

lasshi and cannot afford to buy drugs, so they had to participate in the methadone program.

#### *After-care*

Because many drug-using prisoners have been treated by the MMT program in Ghezel Hesar prison, concern about the aftercare of these patients has been increasing among both prisoners and health policymakers. Aftercare constitutes a substantial problem because no referral system exists and inmates are simply informed about MMT centres in the community. Moreover, MMT services are not available throughout Iran, rendering geographic distance, overcrowded programs, and long waiting lists major obstacles to continued treatment upon release.

#### **Discussion**

MTT constitutes one of the main components of the Iran Prison Organization's comprehensive HIV prevention package and is becoming increasingly accessible to opioid-dependent prisoners in Iran; however, there was little research-based evidence on the context of this treatment inside prisons. In this study, we explored the current provision of MMT in Ghezel Hesar prison, Iran, and investigated its potential impact on drug-related risk behaviours and the well-being of prisoners' families. Our findings indicate that the MMT program in Ghezel Hesar prison has been successful in helping many drug-using inmates reduce their risk of drug-related harm. Our findings also indicate that the MMT program has effects beyond those on the direct recipients of methadone because it also benefits the social wellbeing of families of MMT recipients.

Recent bio-behavioural studies conducted among visitors to drug-treatment facilities and those in a community-based setting in Tehran found that HIV-1 infection was associated with a history of shared drug injection while in prison and with multiple incarcerations (Zamani et al., 2005, 2006). Other studies have also documented the risk of HIV transmission associated with shared drug injection in Iranian prisons (Razzaghi & Rahimi, 2005). As a high risk of HIV transmission occurs through shared drug injection inside prison, the significant reduction in the amount of drug injection, and thus needle sharing, MMT program is of great importance in preventing HIV infection in Ghezel Hesar prison.

Our qualitative findings indicate that after introduction of the MMT program in Ghezel Hesar prison, the rates of drug injection and consequently of sharing needles have reportedly been reduced to very low levels among both recipients and non-recipients of MMT in the study unit. Thereby, the MMT program can potentially reduce drug use and drug injection by inmates in Ghezel Hesar prison, a finding that concurs with evidence from other countries (Dolan et al., 2003, 2005; Gossop et al., 2001; Tomasino et al., 2001). Consequently, it is very important that comprehensive HIV prevention measures, including MMT, become widely available for drug-using prisoners to best control the epidemic among injection drug users and prevent further transmission of the infection to broader populations.

To our knowledge, our study is among the first to reveal a possible impact of the MMT program on the social and economic well-being of the families of the prisoners. The participants unanimously reported that MMT has helped ease the financial burden on their families, as they no longer need to give money to the prisoners to buy illicit drugs, which are particularly expensive inside prison. This in turn may have helped prisoners maintain ties with their families by eliminating such financial problems.

Our findings indicate that at the time of the study, several barriers existed to the provision of quality MMT and scale-up of this prevention intervention in Ghezel Hesar prison. The shortage of

qualified personnel seems to be a real impediment to the controlled administration of methadone in the prison. This shortage of health personnel is mirrored in some deficiencies, including some degrees of methadone diversion in the prison unit. Although the level of dedication and commitment of the health personnel and other people currently involving in providing MMT in Ghezel Hesar prison is very high, any plan for further scale-up MMT in this prison must find a way to deal with the shortage of qualified health personnel as the first priority.

Although the health care staffs seem non-judgemental toward drug-using inmates, including IDUs and MMT recipients, the fact that MMT commenced with the most disadvantaged prisoners has unintentionally stigmatized the inmates in the MMT program. This might pose an obstacle to scaling up the process. Although it sounds paradoxical, this problem might be solved after expanding the program to other units with more neutral reputations in terms of the types of prisoner incarcerated.

The high levels of concern among drug-using prisoners over the potential side effects of methadone were much more intense than expected. Unless a well-targeted educational program regarding the overall safety of methadone for long-term use is developed, these concerns, which might have been intensified by drug dealers in Ghezel Hesar prison, may affect the acceptability of MMT to a substantial degree.

Many of these misconceptions could be corrected through sufficient information provision and education by the health care staff of the prison. Some limitations to this study should be noted. This qualitative study did not seek to produce generalizable findings, but rather to offer variety of observations about the provision of MMT and its utilisation by incarcerated drug users. Although the research team and prison health staff made substantial efforts to help participants feel comfortable and share their thoughts and experiences in focus group discussions, socially desirability in responding remains a potential source of bias in research involving inmates in a punitive setting. In addition, some important issues as the compliance of opioid-users with the MTT program, the details of methadone diversion, and impact of methadone on sexual health of opioid-dependent prisoners await future research.

In conclusion, our findings suggest that access to MMT is helpful for improving the physical and psychological health of the recipients. In particular, MMT is perceived as being effective in reducing illicit drug injection in a prison setting and can be considered an important intervention for preventing the transmission of blood-borne infections among inmates. MMT also had a promising impact on the financial and social well-being of prisoners' families by easing the financial strain placed on both the families and opioid-dependent prisoners before receiving MMT. It is recommended that comprehensive prevention measures, including a MMT program, are made available to incarcerated drug users and these programs be better coordinated with those available in the outside community.

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#### **Conflict of interest statement**

None.

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Research article

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## Methamphetamine use and correlates in two villages of the highland ethnic Karen minority in northern Thailand: a cross sectional study

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### Abstract

**Background:** The prevalence of methamphetamine use and human immunodeficiency virus (HIV) incidence are high in lowland Thai society. Despite increasing social and cultural mixing among residents of highland and lowland Thai societies, however, little is known about methamphetamine use among ethnic minority villagers in the highlands.

**Methods:** A cross-sectional survey examined Karen villagers from a developed and a less-developed village on February 24 and March 26, 2003 to evaluate the prevalence and social correlates of methamphetamine use in northern Thailand. Data were collected in face-to-face interviews using a structured questionnaire.

**Results:** The response rate was 79.3% (n = 548). In all, 9.9% (males 17.6%, females 1.7%) of villagers reported methamphetamine use in the previous year. Methamphetamine was used mostly by males and was significantly related to primary or lower education; to ever having worked in town; to having used opium, marijuana, or heroin in the past year; and to ever having been diagnosed with a sexually transmitted infection (STI).

**Conclusion:** Since labor migration to towns is increasingly common among ethnic minorities, the prevention of methamphetamine use and of HIV/STI infection among methamphetamine users should be prioritized to prevent HIV in this minority population in Thailand.

### Background

Historically, Thailand was once notorious for its opium production, which started in the late nineteenth century and continued until the mid twentieth century [1]. However, in modern Thailand methamphetamine is the most popular illicit drug. Of all new hospital admissions for

drug treatment in Thailand in 2006, 75.6% (n = 29,235) of patients were admitted for methamphetamine use. Furthermore, 75.2% (n = 51,457) of all drug-related arrests in 2006 were methamphetamine related [2]. A household survey conducted in 2003 suggested that 0.2% of the 45 million Thai people aged 12 to 65 years had used meth-

amphetamine during the previous year (2002), and 2.4% had used it in their lifetimes [3]. There is increasing concern that methamphetamine use is now prevalent among young people (aged 15–21 years) in Thailand. A urine test conducted among vocational school students in this age group ( $n = 1725$ ) determined that 10.3% of this study group tested positive for current methamphetamine use. Additionally, 29.0% of the study group reported having ever used methamphetamine [4]. Moreover, methamphetamine use has been identified among highland ethnic minorities in areas of upper northern Thailand [5,6].

