

Table 3
Sexual behavior characteristics and factors for unintended pregnancy among sexually active students

	Male (n=1835)			Female (n=848)		
	Total n ^a (%)	Pregnancy n (%)	COR (95% CI)	Total n ^a (%)	Pregnancy n (%)	COR (95% CI)
Period of first sex						
Before high school	109 (6.0)	28 (25.7)	3.49 (2.16–5.64)	18 (2.1)	10 (55.6)	12.31 (4.68–32.39)
High school	670 (36.8)	72 (10.7)	1.22 (0.88–1.68)	186 (22.0)	28 (15.1)	1.75 (1.08–2.83)
University	1043 (57.2)	94 (9.0)	1	640 (75.8)	59 (9.2)	1
Condom use during first sex						
Yes	547 (30.0)	40 (7.3)	1	225 (26.6)	15 (6.7)	1
No/not sure	1276 (70.0)	154 (12.1)	1.74 (1.21–2.50)	621 (73.4)	82 (13.2)	2.13 (1.20–3.78)
Consent at first sex						
Consent	1748 (96.7)	185 (10.6)	1	525 (63.0)	50 (9.5)	1
Nonconsent	59 (3.3)	6 (10.2)	0.96 (0.41–2.26)	308 (37.0)	45 (14.6)	1.63 (1.06–2.50)
No. of sexual partner during their lifetime						
1	1076 (63.7)	86 (8.0)	1	640 (78.9)	49 (7.7)	1
≥2	614 (36.3)	90 (14.7)	1.98 (1.44–2.71)	171 (21.1)	43 (25.1)	4.05 (2.58–6.37)
Condom use during their lifetime						
Always	261 (14.5)	12 (4.6)	1	156 (18.9)	5 (3.2)	1
Often	532 (29.6)	65 (12.2)	2.89 (1.53–5.45)	197 (23.9)	28 (14.2)	5.00 (1.88–13.29)
Sometimes/never	1002 (55.8)	117 (11.7)	2.74 (1.49–5.05)	471 (57.2)	65 (13.8)	4.84 (1.91–12.24)
History with diagnosed STI						
Yes	25 (1.4)	8 (32.0)	4.11 (1.75–9.67)	14 (1.8)	6 (42.9)	6.25 (2.12–18.46)
No	1704 (98.6)	175 (10.3)	1	775 (98.2)	83 (10.7)	1
Condom use during most recent year ^b						
Always	202 (15.1)	11 (5.4)	1	105 (19.4)	5 (4.8)	1
Often	363 (27.1)	48 (13.2)	2.65 (1.34–5.22)	114 (21.0)	19 (16.7)	4.00 (1.43–11.14)
Sometimes/never	775 (57.8)	107 (13.8)	2.78 (1.47–5.28)	323 (59.6)	49 (15.2)	3.58 (1.39–9.23)
OC use during most recent year ^b						
Always	104 (7.6)	6 (5.8)	1	81 (14.3)	5 (6.2)	1
Often	208 (15.2)	26 (12.5)	2.33 (0.93–5.86)	89 (15.8)	15 (16.9)	3.08 (1.07–8.91)
Sometimes/never	1052 (77.1)	136 (12.9)	2.43 (1.04–5.64)	395 (69.9)	59 (14.9)	2.67 (1.04–6.88)
Condom use during most recent sex						
Yes	836 (48.3)	76 (9.1)	1	368 (46.0)	37 (10.1)	1
No	894 (51.7)	104 (11.6)	1.32 (0.96–1.80)	432 (54.0)	56 (13.0)	1.33 (0.86–2.07)
OC use during most recent sex						
Yes	454 (26.5)	44 (9.7)	1	224 (29.2)	20 (8.9)	1
No	1257 (73.5)	135 (10.7)	1.12 (0.78–1.61)	543 (70.8)	73 (13.4)	1.58 (0.94–2.67)

^a Total may not add up to 1835 for male and 848 for female due to missing data.

^b Students who were sexually active in the most recent year: n=1403 for male and 585 for female; total may not be so large due to missing data.

condom use during their lifetime remained as risk factors for pregnancy. Having smoked cigarettes among males and having danced among females were also associated with unintended pregnancy.

4. Discussion

To our knowledge, these are the first data regarding the reproductive health of Chinese university students. The high prevalence of pregnancy and abortion found in this study indicates that sex education and contraceptive services for young people in China do not seem to be adequate.

In China, family planning programs are now widely available, free of charge. However, these services are used primarily by adults and rarely by unmarried young people. Although the acceptance of premarital sex is increasing in China, unmarried youth still face the risk of being stigmatized by their search for contraceptive services, and the lack of counseling and privacy in these services prevents

many young people from seeking contraception [13]. Further, family planning workers are often ambivalent about the provision of sexual and reproductive health information to unmarried young people [14], and parents and teachers still avoid discussing sensitive topics such as premarital sex, contraception, and abortion with young people [15]. These barriers may cause young people to have lower risk awareness and lower use of contraception, resulting in the high rate of pregnancy seen in this study. In unmarried young women, especially young students, being pregnant is still considered unacceptable in Chinese culture. Data from China have shown that the primary reason for unmarried women to undergo induced abortions is simply that they are unmarried [8,12], and this could be true in the present study as well.

When used consistently and correctly, condoms offer considerable protection against unintended pregnancy as well as STIs, including HIV infection. The condom is the most popular method of contraception among young Chinese [5,13,16,17]. However, our data revealed that

Table 4
Factors associated with unintended pregnancy among sexually active students by genders

Risk factors	Male	Female
	AOR (95% CI)	AOR (95% CI)
Age		
≤19	1	
≥20	2.12 (1.15–3.88)	
Period of first sex		
Before high school	2.45 (1.36–4.44)	5.12 (1.49–17.68)
High school	1.05 (0.71–1.55)	1.12 (0.63–1.99)
University	1	1
Consent at first sex		
Consent		1
Nonconsent		1.77 (1.08–2.90)
Condom use during first sex		
Yes	1	
No/not sure	1.71 (1.10–2.64)	
No. of sexual partner during their lifetime		
1	1	1
≥2	1.54 (1.06–2.23)	2.75 (1.61–4.71)
Condom use during their lifetime		
Always	1	1
Often	1.97 (1.01–3.81)	3.92 (1.43–10.73)
Sometimes/never	1.49 (0.77–2.88)	3.02 (1.16–7.87)

Ever cigarette smoking among males and ever dancing among females were associated with unintended pregnancy as well. AOR, adjusted odds ratio.

“always used a condom during their lifetime” was true for less than 20% of sexually active males and of females’ partners. In addition, of those “always” condom users, 4.6% of males and 3.2% of females reported that their partner or they had a history of pregnancy. This rate was significantly lower than that for “not always” users and may be attributable to condom use failures among young people [10,18], suggesting that sex education should address the correct use of a condom while also emphasizing the importance of consistent condom use for the prevention of unintended pregnancy and STIs.

We found that the female partners of male students who used a condom in first sex had a significantly lower pregnancy rate. It may be that those who used condoms during first sex were more likely to also use them later [19,20], highlighting the importance of condom use in first sex. Our data also showed that the condom use rate increased greatly between first sex and most recent sex, for both males and females’ partners. Thus, it appeared that condom use increased as sex life become longer. Studies in China have shown that OC use during first sex was 4.1% for males’ partners and 6.3% for females among university students [16], and 4.9% for both genders among unmarried persons [13]. Our findings indicated that the OC use rate during the most recent sex was 26.5% for males’ partners and 29.5% for females. Studies in other countries have reported that the likelihood of using contraception increases with age in sexually active young people [21–24]. If this pattern applies in China, then students who are at an early stage of their sex life would be less likely to use condoms and OCs and thus

would be more vulnerable to pregnancy and STIs than those further along in their sexual life.

