characteristics and social influences, and HIV-related knowledge and perceived vulnerability between current drug users who had unprotected casual sex in the 30 days prior to the survey and those who did not. Compared to those who did not have unprotected casual sex, drug users who had unprotected casual sex in the month prior to the survey were younger and more likely to be single and migrants. In terms of economic and psychosocial wellbeing, they scored significantly higher on the depression, loneliness, and lax social control scales. For behavior-specific characteristics and influence, all five factors were statistically significant. Drug users who reported unprotected casual sex were more likely than those who did not to have initiated sex at an earlier age and before marriage, to have bought sex or exchanged sex for money, to take drugs or alcohols while having sex, and to have more relatives or peers with HIV risk sexual behaviors (i.e., scored higher on the sex influence index). Finally, for HIV-related knowledge, current drug users who had unprotected casual sex did not differ significantly from those who did not. But they perceived greater HIV vulnerability and were more likely to have discussed condom use with friends or peers.

For HIV risk drug using behaviors, 58% of the weighted sample of current drug users injected drugs, and 35% of those who injected drugs shared used needles while injecting in the 30 days prior to the survey. However, data in Table III suggest that few variables could statistically separate drug users who shared needles while injecting drugs from those who did not inject or who injected but did not share needles. Of the 15 factors examined, only age, the lax social control scale, age at first drug use, and ever selling or buying sex obtained statistical significance at the bivariate level. On average, drug users who shared needles were younger and initiated drug use at younger ages; they were also more likely to have had more anti-social behaviors (i.e., scored higher on the lax social control scale) and to have been involved in commercial sex than those who did not inject or who injected but did not share needles.

In the multivariate logistic regression, marital status, ethnicity, and migrant status were significant and independent predictors of the odds of having unprotected casual sex (See Table IV). Being married and ethnic majority (i.e., Han) predicted respectively 87 and 61% reduction in the odds of having unprotected casual sex. Being migrant, however, was associated with more than four-fold increase in the odds of unprotected casual sex. Therefore, demographically, current drug users who were single, ethnic minority, and migrants were the most vulnerable to HIV risk sexual behavior.

As expected, psychosocial wellbeing contributed independently to drug users' sexual behavior. Depression and lax social control both increased the odds of unprotected casual sex among current drug users. But social isolation as measured by the

Table II. Population Weighted Means/Proportions of Independent Variables by Unprotected Casual Sex in the 30 Days Prior to the Survey among Current Drug Users

	Unprotected Casual Sex				
	Yes		No		
Independent Variables	*N*	Mean or %	*N*	Mean or %	*F* ratios[a]
Demographic Characteristics					
Age (mean)	96	27.8	1,024	30.5	5.24**
Male (%)	96	81.2	1,022	81.7	0.0
Education (%)[b]					
Less than junior high	49	51.6	511	64.8	2.33
Junior high	36	32.6	422	29.4	2.33
Senior high or more	11	15.8	93	5.8	2.33
Married (%)	96	12.4	1,024	52.6	29.72***
Han majority (%)	96	53.5	1,019	62.2	0.63
Temporary migrant (%)	95	14.4	1,017	4.3	7.60***
Economic and Psychosocial Wellbeing					
Economic marginalization (mean)	96	12.4	1,026	11.8	1.26
Depression scale (mean)	96	45.5	1,026	41.2	4.58**
Loneliness scale (mean)	96	48.1	1,026	44.5	2.95*
Lax social control scale (mean)	96	3.2	1,026	2.1	14.71***
Behavior-Specific Characteristics/Influences					
Age at first sex (mean)	96	17.9	1,025	20.1	12.57***
First sex premarital (%)	96	92.1	1,025	66.4	14.86***
Ever selling/buying sex (%)	95	44.2	1,026	14.7	15.81***
Taking drug/alcohol during sex (%)	94	79.3	1,024	21.7	49.38***
Sex influence index (mean)	96	1.4	1,026	0.7	6.71**
HIV Related Knowledge/Vulnerability					
HIV knowledge index (mean)	96	8.3	1,026	7.0	1.91
Perceived vulnerability (mean)	96	1.0	1,023	0.5	6.51*
Discussed condom use (%)	96	48.6	1,026	30.8	4.36**

[a]Statistical significance tests are based on survey design-based (adjusted for population weights and PSU effect) *F* tests (*df*=1 and 40), using "svytab" and "svymean" commands in STATA for categorical and continuous variables, respectively.
[b]Degrees of freedom for this three (education) by two (unprotected casual sex) survey design-based *F* test are 2 and 75, respectively.
*$p<0.1$; **$p<0.5$; ***$p<0.01$.

loneliness scale decreased the odds of unprotected casual sex.