In Thailand, roughly 1 million people are members of ethnic minorities, constituting 1.6% of the entire Thai population. These minorities have distinct cultural backgrounds, practices and languages. Most (approximately 920,000) are members of nine ethnic minorities that reside in the highland areas at elevations from 500 to 2,500 meters. These highlanders are officially classified as "hill tribes," or highland ethnic minorities, among which the Karen account for the largest population (47.5%) [7,8]. Karen villagers originally resided in Myanmar for centuries but began to migrate into Thailand in the eighteenth century; today the vast majority of Karens, some 4 million, still remain in Myanmar [9]. While they face a struggle to attain their basic human rights, including democracy, and self-determination, the Karen in Thailand also face cultural and political discrimination. There is a stereotyped public view that highland ethnic minorities, including Karen residents, practice forest destruction by engaging in swidden cultivation, despite the fact that much of the deforestation has been caused by illegal logging [10]. Although the Karen have been mobile for many centuries, migration to lowland cities in search of labor or educational opportunities has increased in recent years. This was especially true in the 1980s for Karen youth. The increasing migration, together with improved infrastructure and media access in the remote villages, has resulted in a rise in material possessions that represent an elevation to prestigious cultural status as well as significant changes in lifestyle, sexual morality, and sexual behaviors [11].

Although opium is traditionally cultivated and used among some highland ethnic minorities, methamphetamine was first used in the highland communities in around 1996 [6]. Methamphetamine use was thought to be more common among Thais than among highland ethnic minorities, as reflected in the results of a recent survey of people attending a drug treatment center in northern Thailand [5]. Apart from its direct toxicity, methamphetamine represents a serious health concern in the context of the HIV epidemic. This is because methamphetamine use leads to engagement in other illicit drug use [12,13], sexual initiation or increase in sexual activity [14,15], multi-

ple steady male partners [15], and STIs [12], though the factors associated with methamphetamine use vary depending on the study population. However, little is known about recent methamphetamine use among ethnic minority villagers in the highlands, where a rapid cultural shift is leading to increased social and cultural mixing with lowland Thai societies, in which the prevalence of methamphetamine use and HIV are high.

In 2003, we conducted a cross-sectional survey in two Karen villages, located in a mountainous area and with differing levels of development, to study the prevalence and social correlates of sexual behaviors, including drug use [16]. In this article, we reanalyze the data, focusing on the demographic and behavioral characteristics of methamphetamine users and the correlates of methamphetamine use.

## Methods

The method used in the study is described elsewhere [16]. Briefly, we conducted a survey in two Karen villages at different levels of infrastructural development in a mountainous region in northern Thailand. The two villages were selected from villages in Category 1, the most developed level, and Category 3, a less developed level, based on the government categorization; among five possible levels within that categorization, more than 90% of villages in the study districts are classified in categories 1 to 3 [7]. We recruited all 15- to 54-year-old residents for the study, assuming that the differences between villages might reflect changes in culture and consequently in the behavioral patterns of the villagers. In detail, village A had electricity and a paved road linking it to town, enabling convenient year-round access to information and town life, whereas village B had no such infrastructure, limiting the villagers' access to town, especially in the rainy season.

Data were collected on February 24 and March 26, 2003. Six Karen health workers, three for each village, conducted face-to-face interviews at the respondents' homes in each village using a structured questionnaire. The questionnaire was developed based on results of eight focus group interviews with male and female Karen villagers. The questionnaire, written in Thai, was translated into the local languages through discussions among interviewers. For sensitive questions, such as questions about drug-related and sexual attitudes or behaviors, a separate answer sheet was prepared, and illustrations were used for those who were illiterate. Prior to the data-collection phase, we pretested the questionnaire in other villages that were distant from the study villages, and then revised the questions iteratively as needed. Informed consent was obtained and no names or other identifiers were collected. After completing each interview, the consent form, ques-

tionnaire, and answer sheet were put in an envelope and sealed in front of the respondent.

For statistical analysis, the chi-square test and Fisher's exact test when necessary were used for bivariate analysis, and a multiple logistic regression analysis was used to identify variables independently associated with methamphetamine use by entering all of the variables simultaneously.  $P < 0.05$  was used as the critical value to determine statistical significance. In both the bivariate and multivariable analyses, the data for males and females and the data for methamphetamine non-users (users of opium, marijuana, or heroin only) and drug non-users were combined due to the small number of females and methamphetamine non-users; this actually had a limited influence on the characteristics of the combined population. The variable "graduated from a school in town" was excluded from the multivariable analysis, since it was strongly ( $r > 0.7$ ) correlated with another variable, education. Variables such as age, religion, education, and main occupation were transformed into dichotomous variables for the bivariate and multivariable analyses.

The study protocol was approved by the National Research Council of Thailand and by the Kyoto University Graduate School and Faculty of Medicine Ethics Committee.

## Results

Out of the 691 15- to 54-year-old residents of both villages, those who were not seen for three home visits or

who were missing essential data on methamphetamine use, sex, age, or sexual behaviors were excluded from the analysis. This resulted in a total response rate of 79.3% ( $n = 548$ ), 80.7% in village A and 76.8% in village B. None of residents visited by interviewers refused to answer the questionnaire.

Table 1 shows the situation of drug use among participants, of whom 9.9% (male 17.6%, female 1.7%) reported methamphetamine use in the past year and 13.3% (male 22.6%, female 3.5%) reported the use of at least one of four major drugs. In both villages, the drug users were predominantly male and methamphetamine was the most commonly used drug; only one participant reported injection drug use. Of the drug users, 61.0% and 36.4% of male users in Villages A and B, respectively, were multiple drug users, whereas all of the female users were single drug users.

Table 2 describes the characteristics of the villagers according to methamphetamine use in the past year. Demographic characteristics such as age, marital status, religion, education, and graduation from a school in town were similar in both the methamphetamine users and methamphetamine/drug non-users. Methamphetamine users were more likely to be daily wage laborers, to have ever worked in town, to have used other drugs in the past year, to have ever been diagnosed with STIs in their lifetimes compared to those who were methamphetamine/drug non-users.

**Table 1: Drug use among Karen villagers in the past one year\***

Drug use	Village A						Village B						Grand total (n = 548)	
	Male (n = 174)		Female (n = 182)		Total (n = 356)		Male (n = 100)		Female (n = 92)		Total (n = 192)			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Methamphetamine use <sup>c</sup>	34	19.5	5	2.7	39	11.0	15	15.0	0	0.0	15	7.8	54	9.9
Opium use <sup>c</sup>	16	9.2	2	1.1	18	5.1	11	11.0	3	3.3	14	7.3	32	5.8
Marijuana use <sup>c</sup>	18	10.3	0	0.0	18	5.1	3	3.0	0	0.0	3	1.6	21	3.8
Heroin use <sup>c</sup>	11	6.3	0	0.0	11	3.1	2	2.0	0	0.0	2	1.0	13	2.4
Any of 4 drugs <sup>b</sup> use	41	23.6	7	3.8	48	13.5	22	22.0	3	3.3	25	13.0	73	13.3
Methamphetamine non-use <sup>d</sup>	7	4.0	2	1.1	9	2.5	7	7.0	3	3.3	10	5.2	19	3.5
Non-drug use	130	74.7	174	95.6	304	85.4	74	74.0	88	95.7	162	84.4	466	85.0
Missing data	3	1.7	1	0.5	4	1.1	4	4.0	1	1.1	5	2.6	9	1.6
Drug injection	0	0.0	0	0.0	0	0.0	1	1.0	0	0.0	1	0.5	1	0.2