Condoms, OCs, periodic abstinence and withdrawal are the most commonly used contraceptive methods among university students [5,16] and unmarried young people [13,17]. It is possible that some of the students who did not use condoms or OCs may have used periodic abstinence or withdrawal. However, both of these methods could lead to contraceptive failure [10,11]. The use of these two methods could have contributed to the unintended pregnancies reported here as well.

We found that young people who commenced sexual activity before high school were more likely to have experienced an unintended pregnancy than those who initiated sex later; they may have been less aware of the risks for pregnancy and thus used contraception less often. Indeed, it has been reported in studies in China and elsewhere that unmarried young people who initiate sex at early ages use contraception less often than do later initiators [10,21,25,26]. This pattern may explain the high rate of pregnancy among early initiators in our study. Further, earlier initiation of sexual intercourse exposes students to an extended period during which they are at risk for becoming pregnant.

It is a major concern that having multiple partners was a predictor of pregnancy in both genders. Compared with students with one partner, students with more than one partner tended to be less likely to use an effective contraceptive method. It is suggested that those students who engaged in multiple sexual partnership without valid protection also put themselves at great risk for STIs. Students who had become pregnant were evidently at greater risk for STIs because they clearly were not effectively protected with a barrier method, mainly condoms, during sex.

For women, non-consensual sexual intercourse at first sex was related to pregnancy in the multivariate analysis. Chinese studies have reported that unmarried women with a history of non-consensual sex were more likely to have initiated sex earlier, to have had multiple partners, to have undergone induced abortions and to have contracted STIs [27,28]. Non-consensual sex was also associated with unintended pregnancies in India and America [29–31]. Given that 37% of females reported that their first sex was non-consensual, the actual history of non-consensual sex over a lifetime could be much higher in females. Reproductive health education should clearly target non-consensual sex as well as its associated contexts and consequences.

This study has some limitations. The data presented here were derived from a sexual behavior survey of university students. Determining the prevalence of and risk factors for unintended pregnancies in students were not the primary objectives, and thus some important information, including OC use at first sex and over a lifetime, and non-consensual sex over a lifetime, was not provided. Second, reporting bias could be an issue because the information on sexual behavior was excluded for those sexually active students

who did not respond to the question about a history of pregnancy. Third, no cause–effect relationship can be established because of the cross-sectional design of the study. Further research is needed to explore unintended pregnancy and how sexual behaviors and lifestyle choices, such as cigarette smoking and dancing, affect the risk of unintended pregnancy in this population.

Sexually active university students in China have a high risk of unintended pregnancies and induced abortions. Sex education programs conducted at Chinese universities should focus on not only HIV/STI prevention but also avoidance of unintended pregnancies, explaining the possible risk factors associated with unprotected sex and unintended pregnancies. A concerted effort that includes increased awareness of reproductive health, the appropriate introduction of contraceptive information, the availability of student-friendly family planning services and the facilitation of access to contraception for young people is urgently required to meet the reproductive health needs of this population.

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Research article

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Sexual behaviors and their correlates among young people in Mauritius: a cross-sectional study

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Abstract

Background: Little is known about the HIV/AIDS epidemic in the Indian Ocean region, including Mauritius. National records suggest a prevalence of HIV in Mauritius of < 1% in the general population, which is one of the lowest prevalence rates in southern Africa. However, HIV-positive cases have been increasing recently in Mauritius. We conducted a cross-sectional survey in January 2003 to assess the prevalence of HIV-related sexual behaviors and their correlates among young people aged 15–24 years in Mauritius.

Methods: We identified 1200 participants using two-stage cluster sampling. Demographic, social, sexual, and knowledge of HIV/AIDS data were obtained in face-to-face interviews using a structured questionnaire administered by trained interviewers. The prevalence of sexual behaviors was described in relation to gender, and the correlates of ever having had sex and nonuse of condom at last sex were analyzed using logistic regression.

Results: In the target population, 30.9% of males and 9.7% of females reported a history of sexual intercourse. Of the currently sexually active participants, 50.6% of men and 71.2% of women did not use condoms at their last sexual encounter. Logistic regression revealed that work experience and marijuana use were significantly associated with men's sexual experience, whereas being out of school and drinking experience were significantly associated with women's sexual experience. For both men and women, being Christian and visiting nightclubs were associated with having ever had sexual intercourse ($P < 0.05$). In addition, not using a condom at the first sexual encounter and lack of exposure to a nongovernmental organization (NGO) dealing with HIV/AIDS were associated with the nonuse of condoms at the last sexual encounter ($P < 0.05$).

Conclusion: Young people in Mauritius are at risk of a future HIV epidemic because behaviors predisposing to HIV infection are prevalent among sexually experienced youth. A focused prevention program targeting young people should be reinforced as part of the National AIDS Control Program, taking into account the predictors of sexual behaviors identified here.

Background

Mauritius is an island country with a population of 1.2 million, located in the Indian Ocean about 900 km east of Madagascar. The country is noted for its current rapid economic growth and the cultural diversity of its inhabitants, who came from Asia, Africa, and Europe. Little information is available about the status of the HIV/AIDS epidemic on Mauritius and in the Indian Ocean region [1,2].

National records report 374 cumulative HIV/AIDS cases (238 males and 136 females) among Mauritians at the end of 2002 since the first AIDS case was reported in 1987. Of these cases, almost 70% occurred through heterosexual contact and nearly 15% through either heterosexual contact or injecting drug use (IDU), although IDU-related cases have increased rapidly as of 2003. The peak age of reported cases up to 2002 was 25–39 years for men and 20–29 years for women. Based on HIV antibody tests for blood donors and pregnant women, the estimated HIV prevalence in the general population of Mauritius is < 1%, which is one of the lowest prevalence in the African region. However, concerns about an HIV epidemic has been growing in this country because the number of reported HIV/AIDS cases continued to increase during the last decade, and suddenly doubled from 50 cases in 2000 to 98 cases in 2002 [3]. In addition, Mauritius hosts more than 700,000 tourists annually, mainly from Europe, South Africa, and India, where HIV epidemics are more pronounced than in Mauritius. Tourists can potentially transmit HIV and sexually transmitted diseases (STDs) from country to country [4]. Growing number of people from overseas is causing concerns about a potential HIV epidemic in Mauritius.

The government of Mauritius launched the National HIV/AIDS Strategic Plan in 2001 and identified 12 strategic objectives [3]. After a reduction in new STI/HIV infections among groups with high-risk behaviors (sex workers, IDUs, men who have sex with men, and prison inmates), reducing vulnerability among the youth and children was the third strategic objective of the plan. About 17% of reported HIV/AIDS up to 2001 were among those aged 15–24. Although more cases were reported among those aged 25–39 for men and 20–29 for women, actual disease contraction must have occurred when these people were younger because people are typically unaware of their infection for several years. Prevention of HIV/AIDS among young people is thus one of the country's priorities.