Two behavior-specific characteristics were predictors of drug users' sexual behavior. Taking drugs or alcohol during sex increased the odds of unprotected casual sex by more than 10 fold, confirming the impact of drug and alcohol consumption on decisions and judgments related to one's sexual behavior. Involvement in commercial sex was another independent risk factor, more than doubling the odds of unprotected casual sex. Somewhat unexpectedly, having family members and friends who practiced risky sexual behavior did not influence drug users' own risky sexual behavior once other factors were controlled for.

Finally, drug users' risky sexual behavior was associated independently with perceived vulnerability and peer discussion of condom use. As expected, peer discussion of condoms use predicted lower odds of unprotected casual sex. But the positive impact of perceived HIV vulnerability seemed just the opposite of what would be expected. Instead of decreasing, greater perceived vulnerability actually increased significantly the odds of unprotected casual sex.

For the likelihood of needle sharing while injecting drugs, three of the six demographic characteristics were independently associated with the odds of needle sharing among current drug users. The relationship between education and the odds of needle sharing seemed to be curvilinear in that current drug users with a junior high school education had significantly lower odds than both their more and less educated counterparts.

For measures of psychosocial wellbeing, social isolation predicted lower, whereas lax social

Table III. Population Weighted Means/Proportions of Independent Variables by Needle Sharing in the 30 Days Prior to the Survey among Current Drug Users

	Needle Sharing while Injecting				
	Yes		No		
Independent Variables	*N*	Mean or %	*N*	Mean or %	(*F* ratios)[a]
Demographic Characteristics					
Age (mean)	285	28.0	866	30.9	4.40**
Male (%)	286	87.7	863	80.5	0.63
Education (%)[b]					
Less than junior high	142	61.9	432	63.0	1.13
Junior high	117	26.2	353	32.0	1.13
Senior high or more	27	11.9	82	5.0	1.13
Married (%)	285	38.2	866	53.6	0.65
Han majority (%)	284	47.2	861	66.1	1.40
Temporary migrant (%)	282	9.1	860	3.9	1.36
Economic and Psychosocial Wellbeing					
Economic marginalization (mean)	286	11.6	867	12.0	0.41
Depression scale (mean)	286	42.0	867	41.4	0.03
Loneliness scale (mean)	286	43.9	867	45.0	0.05
Lax social control scale (mean)	286	3.1	867	1.9	11.75***
Behavior-Specific Characteristics/Influences					
Age at first drug use (mean)	286	21.8	838	23.7	8.94***
Ever selling/buying sex (%)	285	30.6	867	12.9	3.18*
Drug use influence index (mean)	286	1.5	867	1.7	0.31
HIV Related Knowledge/Vulnerability					
HIV knowledge index (mean)	286	6.9	867	7.2	0.02
Perceived vulnerability (mean)	284	0.9	866	0.4	2.16

[a]Statistical significance tests are based on survey design-based (adjusted for population weights and PSU effect) *F* tests (*df*=1 and 40), using "svytab" and "svymean" commands in STATA for categorical and continuous variables, respectively.
[b]Degrees of freedom for this three (education) by two (needle sharing) survey design-based *F* test are 1 and 46, respectively.
*$p<0.1$; **$p<0.5$; ***$p<0.01$.

control predicted higher odds of needle sharing among current drug users. In addition, drug users' odds of needle sharing were also predicted independently and significantly by two behavior-specific characteristics, HIV-related knowledge, and perceived vulnerability. Once other factors were controlled, involvement in commercial sex more than doubled the odds of needle sharing. The older the respondent initiated drug use, the lower the odds of having shared needles while injecting. Drug users who know more about HIV and its transmission were less likely to share needles while injecting. But, in opposite to what would be expected, drug users who perceived greater vulnerability were more likely to share needles.