\*Proportion of missing data varied from 0.5 to 6.7%

<sup>b</sup>Methamphetamine, opium, marijuana, or heroin

<sup>c</sup>Included multiple use

<sup>d</sup>Included multiple use except for methamphetamine

**Table 2: Characteristics of villagers by status of drug use in the past one year<sup>a</sup>**

Variables	Methamphetamine user						Methamphetamine/drug non-user <sup>b</sup>						
	Village A (n = 39)		Village B (n = 15)		Total (n = 54)		Village A (n = 317)		Village B (n = 177)		Total (n = 494)		
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	
Age group (years)	15 – 24	18	46.2	2	13.3	20	37.0	141	44.5	66	37.3	207	41.9
	25 – 34	11	28.2	3	20.0	14	25.9	85	26.8	58	32.8	143	28.9
	35 – 44	5	12.8	7	46.7	12	22.2	73	23.0	37	20.9	110	22.3
	45 – 54	5	12.8	3	20.0	8	14.8	18	5.7	16	9.0	34	6.9
Sex	Male	34	87.2	15	100.0	49	90.7	140	44.2	85	48.0	225	45.5
	Female	5	12.8	0	0.0	5	9.3	177	55.8	92	52.0	269	54.5
Marital status	Never married	17	43.6	1	6.7	18	33.3	107	33.8	57	32.2	164	33.2
Religion	Christianity	15	38.5	13	86.7	28	51.9	73	23.0	144	81.4	217	43.9
	Animism	3	7.7	2	13.3	5	9.3	22	6.9	9	5.1	31	6.3
	Buddhism	20	51.3	0	0.0	20	37.0	211	66.6	22	12.4	233	47.2
	Missing data	1	2.6	0	0.0	1	1.9	11	3.5	2	1.1	13	2.6
Education	Primary or lower	25	64.1	15	100.0	40	74.1	188	59.3	135	76.3	323	65.4
	Junior high school	7	17.9	0	0.0	7	13.0	73	23.0	21	11.9	94	19.0
	High school or higher	6	15.4	0	0.0	6	11.1	52	16.4	20	11.3	72	14.6
	Missing data	1	2.6	0	0.0	1	1.9	4	1.3	1	0.6	5	1.0
Main occupation	Farmer	20	51.3	15	100.0	35	64.8	215	67.8	145	81.9	360	72.9
	Daily wage laborer	14	35.9	0	0.0	14	25.9	26	8.2	10	5.6	36	7.3
	Student	0	0.0	0	0.0	0	0.0	41	12.9	20	11.3	61	12.3
	Other	4	10.3	0	0.0	4	7.4	28	8.8	1	0.6	29	5.9
	Missing data	1	2.6	0	0.0	1	1.9	7	2.2	1	0.6	8	1.6
Graduated from a school in town	Graduated	9	23.1	0	0.0	9	16.7	82	25.9	36	20.3	118	23.9
	Missing data	1	2.6	0	0.0	1	1.9	15	4.7	3	1.7	18	3.6
Ever worked in town	Ever worked	16	41.0	10	66.7	26	48.1	50	15.8	47	26.6	97	19.6
	Missing data	0	0.0	0	0.0	0	0.0	11	3.5	1	0.6	12	2.4
Opium use	Yes	11	28.2	6	40.0	17	31.5	7	2.2	8	4.5	15	3.0
	Missing data	0	0.0	0	0.0	0	0.0	1	0.3	1	0.6	2	0.4
Marijuana use	Yes	15	38.5	0	0.0	15	27.8	3	0.9	3	1.7	6	1.2
	Missing data	0	0.0	1	6.7	1	1.9	4	1.3	3	1.7	7	1.4
Heroin use	Yes	9	23.1	0	0.0	9	16.7	2	0.6	2	1.1	4	0.8
	Missing data	0	0.0	1	6.7	1	1.9	1	0.3	5	2.8	6	1.2
Opium, Marijuana, or Heroin use	Yes	23	59.0	6	40.0	29	53.7	9	2.8	10	5.6	19	3.8
	Missing data	0	0.0	0	0.0	0	0.0	4	1.3	5	2.8	9	1.8
Ever diagnosed with STIs	Yes	5	12.8	1	6.7	6	11.1	3	0.9	3	1.7	6	1.2
	No (Ever had sex)	21	53.8	12	80.0	33	61.1	210	66.2	114	64.4	324	65.6
	No (Never had sex)	13	33.3	1	6.7	14	25.9	103	32.5	54	30.5	157	31.8
	Missing data	0	0.0	1	6.7	1	1.9	1	0.3	6	3.4	7	1.4

<sup>a</sup>N = 548, Those who missed the answer on methamphetamine use were excluded<sup>b</sup>Including methamphetamine non-user and drug non-user

Among methamphetamine users, those from village A (developed) were more likely to be younger, to never have been married, to be daily wage laborers, to have graduated from a school in town, to have never worked in town, to have used marijuana and heroin in the past year, to have been diagnosed with an STI in their lifetimes, compared to those from Village B; no such differences were seen between villages within methamphetamine/drug non-users.

Table 3 shows the results of the bivariate and multivariable analyses of the Karen villagers. In the bivariate analysis, the respondents who were male; had never married; were not farmers; had worked in town; had used opium, marijuana, or heroin in the past year; and had been diag-

nosed with an STI were significantly more likely to be methamphetamine users. The multivariable analysis showed that respondents who were male; had primary or lower education; had worked in town; were opium, marijuana, or heroin users in the past year; and had ever been diagnosed with an STI were significantly more likely to be methamphetamine users.

### Discussion

To our knowledge, this is the first study to describe the prevalence of methamphetamine use and its correlates among the Karen villagers in a mountainous area of northern Thailand. Specifically, our study revealed that in 2003 methamphetamine was readily available and was used by 9.9% of the residents of two separate Karen vil-

**Table 3: Correlates of Methamphetamine use in the past one year among Karen villagers**

Variables	N	MA <sup>a</sup> user		P-value	Bivariate analyses		Multivariable analyses			
		n	%		OR	95CI	P-value	AOR	95CI	
Village	A (developed)	356	39	11.0	0.239	1.45	(0.78 – 2.71)	0.109	2.20	(0.84 – 5.78)
	B (traditional)	192	15	7.8		1.00				
Age group (years)	15 – 34	384	34	8.9	0.229	0.70	(0.39 – 1.26)	0.440	1.46	(0.56 – 3.82)
	35 – 54	164	20	12.2		1.00				
Sex	Male	274	49	17.9	0.000	11.72	(4.59 – 29.91)	0.012	3.90	(1.35 – 11.28)
	Female	274	5	1.8		1.00				
Marital status	Never married	182	18	9.9	0.984	1.01	(0.55 – 1.83)	0.275	2.90	(0.43 – 19.68)
	Ever married	366	36	9.8		1.00				
Religion	Christian	245	28	11.4	0.285	1.36	(0.77 – 2.41)	0.893	1.06	(0.44 – 2.56)
	Buddhism or Animism	289	25	8.7		1.00				
Education	Primary or lower	363	40	11.0	0.166	1.58	(0.82 – 3.04)	0.038	3.10	(1.06 – 9.03)
	Junior high school or higher	179	13	7.3		1.00				
Main occupation	Other than Farmer <sup>c</sup>	144	18	12.5	0.209	1.47	(0.80 – 2.69)	0.400	1.52	(0.58 – 4.01)
	Farmer	395	35	8.9		1.00				
Graduated from a school in town	Not graduated	402	44	10.9	0.207	1.61	(0.76 – 3.40)			-
	Graduated	127	9	7.1		1.00				
Ever worked in town	Ever worked	123	26	21.1	0.000	3.69	(2.07 – 6.57)	0.003	3.55	(1.53 – 8.28)
	Never worked	413	28	6.8		1.00				
Opium, Marijuana or Heroin use	Yes	48	29	60.4	0.000 <sup>b</sup>	28.45	(14.06 – 57.56)	0.000	19.63	(8.04 – 47.94)
	No	491	25	5.1		1.00				
Ever diagnosed with STIs	Yes	12	6	50.0	0.000	11.21	(3.19 – 39.41)	0.008	20.76	(2.18 – 197.43)
	No (Ever had sex)	357	33	9.2	0.690	1.14	(0.59 – 2.20)	0.238	2.95	(0.49 – 17.88)
	No (Never had sex)	171	14	8.2		1.00				

<sup>a</sup>Methamphetamine

<sup>b</sup>Fisher's exact test

<sup>c</sup>Daily wage worker (n = 50), student (n = 61), jobless (n = 26), housework (n = 6), other job (n = 1)

lages. This is a much higher rate than that reported for the general Thai population (2.4% in 2001, and 0.2% in 2003 [3]), contrary to what has been suggested in previous reports. The results presented herein strongly suggest that methamphetamine use may have spread within the Karen population since its introduction in the mid 1990s.