Several studies have examined the sexual behavior of young people in Mauritius. One study of female Economic Processing Zone workers in 1994 revealed that 68% of young female workers reported some sort of intimate behavior with their boyfriends, although only 7%

reported full penetration (*i.e.*, penile-vaginal sex) [5]. A nationwide survey of male and female adolescent behavior using two-stage clustered sampling was conducted as part of the Youth Profile of the Republic of Mauritius in 1996. According to the survey, 43% of never-married males and 11% of never-married females aged 18–25 years reported having experienced sexual intercourse, and the mean age at first sexual intercourse was approximately 18 years [6]. Other surveys were undertaken to assess the knowledge, attitudes, behaviors, and practices (KABP) related to HIV/AIDS among individuals aged 15–49 years [7–9].

Although some studies have yielded useful information, they have several limitations in aiding the design of HIV prevention programs for young people. For example, some of these studies targeted subgroups of young people such as female workers or people approached using convenient sampling methods, thus limiting the generalizability of the results. Other studies included populations other than young people, yielding limited information on young people. In addition, the studies assessed the sexual behaviors of people in terms of certain demographic characteristics, and did not adequately assess them in relation to social and cultural factors, although these factors are undoubtedly important determinants of HIV-associated behavior and are important in designing prevention programs [10–12]. Most of the studies were conducted in the mid-1990s; thus, the information needs to be updated because the prevalence of HIV has increased markedly in the ensuing years.

We designed our study to assess the current HIV-related sexual behaviors of unmarried young people and to investigate the correlates of sexual debut and condom nonuse. More broadly, we assessed the possible influence in the lives of young people of changing Mauritian society brought about by modernization and globalization, *e.g.*, educational attainment and exposure to a variety of socializing items, in connection with sexual behavior. Our ultimate objective was to assist the National AIDS Control program of Mauritius to monitor, evaluate, and reformulate its HIV prevention program for young people.

Methods

Sampling frame

The target population was never-married men and women aged 15–24 years living on the island of Mauritius. This population consisted of approximately 173,200 people, which was about 15% of the total population of Mauritius in 2000 [13].

A two-stage cluster sampling method was used to select respondents. The enumeration areas (EAs) of the Central Statistics Office were used as the sampling frame for the

first stage. Each EA consisted of approximately 300–600 people comprising 75–150 households, and those in the capital city of Port Louis and Plaines Wilhems District were defined as being from urban areas (43% of the total population). In the first stage, 50 EAs from a total of 3472 were selected using the probability proportional to size (PPS) method [14,15]. All never-married persons aged 15–24 years in selected areas were listed during the preparatory fieldwork for a total of 2592 persons. In the second stage, 12 males and 12 females from each EA were selected using a computer-generated random numbers algorithm. Using this multistage procedure, 600 males and 600 females were chosen to participate in the survey. The sample size was chosen to allow us to detect a 10% difference in sexual experience rate between in-school and out-of-school students with sufficient statistical significance ($\alpha = 0.05$, two-tailed) and a power of 0.8, as well as to adjust for the confounding effect of multiple factors.

Of the young people selected, 59 respondents (4.9%) did not participate. The primary reasons for nonparticipation were "moved away," "gone abroad," "refused (by himself/herself or parents)," and "married." Consequently, 1141 young people (575 men and 566 women) completed the survey interviews, yielding a response rate of 95.1%. Comparisons of participants and nonparticipants showed no marked difference in sociodemographic characteristics with respect to gender, religion, or age.

Instrument development

The research questionnaire was developed based on the Family Health International (FHI) HIV/AIDS/STD Behavioral Surveillance Surveys (BSS) Questionnaire for youth [15]. This instrument includes questions that can assess internationally agreed-upon indicators for young people's behaviors in relation to HIV/AIDS [16].

A multiphase process was used to develop the research instrument to ensure that it was developmentally, culturally, and linguistically appropriate. First, seven focus group discussions were conducted in youth centers to tailor the instrument culturally and linguistically for Mauritian youth. Second, persons working in nongovernmental organizations (NGOs) that deal with HIV/AIDS and drug use were invited to review the instrument and make recommendations for its modification. Third, the English instrument was translated into Creole and back-translated into English to confirm the accuracy of the Creole translation. Finally, the instrument was pilot-tested with 50 young people during preparatory fieldwork. Fieldworkers reported the items for which participants had difficulty in understanding the phrase or terms of the question after the pretest interview. The questionnaire was modified based on the fieldworkers' comments and finalized in January 2003.

The final version of the instrument included the following domains of interest: sociodemographic characteristics (19 items), social life (15 items), knowledge and attitude about condoms (10 items), sexual experience (22 items), and knowledge of HIV/AIDS and exposure to an HIV/AIDS program (30 items). A complete questionnaire may be obtained from the first author.

The sociodemographic variables included sex, age, religion, educational background, and work experience. Religion represents racial/ethnic background of the participants. Usually, Hindus represent people whose ancestors came from India, Muslims, from India and the Middle East, and Christians, from Africa, Europe, and China. Concerning social life, questions were asked regarding respondents' mobile phone use, nightclub visits, pornographic film viewing, Internet use, and alcohol and other drug use. Items concerning knowledge and attitude about condoms included questions related to obtaining and the ability to use condoms.

In the section on sexual behavior, young people were first asked about lifetime sexual experiences. Sexual intercourse was defined as vaginal or anal penetration. Those who reported a history of sexual intercourse responded to further questions, including the age of first sexual intercourse, condom use at the first sexual encounter, age of the partner, number of lifetime sexual partners, and sexual activity in the previous 12 months. Those who were sexually active in the previous 12 months were also asked questions regarding the use of condoms at the last sexual encounter and the frequency of condom use with both commercial and noncommercial partners. A commercial partner was defined as a partner with whom a respondent had sex in exchange for money; any partner other than this was defined as a noncommercial partner.

The section on HIV/AIDS knowledge contained 11 items, including modes of HIV transmission and measures for preventing sexual transmission. Items on the exposure to HIV/AIDS prevention programs had questions on exposure to posters on HIV/AIDS and knowledge of government programs and NGOs.

Instrument validation

To examine the instrument's reliability, 45 items extracted from the original survey were retested 1 week later for 48 randomly selected respondents. Overall, a high test-retest correlation was observed between items (Pearson $r = 0.85$ –1.00 [median = 0.96] for continuous variables, kappa = 0.26–1.00 [median = 0.71] for categorical variables) [17]. The internal consistency was satisfactory ($\alpha = 0.68$) for 11 items of knowledge. In addition, a random response technique was administered to all subjects to assess the validity of the interview-based response on sex-

ual experience in a subsequent procedure [18-20]; at the end of interview, respondents were asked to answer one of two "yes/no" questions, (1) "Is your birthday on the 1st to 10th of the month?" or (2) "Have you ever had sexual intercourse?" by randomly picking up a piece of paper that contained one of these questions. The interviewer did not know which question they answered. Under this less intimidating circumstance, 28.4% male and 7.4% female were estimated to have answered "yes" to question 2. These prevalence rates were comparable to those obtained in the face-to-face interviews (30.9% for men and 9.7% for women).

Data collection

A team of 50 trained fieldworkers under the direct supervision of five superiors conducted the fieldwork. Data were collected over a 3-week period in January and February 2003. Fieldworkers visited the homes of the respondents and interviewed them in their native language, Creole, using the structured questionnaire. Due to the sensitive nature of some questions, the gender of the interviewers was matched to that of the respondents. The interviews took 20-30 min to complete on average. The decision to use face-to-face interviews was made by taking into account the local language environment of Mauritius where the first language (Creole) is a highly conversation-based language, and French or English is not understood by people with a low educational attainment.