DISCUSSION

The results of this cross-sectional study in southwestern China revealed that close to 60% of current drug users in the study injected drugs and more than one third of those who injected drugs shared needles while injecting. Compared to non-users, current drug users were significantly more likely to have had unprotected casual sex with non-stable partners. They were at significant risk of HIV/STDs and actually had significantly higher prevalence rates of HIV and STDs. The combination of high prevalence of HIV and unprotected casual sex among drug users suggests that drug users are not only at significant risk themselves but also an important source of HIV infection and a critical bridging population between high risk and the general populations through sexual transmission. Effective intervention efforts are urgently needed, which should target not only drug users' HIV risk drug using practices but also their risky sexual behavior.

However, not all drug users have engaged in HIV risk behaviors to the same extent and are at the same risk of acquiring or transmitting HIV. As the

Table IV. Logistic Regression of Unprotected Casual Sex and Needle Sharing in the 30 Days Prior to the Survey among Current Drug Users[a]

Independent Variables (reference category)	Unprotected Casual Sex (robust z)[b]	Needle Sharing while Injecting (robust z)
Demographic Characteristics		
Age	1.00 (0.20)	1.00 (0.09)
Male (female)	1.89 (0.61)	1.24 (0.79)
Education (senior high or more)		
Less than junior high	0.70 (−0.86)	0.55 (−1.84)*
Junior high	0.41 (−1.49)	0.40 (−3.05)***
Married (single)	0.13 (−3.27)***	0.70 (−1.15)
Han nationality (ethnic minority)	0.39 (−2.95)***	0.47 (−2.07)**
Temporary migrant (non-migrant)	5.55 (3.15)***	3.71 (1.97)**
Economic and Psychosocial Characteristics		
Economic marginalization index	1.06 (1.02)	0.94 (−1.01)
Depression scale	1.04 (2.32)**	1.02 (1.11)
Loneliness scale	0.95 (−2.34)**	0.96 (−1.76)*
Lax social control scale	1.18 (3.00)***	1.20 (2.24)**
Behavior-Specific Characteristics/Influences		
Age at first sex	0.91 (−1.28)	–
First sex premarital (no)	0.74 (−0.54)	–
Taking drug/alcohol during sex (no)	11.50 (5.27)***	–
Ever selling/buying sex (no)	2.53 (3.26)***	2.34 (2.80)***
Sex influence index	1.15 (0.57)	–
Age at first drug use	–	0.95 (−2.42)**
Drug influence index	–	1.01 (0.05)
HIV Knowledge/Vulnerability		
HIV knowledge index	0.94 (−1.23)	0.86 (−2.27)**
Perceived vulnerability	1.37 (2.15)**	1.44 (3.45)***
Discussed condom use (no)	0.60 (−1.67)*	–
Sample Size	1,089	1,094
Pseudo R^2 (Wald χ^2)[c]	0.35 (1, 247)***	0.18 (197)***

[a]Results presented are odds ratios adjusted for population weights and PSU design effects.
[b]Statistical significance tests for odds ratios are two-tailed robust z tests, adjusted for clustering on PSU.
[c]Statistical significance tests for pseudo R^2 are based on Wald χ^2.
*$p<0.1$; **$p<0.5$; ***$p<0.01$.

analyses suggest, being ethnic minority and migrant were the common risk factors of unprotected casual sex and needle sharing. Therefore, ethnic minority and migrant drug users are particularly vulnerable to HIV and should be particularly targeted for prevention intervention.

Drug users' psychosocial wellbeing was found to contribute significantly and independently to their HIV risk behaviors. An important finding was that drug users who had experience of anti-social behaviors (i.e., scored higher on the lax social control scale) were significantly more likely to report unprotected casual sex and needle sharing while injecting drugs. This suggests that HIV risky sexual and drug using behaviors may be related to individuals' predisposition toward problem behaviors in general and, like other problem behaviors, caused by weak normative and/or social control or individuals' disregard for prevailing social norms (Compton *et al.*, 1995; Kelley and Petry, 2000). The implication and challenge for HIV prevention intervention is, therefore, the need to develop a comprehensive approach that goes beyond targeting exclusively specific HIV risk behaviors and promotes HIV risk reduction in the context of problem behavior reduction in general. In particular, early prevention of problem behaviors through measures that enhance the normative control of behavior may be an important step to take to prevent HIV risk behaviors.