In contrast to our hypothesis that residential development would significantly affect the drug-use behavior patterns of the local villagers, the results of the multivariable analysis showed that experience of working in town (rather than the level of development of one's village) was the significant predictor of methamphetamine use. Contact with lowland Thai society through labor migration might have increased the use of methamphetamine because it enables laborers to work longer hours or to cope with work-related stress associated with different socio-cultural situations. It is also possible that once exposed to methamphetamine, Karen villagers might be less reluctant than Thais to use new narcotic drugs, including methamphetamine, owing to the Karen's cultural and traditional use of opium, dating from the late nineteenth century [17]. The fact that the use of opium, marijuana, or heroin was a very strong predictor of methamphetamine use supports this inference. Importantly, the multivariable analysis showed that a history of an STI was potently associated with methamphetamine use, suggesting that methamphetamine users constitute an important subpopulation of Karen villagers that should be targeted by HIV-prevention programs.

There are some limitations to our study. There may have been interviewer or reporting bias despite the intensive training of the interviewers before data collection and the use of a separate answer sheet, with illustrations for those who were illiterate, for responding to sensitive questions. The small number of methamphetamine users ( $n = 54$ ) may make the model unstable and reduce the statistical power. We may not be able to generalize the results to the entire Karen population, since the results were for only two villages. Furthermore, our results may have been influenced by the so-called "war on drugs" that the Thai government started to crack down on drug businesses in February, 2003, the month our study started; however, this influence may have been mixed, since one study identified a reduction in methamphetamine use among middle school students after the "war" began [18], while another study observed a shift to methamphetamine use from injected drugs among injection-drug users [19].

### Conclusion

Despite these limitations, our study identified a high prevalence of methamphetamine use among highland Karen villagers and a strong association with experience of working in town. Since labor migration to town is increasingly

common among ethnic minorities in Thailand, with the hope of achieving better economic status, the prevention of methamphetamine use and of HIV/STI infection among methamphetamine users should be given priority among minority populations in Thailand.

### Competing interests

The authors declare that they have no competing interests.

### Authors' contributions

EK planned the study and its design, carried out the data collection, analysis, and interpretation, and drafted the manuscript. SV developed the study design, coordinated the study, participated in collection the data, and made comment to the manuscript. YM participated in data analysis, data interpretation, and manuscript writing. SW was involved in coordination of the study, collection and interpretation of the data. AK was involved in data collection and analysis, and made comment to the manuscript. MOK participated in development of the questionnaire, data interpretation, and made comment to the manuscript. YH participated in development of research conception, revision of the questionnaire, and interpretation of the data from anthropological perspectives on the Karen. MK participated in planning of the study design, data analysis and interpretation, made comment to the manuscript and gave final approval for the submission of the manuscript. All authors read and approved the final manuscript.

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Research article

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## Early initiation of sexual activity: a risk factor for sexually transmitted diseases, HIV infection, and unwanted pregnancy among university students in China

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### Abstract

**Background:** To explore any association between the timing of the initiation of sexual activity and sexual behaviors and risks among university students in China.

**Methods:** Data were derived from a cross-sectional study on sexual behavior among university students conducted in Ningbo municipality, China, at the end of 2003. Students completed a self-administered, structured questionnaire. Of 1981 sexually active male students, 1908 (96.3%) completed the item for timing of the initiation of sexual activity and were included in bivariate trend analyses and multiple logistic regression analyses to compare the association between this timing and sexual behavior and risks.

**Results:** Male early sexual initiators had a significantly higher risk profile, including a significantly higher proportion reporting non-regular partners (i.e., casual or commercial partners), multiple partners, diagnosis with a sexually transmitted disease (STD), partner history of pregnancy, partner history of induced abortion, and less condom and oral contraceptive use, compared with late initiators. Multivariate analyses confirmed the increased likelihood of these risks in early initiators versus late initiators, other than partner type during the last year.

**Conclusion:** Our results showed that, compared to late initiators, people who initiated sexual activity early engaged in more risky behaviors that could lead to elevated risks of unwanted pregnancies and STDs or human immunodeficiency virus infection. Sex-education strategies should be focused on an earlier age, should include advice on delaying the age of first sexual activity, and should target young people who continue to take sexual risks.

## Background

Sexual activity rates in Chinese university students are still low; studies in different regions have shown that the range of those engaging in sexual activity is between 5 and 20% [1-5]. However, with the great changes in the economy and culture in China since the start of its open-door policies in the 1970s and the economic reforms of the 1980s, the sexual behaviors and attitudes of Chinese people are changing rapidly, becoming more active and liberal [6-8]. More and more young people are having sex at an earlier age, and they generally do not protect themselves [9,10]; indeed, the age of sexual activity onset in university students has decreased [4]. At the same time, sexually transmitted diseases (STDs) and a human immunodeficiency virus (HIV) epidemic have spread rapidly in China in recent years [11]. National reports in 2005 and 2007 indicated that HIV/acquired immunodeficiency syndrome (AIDS) is still on the rise, spreading from high-risk groups to the general population, and the proportion of sexual transmission among HIV-infected persons is increasing each year [12,13]. STD incidence is one of the highest among all notifiable infectious diseases [14]. From 1987 to 2006, the reported incidence of syphilis increased from .08 to 13.35 per 100,000 people [13]. Previous reports have indicated that, although the rate of sexual activity in Chinese university students is generally low, some sexually active students engage in much risky behaviors, including very low condom use, very low contraceptive use generally, and sex with multiple and commercial partners [2-5]. Such behaviors make them vulnerable to STD/HIV infection and pregnancy. With more people being likely to initiate sexual activity earlier than ever before, often becoming sexually active in the adolescent period, there is serious concern regarding the health consequences of such early sexual initiation. However, information about the behavioral characteristics of those who initiate sexual activity early and the risks among young Chinese people, including university/college students, is very limited. If safe-sex education programs are to be successful in the future for Chinese students, a better understanding of early onset sexual activity and subsequent sex-related risks and behaviors among young people is necessary.

The purpose of this study was to explore the relationship between early initiation of sexual activity and risks to sexual and reproductive health among a group of sexually active male university students in an eastern Chinese city, and to understand how best to tailor effective sex education for this sort of population.