Statistical analysis

Statistical analyses were performed using SPSS Complex Samples 12.0J (SPSS Japan, Tokyo, Japan) and SUDAAN 8.0.2 (Research Triangle Institute, Research Triangle Park, NC, USA) to account for the clustered sampling design. First, we assessed the prevalence of HIV-related sexual behaviors. Subsequently, using "being sexually experienced" and "condom nonuse at last sex" as the outcome variables, bivariate associations with dichotomous correlates were analyzed using cross-tabulation. Finally, variables that achieved a statistically significant association ($P < 0.10$) in the bivariate analyses and variables that were epidemiologically important were entered into logistic regression models to obtain an adjusted odds ratio for each association.

Ethical issues

The study protocol was reviewed and approved by the Kyoto University Graduate School and Faculty of Medicine Ethics Committee and Mauritius Ministry of Health and Quality of Life. Before each interview, the interviewer explained the objectives and methodology of the study to each participant; the interviewer signed the survey document when verbal informed consent was obtained from the participant.

Results

Description of the sample

The mean age for men was 19.2 years ($SE = 0.14$) and that for women was 18.6 years ($SE = 0.11$). The median ages were 19 years for men and 18 years for women, respectively. Religious affiliations comprised approximately 55% Hindu, 20% Muslim, and 25% Christian. Nearly half of the participants were still attending school and lived in urban areas at the time of the survey. For men, 45.8% were employed full time, whereas 57.4% of women had not worked in the previous 12 months (Table 1).

Sexual behavior

The proportion of people who had ever had penetrative sexual intercourse differed significantly between men (30.9%; 95% CI, 25.8-36.5) and women (9.7%; 95% CI, 6.5-14.0; $P = 0.001$). The mean age of first sex among those sexually experienced was 17.4 years for males (median = 17) and 17.8 years for females (median = 18). The mean age of the first partner was 21.4 years for females (median = 21), indicating that women tend to have an older first partner. Significantly more men (65.0%) than women (32.0%) reported having had more than one sexual partner ($P = 0.001$). Condom use during sexual intercourse was low for both men and women, and only 35.7% of men and 24.5% of women reported having used a condom consistently with their noncommercial sex partner during the 12 months before completing the survey (Table 2). Only 23 male respondents reported sex with a commercial partner.

Correlates of sexual experience

The correlates of sexual experience in terms of sociodemographic characteristics and social life indicators such as exposure to nightclubs and drug use were analyzed by gender (Table 3). Logistic regression results indicate that for both sexes, non-Christians (i.e., Hindus and Muslims) had a significantly lower adjusted odds ratio (AOR) of being sexually experienced (AOR = 0.27 for men and 0.15 for women). Men who had ever worked, ever visited nightclubs, or had a history of using marijuana had a significantly higher likelihood of being sexually experienced (AOR = 3.14, 3.07, and 3.09, respectively). Although not statistically significant in the logistic regressions, most social life factors among men, i.e., having a mobile phone, a history of watching pornographic films, and drinking alcohol, were associated with being sexually experienced in bivariate analyses. Women who were not in school, had ever visited nightclubs, or reported a history of alcohol use in the 12 months before the survey had a significantly higher likelihood of being sexually experienced in logistic regression analyses (AOR = 4.28, 3.14, and 2.81, respectively).

Table 1: Demographic characteristics of participants by gender

	Male (n = 575) %	Female (n = 566) %
Age group		
15-19	53.1	63.3
20-24	46.9	36.7
Mean age	19.2 (SE 0.14)	18.6 (SE 0.11)
Religion		
Hindu	55.7	52.6
Muslim	20.5	20.6
Christian	22.8	25.8
Other/No religion	1.0	1.0
Education status		
Currently attending school	41.2	48.5
Completed > 3 years in secondary	39.6	38.2
Completed ≤ 3 years in secondary	19.2	13.0
Never attended school	0	0.3
Geographic region of residence		
Urban	42.8	42.9
Rural	57.2	57.1
Work experience in the previous 12 months		
Full time	45.8	29.9
Part time	19.5	12.7
Did not work	34.7	57.4
Monthly personal expenditure (in Rupees) ^a		
High	65.4	48.7
Low	34.6	51.3
Mean expenditure	1662.5 (SE 75.68)	1307.8 (SE 93.62)

SE, standard error.

a. Median split of total sample spending pattern: "Low," < 1000; "High," ≥ 1000; n = 574 for males and n = 561 for females.

Correlates of condom nonuse at the last sexual encounter Of those who had sex with noncommercial partners in the last 12 months (n = 123 for men and n = 40 for women), more than 50% of men and 70% of women did not use a condom at the last sexual encounter. The correlates of condom nonuse at the last sexual encounter were analyzed in terms of sociodemographic characteristics, condom attitudes, sexual behaviors, HIV/AIDS knowledge,

and exposure to an HIV/AIDS program (Table 4). Male and female data were combined for condom nonuse analyses because prior bivariate analyses stratified by gender indicated that the direction and magnitude of all independent variables were similar for men and women. In the logistic regression analyses, condom nonuse at the first sexual encounter was found to be the most significant correlate of nonuse at the last sexual encounter (AOR =

Table 2: Prevalence of sexual behavior by gender

	Male % (95% CI)	Female % (95% CI)	P ^d (χ ²) ^e
Ever had sex ^a	30.9(25.8-36.5)	9.7(6.5-14.0)	0.001 (51.53**)
Mean age at first sexual encounter ^b	17.4 (SE 0.20)	17.8 (SE 0.33)	0.362
Mean age of first partner ^b	18.1 (SE 0.25)	21.4 (SE 0.58)	0.001
Used condom at first sexual encounter ^b	41.1 (31.9-51.1)	32.0 (18.7-49.0)	0.277 (1.21)
Had multiple sexual partners ^b	65.0 (56.8-72.5)	32.0 (21.5-44.8)	0.001 (14.83**)
Had sex in the past 12 months ^b	71.3 (63.5-78.1)	75.1 (57.4-87.1)	0.688 (0.16)
Used a condom at last sexual encounter ^c	49.4 (38.2-60.6)	28.8 (12.1-54.2)	0.079 (3.23)
Always used a condom ^c	35.7 (25.6-47.4)	24.5 (10.1-48.4)	0.274 (1.23)

CI, confidence interval; SE, standard error.

a. Among total respondents (n = 575 for males and n = 566 for females).

b. Among people who had ever had sex (n = 183 for males and n = 55 for females).

c. Among people who had sex with noncommercial sex partners in the past 12 months (n = 123 for males and n = 40 for females).

d. Chi-square test for the percentage and t-test for the mean.

e. ** P < 0.01.