An interesting and unexpected finding was that other things being equal social isolation was associated with lower odds of both unprotected casual sex and needle sharing. One possible explanation is that social withdrawal—often a result of drug

addiction—may insulate drug users from social contacts, which in turn may advertently reduce their likelihood of unprotected casual sex and needle sharing.

Results on behavior-specific factors underscored the potentially detrimental impact of drug and alcohol consumptions on individuals' decisions concerning sexual behavior, which in turn may increase the likelihood of having unprotected casual sex. Given the widespread consumption of alcohols in China, HIV intervention programs need to pay particular attention to the influence of alcohol on risky sexual behavior. Our results also confirmed a clear link between the age at initiation of drug use and the likelihood of needle sharing later. The younger one started using drugs, the more likely he/she ended up sharing needles while injecting drugs. This calls for early prevention and education to be built into school curriculum, job training, or community outreach programs (Cuijpers, 2002; McBride, 2003; Nation *et al.*, 2003; Wu *et al.*, 2002). Such early prevention efforts can help to prevent young adults from starting the drug habit. Even if that outright prevention fails our finding suggests that a delay in initiation in drug use may help reduce drug addicts' HIV risk drug using behavior later.

A surprising finding on behavior-specific factors was the lack of significant impact of social influences of family and peers. Neither unprotected casual sex nor needle sharing among drug users was predicted by similar behaviors in their social network of family and peers. The finding is in sharp contrast to the literature, which suggests important influence of family and peers in risky drug using behaviors (Lai *et al.*, 2000; Wu *et al.*, 1996a, 1996b). It is also inconsistent with a previous study in the general population from the same survey (Yang, in press), in which the same sexual and drug use influence indices were found to be significant and powerful predictors of risky behaviors in the general population. It is possible that family members and peers may exert important influence on the initiation of drug use. But once started the drug habit, drug users' risky behaviors are influenced more by factors other than family and peers. More research is needed to look into the impact of social influence of family and peers on drug users' HIV risk behaviors.

Consistent with the literature, we found that knowledge about HIV and its transmission helped to reduce drug users' HIV risk behaviors. Although perceived vulnerability was found significant in predicting both unprotected casual sex and needle sharing, the direction of the impact was counterintuitive. Instead of reducing risk behavior, greater perceived vulnerability predicted higher odds of both unprotected casual sex and needle sharing among the study participants. One possibility is that drug users who had unprotected casual sex and/or shared needles might feel more vulnerable to HIV exactly because of their risk behaviors. Unfortunately, the cross-sectional and retrospective design of the survey did not provide data that would allow a clear identification of cause and effect.

Another limitation of the study is that, like many behavioral studies of HIV risk behavior, data were based on self-report, which is subject to recall errors. Further, because of high sensitivities of drug using and casual sex in China, people may underreport these behaviors. A third limitation of the study was the use of drug user registries in sample selection. Although the study sample included both drug users enrolled in involuntary detoxification centers and those living in communities, they were known to community and government authorities. Some hidden drug users might have been included in the sample and revealed drug using activities during the interview. But the final sample consisted mainly of known drug users, not representative of hidden drug users. For these study limitations, a prospective study design that also includes hidden drug users in natural settings and incorporates biomarkers to verify HIV risk behaviors is highly recommended in future research.

This is one of only a few population-based studies in China that have used probability samples of both drug users enrolled in detoxification centers and those living in communities and appropriate statistical methods to adjust for sampling weights and survey design effects. It is also one of few studies in China that have examined the impact of drug users' psychosocial wellbeing on their HIV risk behavior. The results are, therefore, more representative, offering a more comprehensive understanding of risk factors of unprotected sex and needle sharing among drug users in China.

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