## Methods

### Setting and Procedures

This research was conducted in Ningbo municipality, a large coastal city in Zhejiang Province in eastern China

that is home to two universities, both of which participated in the study. The research methods have been introduced elsewhere [8]. Briefly, an instrument was developed based on a review of domestic and international literature, modified by qualitative studies that included 11 in-depth interviews and four focus groups among students from the two universities. The revised instrument was pilot tested in a group of 50 students at one of the universities. Then, the instrument's reliability was evaluated in 89 of 160 college students recruited from another city, who could be matched between the two tests with a one-week interval. The survey was conducted in November and December, 2003. All grade I-IV students at the two universities were requested by university staff and student leaders to come to classrooms at specified times outside normal lecture hours to fill out a self-administered and anonymous questionnaire. The trained staff of the local Centers for Disease Control (CDC) and the two universities collected data in the field.

### Participants

Of the total of 29,409 eligible participants at the two universities, 22,940 (78.0%) actually responded; 447 were eliminated from the analysis due to evident invalid responses. Thus, 22,493 students responded validly (valid response rate of 76.5%). Of the 22,493 respondents, 1981 (17.6%) men and 963 (8.6%) women reported being sexually active. In this paper, sexually active male students who responded to the question, "in which school period did you initiate sexual activity," were included in the analysis, resulting in a final sample size of 1908 men, 96.3% of all sexually active male students. Female students were excluded because only a small number of them were sexually active before high school (i.e., in primary school or junior high school). We categorized sexually active male students into three groups according to the timing of their reported sexual initiation: those who initiated sex before high school (BHS initiator), those who initiated sex in high school (HS initiator), and those who reported initiating sex at university (Univ initiator).

### Ethical assessment

The research protocol, including the questionnaire, was ratified by the institutional review processes of the local education board, the two universities involved, and Zhejiang Provincial Center for Disease Prevention and Control. Participants were informed of the purpose and the methods of the study. All were welcome to participate, with no advantage or disadvantage for participation or non-participation. These policies were also printed on the front page of the questionnaire.

### Statistical analyses

Epi-Info (Version 6.0, CDC, Atlanta, GA) and SPSS for Windows (Version 12.01; SPSS Inc., Chicago, IL) were

employed for the analyses. Differences in the prevalence of sexual behaviors and their consequences and their relationship to the timing of sexual activity onset were assessed using a chi-square test for linear trends in proportion. Those variables exhibiting a significant linear trend, where greater risk was associated with the timing of sexual activity onset, were further assessed using multiple logistic regression analysis, adjusted for possible confounding by university, grade, faculty, hometown area, and reported family economic status, with sexual activity initiation in university as a reference. Lifetime sexual behavior and that during the the most recent year were further adjusted for the duration of sexually active life, calculated by subtracting the age of first sexual activity from the current age, to adjust for confounding by different lengths of sexually active life versus the timing of sexual initiation. Adjusted odds ratios and 95% confidence intervals summarizing any association between the selected variables and the timing of sexual initiation were calculated for each category. A *P* value of less than 0.05 was deemed to indicate statistical significance.

## Results

### Socio-demographics

The percentages of the 1908 sexually active male students designated as BHS, HS, and Univ initiators were 6.0% (115), 36.9% (705), and 57.0% (1088), respectively (Table 1). The age range of all participants was 17–25 (median, 21). About three-quarters of the sexually active males among the BHS and HS initiators were aged over 19 years old; this age group made up 93.3% of Univ initia-

tors. Of the students, 94.8% of BHS and 95.7% of HS initiators were in Grades I–III, whereas 91.5% of Univ initiators were in Grades II–IV (Table 1). For all timings of sexual initiation, the majority of sexually active males perceived their family economic status to be mid-level, and the majority came from a town or city. The age range for initiating sexual activity in all participants was 10–24 (median, 20). The mean ages at first sexual activity for BHS, HS, and Univ initiators were 15.53 (SD, 1.94), 18.38 (SD, 1.25), and 20.44 (SD, 1.16), respectively.

### Sexual behaviors and risks

At the first experience of intercourse, the proportion of sexually active male students who had sex with a non-regular partner (a casual or a commercial partner), was significantly greater in early than in late sexual initiators. The proportion of non-regular partners in BHS initiators was 35.7%, but it was only 10.2% in Univ initiators. An opposite trend was detected in condom use at first sex: 15.7% of BHS initiators and 32.9% of Univ initiators used condoms (Table 2).

In their most recent sexual experience, the proportion having sex with a non-regular partner was 26.1% in BHS initiators and 8.4% in Univ initiators, whereas the proportion of condom use in their most recent sexual activity was 32.2% in BHS initiators and 46.7% in Univ initiators. Oral contraceptive (OC) use by female partners was slightly higher in BHS initiators than in Univ initiators, although no significant difference was detected between them.

**Table 1: Socio-demographic characteristics of sexually active males by timing of sex initiation.**

Variables	Timing of sex initiation		
	BHS (n = 115) <sup>a</sup>	HS (n = 705) <sup>a</sup>	Univ (n = 1088) <sup>a</sup>
Current age			
≤ 19	21.4	24.3	6.7
> 19	78.6	75.7	93.3
Grade			
I	40.9	40.4	8.5
II	30.4	28.9	26.9
III	23.5	26.4	42.4
IV	5.2	4.3	22.2
Families' economic status			
Rich	14.9	14.5	10.8
Between	73.7	79.1	82.2
Poor	11.4	6.4	7.0
Hometown area			
Countryside	24.6	19.1	27.3
Town/city	75.4	80.9	72.7
Mean age of first sex ± SD <sup>b</sup>	15.53 ± 1.94	18.38 ± 1.25	20.44 ± 1.16

<sup>a</sup> Data were shown in percentages, and the percentages of some items may not add up to 100 due to missing data.

<sup>b</sup> SD, standard deviation.

**Table 2: Timing of sex initiation and its association with subsequent sexual behaviors and risks.**

Variables	Total (n = 1908) <sup>a</sup>	BHS (n = 115) <sup>a</sup>	HS (n = 705) <sup>a</sup>	Univ (n = 1088) <sup>a</sup>	P value <sup>b</sup>
<b>First sex</b>					
Partner type					
Regular	85.4	60.9	83.4	89.2	
Non-regular	13.9	35.7	16.2	10.2	< 0.001
Condom use					
Used	29.8	15.7	27.2	32.9	< 0.001
Not used/unsure	69.8	84.3	72.2	66.6	
<b>Most recent sex</b>					
Partner type					
Regular	78.6	62.6	78.0	80.7	
Non-regular	10.5	26.1	11.2	8.4	< 0.001
Condom use					
Used	44.2	32.2	42.3	46.7	0.002
Not use	46.9	59.1	48.9	44.3	
OC use by partner					
Used	23.8	21.7	23.3	24.4	0.429
Not use	66.1	70.4	66.4	65.4	
<b>Sex during last year<sup>c</sup></b>					
Partner type					
Only regular	83.0	55.0	81.8	86.5	
Ever non-regular	14.7	40.0	17.4	10.6	< 0.001
Condom use					
Always/often	40.3	18.8	35.6	45.2	< 0.001
Never/rarely/sometime	55.1	76.3	60.4	49.9	
OC use by partner					
Always/often	22.3	13.8	20.2	24.4	0.003
Never/rarely/sometime	74.8	83.8	77.8	72.1	
Partner number					
1	74.1	33.8	66.0	82.9	
≥ 2	17.6	40.0	25.6	10.6	< 0.001
<b>Sex over lifetime</b>					
Condom use					
Always/often	41.7	20.9	38.3	46.1	< 0.001
Never/rarely/sometime	52.8	74.8	55.9	48.4	
Partner number					
1	56.9	15.7	40.7	71.8	
≥ 2	32.1	67.0	47.9	18.1	< 0.001
Anal sex					
Yes	3.9	12.2	4.3	2.8	< 0.001
No	90.7	83.5	90.1	91.8	
Partner's pregnancy					
Yes	10.2	24.3	10.2	8.6	< 0.001
No/unsure	85.3	70.4	84.8	87.2	
Partner's induced abortion					
Yes	9.6	23.5	9.8	8.0	< 0.001
No/unsure	85.6	70.4	84.7	87.8	
Diagnosed with an STD					
Yes	1.3	7.0	1.6	0.6	< 0.001
No	89.3	86.1	87.8	90.5	

<sup>a</sup> Data were shown in percentages, and the percentages of some items may not add up to 100 due to missing data.