Table 3: Bivariate and multivariate association between dichotomous correlates and ever having had sex (male and female)

Correlate	Male					Female						
	n	Percent reporting ever had sex	Bivariate		n	Percent reporting ever had sex	Bivariate		n	Adjusted odds ratio (95%CI)	P	
			Prevalence ratio (95% CI)	P (χ ²) ^b			Prevalence ratio (95% CI)	P (χ ²) ^b				
Sociodemographic												
Age group (years)												
Older (20-24)	273	42.5	2.06 (1.63-2.60)	0.001 (43.25***)	1.50 (0.88-2.56)	0.131	206	14.5	2.12 (1.20-3.75)	0.013 (6.72*)	1.18 (0.49-2.89)	0.705
Younger (15-19)	302	20.7				360	6.9					
Geographic area												
Urban	236	30.3	0.97 (0.67-1.38)	0.847 (0.04)	0.74 (0.47-1.17)	0.195	232	11.4	1.35 (0.64-2.86)	0.426 (0.65)	0.80 (0.32-1.99)	0.630
Rural	339	31.4				334	8.4					
Currently in school												
No	337	41.8	2.74 (1.82-4.13)	0.001 (44.13***)	1.75 (0.89-3.47)	0.104	288	15.3	4.08 (1.93-8.62)	0.001 (16.51***)	4.28 (1.84-9.97)	0.001
Yes	238	15.3				276	3.8					
Work experience												
Ever worked	376	41.7	3.92 (2.31-6.67)	0.001 (48.48***)	3.14 (1.50-6.54)	0.003	236	15.9	3.13 (1.58-6.22)	0.002 (10.31***)	1.17 (0.52-2.63)	0.701
Never worked	199	10.6				330	5.1					
Religion												
Non-Christian	442	25.3	0.51 (0.39-0.66)	0.001 (18.53***)	0.27 (0.16-0.46)	0.001	422	3.6	0.13 (0.07-0.26)	0.001 (24.46***)	0.15 (0.07-0.34)	0.001
Christian	133	49.8				144	27.0					
Social life												
Have a mobile phone												
Yes	318	36.8	1.55 (1.21-1.98)	0.001 (14.26***)	1.46 (0.90-2.36)	0.119	245	12.6	1.75 (0.98-3.12)	0.048 (4.13*)	1.53 (0.73-3.19)	0.250
No	257	23.8				321	7.2					
Ever been to a nightclub												
Yes	254	51.9	3.59 (2.58-5.01)	0.001 (83.69***)	3.07 (1.74-5.42)	0.001	82	28.5	4.67 (2.49-8.78)	0.010 (7.30*)	3.14 (1.15-8.56)	0.027
No	321	14.4				484	6.1					
Ever watched a pornographic film												
Yes	404	36.5	2.10 (1.50-2.96)	0.001 (26.90***)	1.50 (0.89-2.50)	0.123	75	15.1	1.70 (0.82-3.56)	0.220 (1.54)	N/A	N/A
No	171	17.4				491	8.9					
Ever used the Internet												
Yes	228	27.2	0.82 (0.66-1.02)	0.085 (3.10)	1.15 (0.62-2.13)	0.652	224	7.5	0.66 (0.28-1.59)	0.319 (1.02)	N/A	N/A
No	347	33.2				342	11.2					
Ever drank alcohol in the past 12 months												
Yes	252	45.4	2.39 (1.90-3.01)	0.001 (58.71***)	1.56 (0.95-2.54)	0.076	130	23.9	4.38 (2.42-7.93)	0.001 (12.23***)	2.81 (1.24-6.37)	0.014
No	323	19.0				436	5.5					
Ever used marijuana												
Yes	64	68.9	2.59 (1.99-3.37)	0.001 (24.09***)	3.09 (1.73-5.51)	0.001	5	48.8	5.25 (1.97-13.98)	0.124 (2.46)	N/A	N/A
No	511	26.6				561	9.3					

N/A, not applicable; 95% CI, 95% confidence interval.
 a. Three basic sociodemographic variables (age group, geographic area, religion) and variables that attained P < 0.10 in bivariate analyses were entered into the logistic regression model.
 b. * P < 0.05. ** P < 0.01.

Table 4: Bivariate and multivariate association between dichotomous correlates and engaging in sex without a condom at the last sexual encounter with a noncommercial partner

Correlate			Bivariate		Multivariate ^a	n = 161
	n	Percent reporting condom nonuse at last sexual encounter	Prevalence ratio (95% CI)	P (χ^2) ^b	Adjusted odds ratio (95% CI)	
Sociodemographic						
Gender						
Female	40	71.2	1.41	0.079	3.09	0.056
Male	123	50.6	(0.94-2.11)	(3.23)	(0.97-9.85)	
Age group (years)						
Older (20-24)	104	61.6	1.45	0.034	2.68	0.051
Younger (15-19)	59	42.5	(1.00-2.11)	(4.78*)	(1.00-7.23)	
Geographic area						
Urban	66	45.0	0.73	0.065	0.95	0.893
Rural	97	62.0	(0.53-0.99)	(3.56)	(0.43-2.11)	
Currently in school						
No	127	58.1	1.42	0.051	0.99	0.984
Yes	36	40.9	(0.97-2.09)	(4.02)	(0.27-3.56)	
Work experience						
Ever worked	132	55.8	1.16	0.520	N/A	N/A
Never worked	31	48.2	(0.74-1.81)	(0.42)		
Condom attitudes						
Perceived difficulty in obtaining a condom						
High	23	80.4	1.58	0.017	4.17	0.084
Low	138	50.9	(1.18-2.12)	(6.17*)	(0.82-21.14)	
Self-efficacy of using a condom with a new partner						
Low	28	88.5	1.83	0.001	3.11	0.066
High	133	48.3	(1.46-2.30)	(27.38**)	(0.93-10.41)	
Confidence to refuse sex without condom						
Low	86	60.4	1.28	0.111	N/A	N/A
High	75	47.2	(0.95-1.72)	(2.64)		
Sexual behaviors						
Used a condom at first sexual encounter						
No	103	78.3	3.75	0.001	12.92	0.001
Yes	60	20.9	(2.34-6.01)	(38.64**)	(4.96-33.62)	
Had more than one sexual partner						
Yes	111	54.4	0.99	0.958	N/A	N/A
No	52	54.9	(0.74-1.34)	(0.00)		
Knowledge of HIV prevention methods						
Effectiveness of condom in HIV prevention						
Low	20	79.1	1.54	0.029	1.94	0.398
High	143	51.4	(1.13-2.10)	(5.06*)	(0.41-9.19)	
Effectiveness of having one faithful partner in HIV prevention						
Low	60	58.7	1.13	0.454	N/A	N/A
High	103	52.0	(0.83-1.54)	(0.57)		
Exposure to HIV program						
Ever heard of PILS (NGO)						

Table 4: Bivariate and multivariate association between dichotomous correlates and engaging in sex without a condom at the last sexual encounter with a noncommercial partner (Continued)

No	66	66.0	1.42	0.018	3.27	0.010
Yes	97	46.5	(1.08–1.86)	(5.98*)	(1.35–7.90)	

N/A, not applicable; 95% CI, 95% confidence interval; NGO, nongovernmental organization.

a. Three basic sociodemographic variables (gender, age group, and geographic area) and variables that attained $P < 0.10$ in the bivariate analyses were entered into the logistic regression model.

b. * $P < 0.05$, ** $P < 0.01$.

12.92). Moreover, those who had not been exposed to HIV prevention programs by NGOs that promoted HIV prevention among young people had a significantly higher AOR (3.27). Those who were female and older had higher likelihoods (AOR = 3.09 and 2.68, respectively) of not using a condom at the last sexual encounter, although these factors were not statistically significant in logistic regression analyses.

Discussion

We described the results of a survey on HIV-related sexual behaviors among a population-based probability sample of young people on the island of Mauritius. Among unmarried young people aged 15–24 years, 30.9% of males and 9.7% of females reported a history of penetrative sexual intercourse. Of these sexually active people, behaviors that increase vulnerability to HIV infection were prevalent, e.g., having multiple partners (males), having sex without a condom, and having an older partner (females) [21–23].