<sup>b</sup> Chi square test for linear trend in proportion.

<sup>c</sup> n = 1409, 80, 500, 829, for Total, BHS, HS, Univ Initiator, respectively.

Among sexually active males, 80 of BHS, 500 of HS, and 829 of Univ initiators were sexually active in the last year (69.6%, 70.9%, and 76.1%, respectively). In the last year, early initiators were significantly more likely to have ever had non-regular partners than late initiators; the propor-

tion ever having had a non-regular partner for BHS initiators was nearly four times that of Univ initiators (40.0% vs. 10.6%). Multiple partners were more prevalent among early than late initiators; the proportion was 40.0% in BHS initiators and 10.6% in Univ initiators. Early initia-

tors also reported being less likely to have often/always used condoms in the last year; the proportion was 18.8% in BHS initiators and 45.2% in Univ initiators. Early initiators also reported a lower likelihood that their female partner used OCs than did late initiators; the proportion of a partner's always/often using OC in BHS initiators was 13.8%, whereas it was 24.4% in Univ initiators.

With regard to sex during their lifetime, similar to sexual behaviors in the last year, early initiators were significantly more likely to have had multiple partners over their lifetimes and to have used condoms less frequently than late initiators. Anal sex was much more commonly conducted by early than late initiators; the rate was 12.2% for BHS initiators, and 2.8% for Univ initiators. Of the participants, 10.2% reported that they had impregnated a female partner. The prevalence was 24.3% for BHS initiators and 8.6% for Univ initiators; this trend and proportion were similar to female partners' reports of induced abortion. Although the reported diagnosed STD prevalence was generally low, BHS initiators were over ten

times more likely than Univ initiators to report having been diagnosed with an STD (7.0% vs. 0.6%).

A multivariate logistic regression model examining the relationship between early sexual initiation and sexual risk and controlling for possible confounding by university, grade, faculty, hometown area, and perceived family economic status, confirmed all trends from the bivariate analyses, showing that early sexual initiation was more likely to be associated with risky sexual behaviors and subsequent consequences. With regard to lifetime sexual behavior and that during the last year, after further adjusting for duration of sexual experience, all the trends showing an increased risk for early sexual initiation compared to late initiation remained, with the majority having an odds ratio > 2, except condom use during the most recent sex activity and number of partners in the last year (an odds ratio of around 1.5); with respect to partner type during the last year, introduction of this adjustment resulted in no such trend (Table 3).

**Table 3: Multivariate analyses assessing the effects of timing of sexual initiation on subsequent sexual behavior and risks.**

Variables	BHS	HS	Univ
	Adjusted Odds Ratio (95% Confidence Interval)		
Partner type first sex <sup>a</sup>			
Non-regular vs. regular	5.24 (3.28–8.36)	1.90 (1.40–2.59)	1.00
Condom use first sex <sup>a</sup>			
Not used/unsure vs. used	2.55 (1.50–4.33)	1.30 (1.03–1.64)	1.00
Partner type recent sex <sup>a</sup>			
Non-regular vs. regular	3.70(2.22–6.15)	1.36 (0.96–1.95)	1.00
Condom use recent sex <sup>a</sup>			
Not used vs. used	1.62 (1.05–2.52)	1.06 (0.85–1.33)	1.00
Partner type last year <sup>b</sup>			
Non-regular vs. regular	1.01 (0.40–2.54)	0.96 (0.61–1.53)	1.00
Condom use last year <sup>b</sup>			
Never/rarely/sometime vs. always/often	3.28 (1.36–7.89)	1.24 (0.88–1.73)	1.00
OC use by partner last year <sup>b</sup>			
Never/rarely/sometime vs. always/often	2.68 (1.03–6.98)	1.40 (0.96–2.06)	1.00
Partner number last year <sup>b</sup>			
≥ 2 vs. 1	1.44 (0.58–3.62)	1.43 (0.93–2.21)	1.00
Condom use lifetime <sup>b</sup>			
Never/rarely/sometimes vs. always/often	3.55 (1.74–7.26)	1.17 (0.88–1.56)	1.00
Partner number lifetime <sup>b</sup>			
≥ 2 vs. 1	4.19 (1.84–9.54)	2.81 (2.02–3.89)	1.00
Anal sex lifetime <sup>b</sup>			
Yes vs. no	2.28 (0.63–8.23)	1.15 (0.55–2.42)	1.00
Partner's pregnancy lifetime <sup>b</sup>			
Yes vs. no/unsure	2.89 (1.21–6.94)	1.42 (0.91–2.22)	1.00
Partner's Induced abortion lifetime <sup>b</sup>			
Yes vs. no/unsure	2.95 (1.20–7.26)	1.48 (0.93–2.36)	1.00
Diagnosed with an STD lifetime <sup>b</sup>			
Yes vs. no	26.13 (2.94–232.09)	5.11 (1.20–2.76)	1.00

<sup>a</sup> Odds ratio with 95% confidence interval in parentheses is adjusted for university, grade, faculty, hometown area, and family economic status.

<sup>b</sup> Odds ratio with 95% confidence interval in parentheses is further adjusted for the duration of sexual experience.

## Discussion

The results of this study show that young people who initiated sexual activity early were at greater risk for a wide range of sexual and reproductive health problems. Our data showed a clear trend indicating that early onset of sexual activity was associated with increased STD infection, pregnancy, induced abortion, multiplicity of partners, and reduced condom and OC use. The higher incidence of risky behaviors and reproductive health problems attributable to early sexual initiation over a lifetime and sexual behavior in the most recent year may also be explainable by other factors, such as the length of sexual activity. However, the results of our multivariate analyses and indices of recent sexual behavior establish that this is not the whole picture.

In the study sample, the mean age of first sexual intercourse for BHS and HS initiators was 15.5 and 18.4 years, respectively, indicating that most BHS and HS initiators initiated sexual activity during adolescence; 6% of sexually active students initiated sexual activity before high school, and 37% did so in high school. These data show that it is important to conduct effective safe sex education for Chinese students at an early age. Thus, current condom education in China, typically conducted at universities [15], may simply be too late.

We also found that the prevalence of non-regular sex (i.e., sex with casual or commercial partners) at the time of the first experience of intercourse increased dramatically from late to early initiators; this trend was also consistent in the most recent year's behavior and the most recent sexual activity. We found that males whose first sexual experience was non-regular were then more likely to engage in non-regular sex and more likely to have multiple sexual partners during later sexual activity (data not shown). This may indicate that early initiators continued with their partner patterns after their first sexual experience. We also found that young people who began sexual activity in an early school period had an increased likelihood of having multiple partners during the past year and over their lifetime, relative to late initiators, which is consistent with results in other countries [16-20]. This effect persisted even after adjustment for the duration of sexual experience, suggesting that the multiple partnerships of early initiators were not due solely to the longer duration of their sexual experience. Indeed, these early sexual initiators may be more inclined to have multiple partners in their later sexual life than are late initiators. The data highlight that delay in the age of first sexual activity is an important element in reducing non-regular sex and the number of sexual partners; this is important because, among the early initiators, few precautions were taken despite risky sexual behaviors. Our data suggest that early initiators are less likely to adopt responsible behaviors

than late initiators, similar to findings in other countries [16,21,22]. The trend for early initiators to use condoms less in sexual activity was seen regardless of time period; these participants seemed not to be worried about STDs/HIV infection in themselves or their partners, or about pregnancy. The quite low rate of condom use in this group increased their risk of acquiring STDs and HIV. Condoms are widely available and affordable in China due to national family planning programs. Why these young initiators had such low condom use is unclear. It may be that early initiators, because of their youth, are less aware of the risks, embarrassed to obtain condoms, or lack the confidence or skill to negotiate condom use with their partners. Furthermore, they may not be prepared when they first engage in sexual activity; thus they do not use condoms then, and once non-protection is established, they continue in this manner, as has been reported in other countries [23,24].