The proportion of sexually active unmarried youth in Mauritius, i.e., 30.9% of men and 9.7% of women, appears to be relatively low compared to that in other African countries. Data from 17 national surveys conducted in the past 5 years among young people aged 15–24 years from diverse countries in sub-Saharan Africa indicate that, on average, about 38% of men and 30% of women report having had premarital sex in the previous year [24]. As prevalence of ever having had sex in these countries should be higher than that of sex in previous year, we can say that sexual activity of Mauritian youth is comparatively much lower than that of other African countries. In addition, when compared with data from the 1996 Mauritius Youth profile study, we did not observe a dramatic change in the proportion of sexually experienced unmarried youth. This relatively low prevalence of sexually active youth may be due at least in part to the predominance of religions with conservative sex norms and may partly explain how Mauritius has managed to maintain a stable low level of HIV infection in the 1990s, despite the devastating HIV epidemic in neighboring Africa.

Nevertheless, these findings do not leave room for complacency. Among sexually experienced Mauritian youths, 50.6% of male and 71.2% of female respondents did not use condoms at the last sexual encounter with a noncom-

mercial partner. Although HIV infection risks may not be very high for young people as a whole, there certainly exist a group of youth who have unprotected sex and are vulnerable to HIV infection. Therefore, the HIV program for youth in Mauritius should aim to maintain the low prevalence of sexually active youth and to promote safe sexual behavior among those who are sexually active.

To achieve these goals, we need to identify the predictors of sexual behavior to effectively and efficiently target HIV prevention to this vulnerable subpopulation. We identified several factors related to the sexual behaviors of young people in Mauritius. For men, having ever worked and marijuana use were significantly associated with having ever had sex. In contrast, being out of school and drinking were associated with women's sexual experience. In addition, being Christian and visiting nightclubs were significantly associated with sexual experience in both sexes. Furthermore, among sexually experienced young people, the use of condom at first sex and exposure to an NGO's HIV program were significantly related to condom use at last sexual encounter. These findings suggest possible directions for effective youth HIV prevention programs in Mauritius. We grouped them into three possible approaches: (1) out-of-school and in-school approaches, (2) nightclub and popular site approaches, and (3) religion and social status approaches.

Out-of-school and in-school approaches

Prevention efforts are needed outside the school system because the young people that were more sexually experienced were men who have ever worked or women who are not in school. Two channels currently exist in Mauritius to reach young people outside the school system: (1) peer educators trained by the AIDS unit of the Ministry of Health and (2) youth leaders attached to the youth centers of the Ministry of Youth and Sports. These resources should be reinforced to reach out-of-school youth to provide better reproductive health services. Furthermore, one of our most important findings was that exposure to an NGO program was associated with safer sexual behavior in young people. Because these activities are easily modifiable, a great opportunity may exist for the promotion of safer sex by reinforcing the activities of NGOs through peer educators or youth leaders.

At the same time, to maintain or reduce the number of out-of-school youth, enrollment in secondary and tertiary education should be promoted in a long-term perspective. In Mauritius, the enrollment ratio for primary school is 100%, but falls to 60% for secondary school, and 4.4% for post-secondary school [25]; there is therefore room to promote secondary and tertiary education. By doing so, young people may delay their sexual debut by having greater access to information and skills, enhanced future orientation and aspirations, and by delaying exposure to the workplace where they encounter older people.

Reproductive health education needs to be promoted in schools because it is important for all young people, including the sexually inexperienced, to have the requisite knowledge and skills to use condoms beginning with their first sexual encounter. Our results indicate that condom nonuse at the last sexual encounter is significantly associated with condom nonuse at the first sexual encounter, i.e., those who used a condom at their first sexual encounter were much more likely to report using a condom at their most recent sexual encounter. The same trends were found among adolescents from other parts of the world [26,27]. These results suggest that HIV prevention programs emphasizing appropriate and consistent condom use should target young people before the onset of sexual activity. In schools, where most students are sexually inexperienced, information on the risks accompanying sexual behavior should be provided to all students so that they can make informed future decisions.

Nightclub and popular site approaches

Nightclub visitation was correlated with other variables assessing popular sensationseeking behavior, such as possession of a mobile phone, watching pornographic films, alcohol intake, and marijuana use, in bivariate analysis. Although only nightclub visitation was significantly associated with sexual behavior in both men and women in multivariate analyses, the effects of these other items should be considered in the HIV prevention program. Media campaigns using various channels are potentially one of the most effective approaches to convey HIV prevention messages to these young people who seek out and are exposed to risks. As suggested in previous studies, role model stories printed in youth-attracting flyers may be a useful means to convey HIV prevention messages, even to hard-to-reach youths, because they can readily be distributed at popular sites where young people congregate [28,29].

In addition, HIV prevention interventions, including education on the risks of drinking and drug use, could be explored in nightclubs because we identified nightclubs as an important place where sexually experienced young men and women congregate. The identification of specific

access points will help the national AIDS control program to effectively use available resources for targeted interventions. Ford and Inman [30] documented successful interventions to promote "safer sex" among young people in nightclubs in southwest England. The event was organized in a way that appeals to young people's sense of humor: competitions run by disc jockeys, free condoms, and "safer sex" materials. Although gaining the cooperation of venue owners may be challenging, such events could be considered in nightclubs in Mauritius to effectively reach young people with high risk factors for contracting HIV.

The effect of watching pornographic films should also be cautiously assessed because the bivariate analysis, but not logistic regression, showed this to be significantly associated with sexual experiences in young men. In fact, 70.6% of men, as compared to 12.9% of women, have reported ever having watched pornographic films. These films, most of which are from overseas, include unprotected sexual behaviors. A recent cohort study in the United States indicated that exposure to sexual content in the media accelerated adolescents' sexual activity and increased their risk of engaging in early sexual intercourse [31]. Similarly, a study in China reported that younger students are more exposed to pornographic media than are older students [32]. Taking these findings and the recent rapid increase in Internet use in Mauritius into account, attention should be given to trends related to the excessive exposure of young men to sexual media content. Video rental stores, of which there are many on the island, are potential intervention sites to address the watchers of pornographic films.

Religion and social status approaches

Christian youth reported more sexual experience than those in other religious groups. This may be partly related to their higher exposure to nightclubs, alcohol, and marijuana use because a relatively higher proportion of Christians live in urban areas compared to Muslims or Hindus. In this context, the popular site approaches (above) should be implemented, focusing on Christian youth.

Given disproportionate differences in sexual experience rates among religious groups, religious gatherings should also be considered as potential places for HIV prevention sessions to address sexual norms and reproductive health [33]. Religious groups in Mauritius are still unwilling to promote condoms as a means of protection, and would rather stress abstinence and fidelity. Some religious people, however, are more involved in the fight against poverty, the commercial sex trade, and substance abuse, and through these related issues, they also deal with HIV/AIDS. Greater participation of religious leaders in HIV/AIDS programs may be facilitated through greater involve-

ment of people living with HIV/AIDS (PLWHA), as suggested by work in Trinidad, where the religious profile is as diverse as in Mauritius [34]. In Trinidad, personal interaction with PLWHA was positively associated with the involvement of religious leaders in HIV/AIDS initiatives.

Finally, it is needless to say that National AIDS Control program of Mauritius should swiftly act on HIV prevention for injecting drug users given the contemporary trends of HIV spread in this group. At the same time, with regard to young people, our findings suggest that early and focused programs are needed. Evidence from Cambodia indicates that young people are more willing to adopt safer behaviors than older people when provided with the appropriate services [35]. Focused programs specifically targeting young people in general, as well as at-risk populations, such as sex workers and drug users, will have maximum impact and require the least resources when implemented at this early stage of the HIV epidemic. In particular, young women warrant special attention because the results indicate that women tended to have older sexual partners, which means that they may be more exposed to HIV than men [22]. In Africa, young people, especially younger women, are the most seriously affected by HIV because of their social and biological vulnerability [36]. Precautions are needed to protect younger women in Mauritius to avoid a situation similar to that on the African continent. The National AIDS Control Program of Mauritius should take every opportunity to intervene before the HIV epidemic escalates.

Our study is not without limitations, which include face-to-face interviews as the only modality of data collection. Although under-reporting might not have been completely avoided, the validity of the responses concerning sexual experience was assessed using a random response technique and considerable effort was made to put the respondents at ease, particularly for sensitive questions. However, self-report information may be subject to reporting errors and biases. Furthermore, the study was based on cross-sectional data for which the direction of causal relationships cannot be determined. Future studies need to assess the effectiveness of HIV prevention interventions in the context of young people's lives in Mauritius.

Conclusion

Premarital sexual intercourse was reported by 30.9% of male and 9.7% of female young people in Mauritius. Of these sexually active young people, behaviors that increase the vulnerability to HIV infection were prevalent and were associated not only with their culture, which was represented by religion, but also with the influence of a changing society such as school enrolment, NGOs, night-clubs, and pornographic films. Taking these predictors of

sexual behaviors into account, a focused HIV prevention program for young people needs to be reinforced in Mauritius to minimize the future consequences of the epidemic, even though HIV levels are currently low.

Competing interests

The author(s) declare that they have no competing interests.

Authors' contributions

YHN, MOK, and MK conceived the study, performed and interpreted the analyses, and wrote the first draft of the manuscript. JCM and RN supervised and coordinated the data collection in the field. TH, RJD, and DLL provided advice on the statistical data analysis and interpretation of results. All authors read and approved the final manuscript.

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第7回 ECC 山口メモリアルエイズ研究奨励賞受賞研究

Shared Drug Injection inside Prison as a Potent Associated Factor for Acquisition of HIV Infection : Implication for Harm Reduction Interventions in Correctional Settings

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Introduction

Iran has faced a rapidly growing HIV/AIDS epidemic particularly among injecting drug users (IDUs). Since 1987, more than 15,500 cases of HIV/AIDS have been reported to the Center for Disease Management with an additional 2,000 AIDS patients dying of the disease. More than 94% of HIV/AIDS reported cases are male. Among those with a known transmission route, 87% were IDUs and 9% reported acquiring the infection through sexual contact¹⁾. Reports show that the number of people with HIV/AIDS has been sharply increasing in recent years²⁾ and an estimate in 2006 indicates that more than 66,000 people with HIV/AIDS are living in Iran^{1,3)}.

Although opium smoking has a centuries-old tradition in Iran, increased availability of heroin, along with its low price in recent years, has led to an explosion of heroin dependency and its injecting use. According to the rapid situation assessment conducted in 1999, there were 1.8 million drug users in Iran of which 9-16% practiced injecting drugs, giving an estimated number of 200,000 IDUs in Iran⁴⁾. The epidemic of injecting drug use in Iran should not only be examined at a national level but also in the wider regional context in that Iran's neighboring country, Afghanistan, is the main producer of opium in the world⁵⁾ and drugs have been heavily trafficked to Iran and through Iran to other

countries⁶⁾. According to the World Drug Report by the United Nations Office for Drugs and Crime (UNODC), opium production is now highly concentrated in Afghanistan's southern provinces especially in Helmand province, with the dubious distinction of more drug cultivation than entire countries such as Myanmar, Morocco or even Colombia⁷⁾.

At the same time, drug-related offences are abundant in Iran, with a report in 2001 showing that over 300,000 individuals were arrested on drug-related charges and the number of people convicted of drug-related offences constitutes 47% of the total prison population in Iran⁸⁾. Though the average number of prisoners in Iran has been moderately reduced in recent years, there is still a high turn over of prisoners entering and exiting prisons⁸⁾. The Iran Prisons Organization reports that there were, on average, 135,000 prisoners in 230 prisons and correctional settings at any point in time in Iran during the 2004 to 2005 Persian fiscal year, and about 600,000 prisoners entered and exited prisons during this period⁹⁾.

In response to the intertwined epidemics of HIV infection and injecting drug use, Iranian health policy makers have adopted a harm reduction approach and have initiated a number of interventions to control further transmission of HIV infection among the large IDU population⁸⁻¹¹⁾. Notably, tri-angular clinics (where integrated services are provided to IDUs, people living with HIV/AIDS and sexually transmitted infections (STIs)¹²⁾ have been expanding across the country; methadone maintenance therapy (MMT) is now being scaled up in community and correctional settings; an integrated bio-behavioral HIV surveillance has been set up for IDUs; and there is greater involvement of non-governmental organizations (NGOs) in HIV preven-

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tion among IDUs including outreach and needle and syringe programs through drop-in centers^{3,11,13}.

While there have been a range of HIV prevention interventions for IDUs in Iran, at the time of our investigation, there was little available data on HIV prevalence or its risk factors in Iran. Consequently, a collaborative research project (called the HADI Project) was established between Department of Global Health and Socio-epidemiology at Kyoto University School of Public Health in Japan and the Center for Disease Management at Ministry of Health in Iran to investigate HIV prevalence and behavioral and contextual risk factors of the infection among drug users in Iran. The project later found another major collaborating partner at Nagoya City University in Japan, and other research partners including the Iranian National Center for Addiction Studies and the Persepolis Society in Iran.

This article reviews the overall findings of phase I and phase II of the HADI Project and further discusses the impacts of these findings on health policy relating to incarcerated drug users in Iran. Further details of the study methods and results can be found in the original research reports^{14,15}.

Methods

This research project is an example of socio-epidemiological studies^{16,17} in which qualitative and quantitative methodologies are integrated in order to produce a clearer insight into health conditions within a complex social context. An obvious example is the transmission of HIV and other blood-borne infections among injecting drug users whose sub-cultures and social life are relatively unknown to the researchers. In this research project, a sequential strategy was used, starting with a preliminary qualitative phase and then followed by a main quantitative phase, which was given greater priority or weight in the final analysis and in related policy reports. However, qualitative inquiries were effectively applied in preliminary work to obtain a deeper insight into the living conditions of drug users, their norms and sub-culture in regard to HIV risk-related behaviors. Based on the results of the preliminary qualitative phase, the overall plan for the quantitative phase was finalized and a culturally-sensitive questionnaire was developed.

Participants and settings

Phase I.

Between late October 2003 and May 2004, drug users attending three public out-patient drug treatment centers in Tehran were recruited into the study. Drug users were eligible for participation if they had used illicit drugs during the previous month, and were seeking drug treatment for the first time in those centers. The

recruitment sites were public drug treatment centers, each representing a subdivision of out-patient health facilities for drug users organized by the Ministry of Health or the State Welfare Organization.

Phase II.