Our results reveal that the earlier male students had initiated sexual activity, the more likely it was that their female partner had experienced pregnancy and induced abortion; similar findings have been reported in other countries, namely that early initiation of sexual activity was associated with pregnancy [16,20,25]. Because this trend remained even after controlling for the length of sexual activity, and because it was also consistent with the lower use of condoms and OC among early initiators compared with late initiators, the higher rates of pregnancy and induced abortions are not explained simply by longer exposure to sexual activity among the early initiators; indeed, the reduced use of oral contraceptives and condoms appears to be the key reason.

Although the reported diagnosed STD rate was low, early sexual activity was associated with increased prevalence of STDs, compared with late initiators. This higher rate of STDs is consistent with lower condom use among early initiators, suggesting that age at first intercourse is a marker for a history of STDs, as has been reported in research in other countries [26,27]. STDs can enhance the transmission of HIV; the early initiators who contracted STDs in this study were particularly vulnerable to HIV infection due to their own risky behaviors and their STD status.

We found a complex risky sexual profile that increased the risks of STDs/HIV infection in early initiators once they started sexual activity. Given the continuing expansion of the HIV/STD epidemic and the rapid social and economic changes in China, if more people initiate sexual activity at an earlier age, the spread of HIV and STDs can be expected to accelerate. Additionally, these male early initiators put both their female partners and themselves at greater risk of HIV/STD infection. Evidence from other countries has

shown that HIV transmission from males to females is two to three times more common than from females to males [28-31].

This study has several limitations. Our sample was from a cross-sectional study; whether early sexual initiation is a cause of a male's future risk or whether early sexual initiation increases the prevalence of other identified risky behaviors and reproductive health problems could not be determined from this study. Prospective studies are needed to address this question. Measurements of sexual activity in this study were based on self-reports; participant sensitivity regarding sexual behavior may have led to reporting bias. Additionally, misreporting of sexual behaviors is a recognized problem in sexual-behavior surveys [32]. Indeed, this was evident for some items in this study, with missing data being as high as 11%, which may have affected the power of testing and biased our results; however, we do not believe this lessens the validity of the overall conclusions of the study. Finally, the length of sexual experience was calculated by subtracting the age at first sexual activity from the current age. Because our sample consisted entirely of young people within a narrow age range, the value of using this adjustment may be limited. Additionally, any students who reported their current age and age of first sexual activity as being in the same year would have had a sexual lifetime of zero, which was clearly not the case; this applied to 26.6% of the 1908 sexually active students, which may have led to some bias in the results of the multivariate analysis.

## Conclusion

Our results show that early sexual initiation was a significant predictor of unwanted pregnancy, induced abortion, and STD/HIV infection, emphasizing that controlling the age of first sex is important to reduce these risks. Since education is compulsory until high school in China, to ensure that sex-education programs reach all adolescents in time to encourage delaying sexual activity, junior high school-based programs may be an effective avenue for reaching this target group before they start engaging in sexual activity. Given the rapid change in sexual attitudes and behavior that is occurring among Chinese youth, it should be kept in mind that sex education at different stages of schooling is important in interrupting the transmission of STD/HIV and reducing unwanted pregnancy in this population. Furthermore, such education should address not only delaying first sexual activity but also other issues such as promoting the use of condoms, reducing the number of sexual partners, and addressing other factors that predispose young people to engage in risky sexual behaviors.

## Competing interests

The authors declare that they have no competing interests.

## Authors' contributions

QM performed the statistical analysis and drafted the manuscript; LC and GX coordinated the study in field; QM, PX, and DZ played a major role in the field survey; SZ, SMR and TH helped analyze the data; MOK and MK supervised the research, statistical analysis and revised the manuscript. All the authors read and approved the contents of the manuscript.

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## HIV-related risk behaviours and the correlates among rickshaw pullers of Kamrangirchar, Dhaka, Bangladesh: a cross-sectional study using probability sampling

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### Abstract

**Background:** National HIV serological and behavioural surveillance of Bangladesh repeatedly demonstrated a very high proportion of rickshaw pullers in Dhaka city, having sex with female sex workers (FSWs) and using illicit substances. However, no study has been conducted to identify the correlates of having sex with FSWs among this population. This study aimed to describe behavioural profile of rickshaw pullers in Dhaka city using probability samples and to identify the correlates for having sex with FSWs in order to focus HIV prevention intervention.

**Methods:** Six hundred rickshaw pullers were randomly selected from rickshaw garages in the Kamrangirchar area, the single largest slum cluster of Dhaka, Bangladesh, during March–April 2008 using the Proportion Probability to Size method. Participants were interviewed, with a response rate of 99.2% (n = 595), using a structured questionnaire and asked about illicit substance use, sexual behaviour and risk perception for HIV and sexually transmitted diseases. Independent predictors of having sex with FSWs were analysed by multivariate analysis. A qualitative study was subsequently conducted with 30 rickshaw pullers to supplement the findings of the initial survey.

**Results:** The proportion of survey respondents who had sex with FSWs and those who used illicit substances in the previous 12 months period were 7.9% and 24.9%, respectively, much lower than the results achieved in the 2003–04 behavioural surveillance (72.8% and 89.9%, respectively). Multivariate analysis revealed the characteristics of younger age, being never married, living alone with family remaining in other districts and using illicit substances in the previous 12 months were significantly associated with having sex with FSWs.

**Conclusion:** HIV-related risk behaviour of our study population of the rickshaw pullers was lower than what has been suggested by the results of behavioural surveillance. While this discrepancy should be addressed in further studies, our study emphasizes the importance of focused HIV prevention programs for rickshaw pullers as high-risk behaviour is displayed at an unacceptable level and concentrated in identifiable sub-populations.

## Background

Among the developing countries in Asia, Bangladesh still has a low level HIV epidemic status, where the adult prevalence of HIV infection is estimated to be below 0.1% [1]. However, the overall prevalence of HIV infection among most at-risk populations is increasing with each subsequent round of national HIV serological and behavioural surveillance (from 0.2% in the 2<sup>nd</sup> round of surveillance to 0.9% in the 7<sup>th</sup> round of surveillance), mostly due to increased HIV prevalence among injecting drug users (IDUs) [2-7]. According to the results from the recent round of surveillance, the HIV epidemic appears to have reached to a concentrated level (7%) among IDUs in Dhaka city, the capital of Bangladesh [1,2].

In order to explore the future course of the HIV epidemic and to develop the most appropriate prevention programs, it is important to monitor the prevalence of HIV-related risk behaviours among high risk groups, the behaviour networks within and between the high risk groups and their changes over time, which is the role of behavioural surveillance. In 1998, Bangladesh adopted one of the world's most comprehensive behavioural surveillance systems [2]. Updated surveillance has revealed the presence of close sexual networks of IDUs with other high risk groups, especially female sex workers (FSWs) [3,5-7]. FSWs were, on the other hand, shown to have close sexual links with multiple male client groups, not restricted to IDUs. According to recent rounds of behavioural surveillance, rickshaw pullers in Dhaka city are among the client groups of street and brothel based FSWs. The report shows as many as 50% and 72.8% of the rickshaw pullers having sex with FSWs in the last month and 12 months, respectively, mostly without consistently using a condom [5]. As more than 2 million rickshaws are estimated to be operating nationwide [8] and with 0.3 million in Dhaka city (pulled by more than 0.5 million rickshaw pullers) [9], the HIV-related risk behaviours of the rickshaw pullers may have a substantial impact on the future course of the HIV epidemic in Bangladesh. However, one study conducted by Population Council in 6 areas of Dhaka division including 2 areas of Dhaka city demonstrated only 2.69% of married pullers having sex with FSWs in the last 3 months [10]. In addition, in spite of such a potential importance of this population in the context of the HIV epidemic in Bangladesh, there is little intervention activities toward this population; even the correlates of the HIV-related risk behaviours which are critical for a focused intervention program have never been identified. We therefore decided to conduct a cross-sectional study on the HIV-related risk behaviour of rickshaw pullers of Dhaka city in a specified geographical area to accurately describe the HIV-related risk behaviour profile of this population and its correlates using probability samples.

## Methods

### Study design

This study was undertaken using a cross-sectional quantitative design, utilizing structured interviews and complementary qualitative studies before and after the survey. The qualitative investigation undertaken prior to conducting the survey collected information necessary to develop the questionnaire and plan the interview structure. On the other hand, the qualitative investigation after the survey was conducted to supplement and/or reinforce the findings of the survey.

### Study population

The target population for the study was rickshaw pullers renting rickshaws from rickshaw garages, and included rickshaw pullers who kept their own rickshaws in the garages of Kamrangirchar in Dhaka, Bangladesh. This population was targeted because: all of the rickshaw pullers pulled rickshaws inside the city; most of the rickshaw pullers rent carts from the rickshaw garages; most of the garages are concentrated in slum areas; and Kamrangirchar is the single largest slum area bordered with Dhaka city, with approximately 265,000 slum residents [11].

### Sampling procedures

In March 2008, due to the fact that no detailed property-usage map for the Kamrangirchar region was available, the garages in the region were mapped by interviewing local inhabitants and visiting each garage to confirm the location. At the time of the location confirmation, garage information (number of carts for rent and number of rickshaw pullers who rented or kept carts) was collected from the garage owners or managers.

After the list was compiled with information from 213 garages, completeness of the list was further confirmed by three random visits to several locations. Using this list of garages, probability samples of rickshaw pullers were prepared according to the Probability Proportional to Size (PPS) method considering each garage as a cluster [12,13]. Eight pullers were sampled for interview from each cluster. The PPS procedure was used to select 75 garages, in order to obtain the sample size of 600 required for the study, as determined by the method described below. In each chosen garage, a list of the rickshaw pullers who had worked in the previous day was obtained from garage owners or managers and eight rickshaw pullers were randomly selected from the list. Replacement of a selected rickshaw puller was considered when the selected person was not available on the day of the interview.

### Sample size calculation

Considering drug use as a main predictor and having sex with a FSW in the previous 12 months as a main outcome, the sample size was calculated based on previous data on

truckers in Dhaka city in which the prevalence of drug use with and without the experience of having sex with FSW in the last 12 months was 67% and 50%, respectively [14]. Assuming expected prevalence of drug use among the rickshaw pullers with and without the experience of having sex with FSW in the previous 12 months to be 70% and 50%, respectively, the sample size required to detect a difference with probability  $\alpha = 0.05$  (two-tailed) and power of 80%, was 206 in total. Taking into consideration the effect of the study design, the expected 88% rate of ever experienced sex among the rickshaw pullers in the last 12 months (extrapolated from the trucker results) and the necessity of adjusting possible confounders, we determined a sample size of 600 was required for the study.

#### **Interviewing procedures and quality assurance**

An explanation of the interview was provided to the owners of the garages selected for participation. Particular efforts were paid to establish good relationship with the owners because the cooperation of them was critical for the success of sampling. The owners were requested to invite the nominated rickshaw pullers to the interviews. In most of the garages, the interviews were carried out early in the morning, according to the owners' preferences. Verbal consent was obtained from each interview participant after an explanation of the nature and purpose of the study. Respondents were also explained about anonymity of the study as their name and address will not be recorded and that they can refuse or stop the interview at any time. The interviews were conducted at a place designated by the participants, in most cases sitting in a rickshaw inside the garage. Fifty taka (US \$0.70) was provided for their time for each participant.

The interviews were conducted by nine graduate and undergraduate students from Dhaka University. All interviewers were provided with a one-day training session where they were informed of the study design and purpose and how to conduct the structured interviews. Practice sessions were also provided with discussion of any problems identified during the interviews to determine how the problems should be resolved. One graduate student and the main investigator supervised the interviews to ensure quality was maintained.

#### **Instrument development**

The questionnaire used in the survey was developed on the basis of the Family Health International (FHI) questionnaire [12] and the findings of focus group interviews (FGIs) conducted prior to the survey. Two FGIs with groups of five rickshaw pullers were conducted in a location (Mohammadpur) outside the study area to obtain information on the occupation, lifestyle, sexual behaviour, sensitivity about sexual behaviour queries, and appropriate wording for different behaviours and knowl-

edge. A draft questionnaire was pre-tested on eight rickshaw pullers to verify the wording and face validity. The questionnaire consisted of four fields of questions: demographic characteristics including job experience; illicit substance use; sexual behaviour including condom use; and knowledge and risk perception regarding HIV/sexually transmitted diseases (STDs). The reliability of the instrument was assessed in a test-retest design on 48 independent samples of rickshaw pullers in five Kamrangirchar garages which were not selected for the main survey and with three-day intervals between the tests. Overall, a high test-retest correlation was observed among the continuous variables (Pearson  $r = 0.86 - 1.00$ ) and among dichotomous variables (Kappa =  $0.67 - 1.00$ ).

#### **Post-survey qualitative study**

Immediately after the main survey, in-depth interviews using semi-structured questionnaires were conducted in the streets among 30 rickshaw pullers living in Kamrangirchar and/or renting rickshaws from garages in that area. The purpose of the post-survey qualitative study included gaining detailed information on having sex with FSWs and drug use practices and to evaluate the possible influence of the interview location on the responses to sensitive questions. Interviews were conducted on the street and tape-recorded after obtaining verbal informed consent from the participant. Data were transcribed and analyzed using content analysis.

#### **Statistical analysis**

All statistical analysis was conducted using SPSS Complex Samples 13.0 (SPSS Inc. Chicago, Illinois, USA) to adjust for the effect of clustering. After univariate analysis, bivariate analysis was conducted to assess the association between the experience of having sex with FSWs ('never had sex', 'had sex but not in the last year' and 'had sex in the last year') with predictor variables. Subsequently, multiple logistic regression analysis was performed using a compulsory entry procedure with the presence or absence of having sex with FSWs in the last 12 months as an outcome and other predictor variables that showed crude odds ratios for the outcome with a statistical level of  $P < 0.1$ .

#### **Ethical approval**

The study protocol was approved by the Ethical Review committee of Kyoto University, Japan and the Bangladesh Medical Research Council, Dhaka, Bangladesh.

#### **Results**

##### **Demographic characteristics of the participants**

In the study 595 respondents were interviewed, including 50 replacement samples. The response rate was 90.8% for the original samples and 99.2% when replacements were included. Only two rickshaw pullers from the original list