The survey was conducted in the *Shoosh* area in south-central Tehran, a relatively poor area where there is a high concentration of migrants and drug users¹³. In October 2004, a further sample of drug users was recruited at the drop-in center and at parks and streets in the area.

Data collection

After obtaining informed consent, each respondent was confidentially interviewed by an experienced interviewer using a structured questionnaire. The questionnaire was developed from a questionnaire produced by Family Health International for use with IDUs¹⁸. Modifications to the original questionnaire were made following the findings of the preliminary qualitative study conducted among 19 drug users. The revised questionnaire was pre-tested for its reliability and those questions producing inconsistent responses were excluded.

HIV testing

On completion of the 20-minute long interview, consenting participants were counseled and then the trained interviewer took an oral mucosal transudate sample. In addition to information given during the counseling, participants received an educational pamphlet and a confidential code for receiving the oral HIV test result.

Oral samples were obtained using the OraSure oral fluid specimen collection device (OraSure Technologies, Inc., Beaverton, OR, USA). Collected samples were kept cool until shipped in batches to Nagoya City University of Japan for testing. All samples were tested for HIV-1 with ELISA (Oral Fluid Vironostika HIV-1 Microelisa System, BioMérieux Inc, Durham, NC, USA). Repeatedly reactive ELISA samples were confirmed using a Western blot test (OraSure HIV-1 Western Blot Kit, OraSure Technologies, Inc. Oregon, USA)¹⁹.

Ethical issues

The protocol used in this research was approved by the Ethics Committee in Medical Sciences Research in the Ministry of Health, the Ethics Committee in the National Center for Addiction Studies in Iran and by the Committee for Research on Human Subjects at Kyoto University in Japan. Separate informed consents were obtained for the interview and HIV testing, and no personal identifier was recorded on the questionnaires.

Statistical analysis

Statistical analysis was performed using SPSS for Windows[®] (version 12.01). Bivariate analyses were performed to determine associations between HIV status

Table 1. Characteristics of male injecting drug users recruited from treatment centers and community-based settings in Tehran between 2003 and 2004, divided by recruitment setting ($n=372$)

Characteristic	Phase I of HADI Project	Phase II of HADI Project
	Mean (SD) or Number (%)	Mean (SD) or Number (%)
Overall	165	207
Recruitment setting	Treatment-based	Community-based
Period of data collection	Oct. 2003 to May 2004	Oct. 2004
Mean age at interview (SD)	31.0 (7.8)	33.3 (8.1)
Mean age at first drug use (SD)	18.7 (4.4)	19.0 (4.3)
Mean age at first drug injection (SD)	26.0 (6.7)	25.4 (6.2)
Infected with HIV (%)	25 (15.2)	48 (23.2)
Ever incarcerated (%)	105 (63.6)	194 (94)
<i>Among incarcerated IDUs</i>		
Ever used drugs inside prison (%)	46 (43.8)	121 (62.4)
Ever injected a drug inside prison (%)	19 (18.1)	55 (28.4)
Ever injected a drug using a shared tool inside prison (%)	19 (18.1)	45 (23.2)

SD, standard deviation; IDUs, injecting drug users.

and self-reported characteristics, followed by logistic regression analyses. Variables were entered into a multivariate model if their association with HIV infection by bivariate analysis had a P value ≤ 0.10 or if they were considered epidemiologically important. A multivariate model was used to obtain adjusted odds ratio (OR) and 95% confidence interval (CI) for the associated factors with HIV infection.

Results

The main findings for injecting drug users with HIV test results are summarized in Table 1. Overall, information from 372 male IDUs (those who reported having ever injected an illicit drug in their lifetime) participated into these two surveys, 165 were recruited from treatment based settings during first phase of the study in 2003-4 and 207 community-based IDUs participated in the second phase conducted in 2004.

As shown in the Table 1, the mean age of male IDUs who were recruited from treatment centers was 31.0 [standard deviation (SD)=7.8] at the time of interview and they reportedly started drug injection on average at 26 (SD=6.7) years of age. For IDUs from community-based settings these figures were 33.3 (SD=8.1) and 25.4 (SD=6.2), respectively.

The majority of IDUs in both surveys reported that they were using heroin as the main injecting drug. Among treatment based IDUs, about 64% reported having been incarcerated and among those with a history of incarceration, 44% reported using drugs inside prison and 18% reported practicing drug injection inside prison. Notably, all of those with a history of

drug injection inside prison reported that at some point in time, they had shared drug injection tools (needle/syringe or hand-made device) there. The incarceration history was more evident among community-based IDUs and 94% of them reported having been incarcerated. Among those community-based IDUs with a history of incarceration, 62% reported using drugs at some time inside prison, 28% practiced drug injection inside prison and 23% reported using shared drug injection tools while inside prison.

Prevalence of HIV infection was 15.2% among IDUs who visited treatment centers but the infection rate was as high as 23.2% among community-based IDUs who were recruited from a drop-in center and its neighboring parks and streets.

Associated factors with HIV infection among IDUs recruited from treatment centers

There was no significant difference in HIV prevalence by age at first injection, by period of injection history, or by time elapsing from last injection. However, total length of lifetime incarcerations was found to be associated with higher prevalence of HIV infection in a dose-dependent manner as the odds ratio increased from 3.24 among IDUs who had experienced incarceration of less than 6 months to 8.38 in those who had been incarcerated for six months or more compared to those who never incarcerated. Those IDUs with a history of sharing injection equipment inside prison had a much higher HIV prevalence compared to those who had never had a shared drug injection tools (OR=10.00, 95% CI: 3.23-30.94), while HIV prevalence among IDUs with a history of sharing injection tools only

Table 2. Multivariable analysis on the association between HIV infection and risk characteristics of injecting drug users visiting public drug treatment centers in Tehran, Iran, 2003-4

Characteristics	Adjusted odds ratio	95% CI	P value
Jobless	2.7	0.9- 8.6	0.082
Injected using a shared needle/syringe but never inside prison ¹	2.4	0.8- 7.8	0.131
Injected using a shared tool inside prison ¹	12.4	2.9-52.0	0.001
Months of incarceration (continuous)	1.0	0.9- 1.0	0.233
Years of injecting (continuous)	1.1	0.9- 1.3	0.105

Variables shown in this model are controlled for age, ethnicity, level of education, and marital status.

¹ Reference group consists of those never had a shared drug injection.

CI, confidence interval.

From Zamani *et al.* AIDS 19 : 709-716, 2005.

Table 3. Multivariable analysis on the association between HIV infection and risk characteristics of injecting drug users recruited from a drop-in center and its neighboring area in Tehran, Iran, 2004

Characteristics	Adjusted odds ratio	95% CI	P value
Injected using a shared tool in prison	2.3	1.0-5.2	0.050
History of multiple incarcerations	3.1	1.1-8.9	0.038
Engaged in sex with another man	0.5	0.1-2.1	0.349
Tattooed inside prison	1.4	0.7-2.9	0.396

Variables shown in this table are controlled for age, levels of education, marital status, job status and number of years of drug injection.

CI, confidence interval.

From Zamani S, *et al.* J Acquir Immune Defic Syndr 42 : 342-346, 2006.

outside prison was not significantly higher than those who had never shared ($P=0.099$) (Not shown in the table)¹⁴.

In the multivariate analysis conducted on the data for male IDUs controlling for basic demographics, a history of sharing injection equipment inside prison remained the major factor associated with HIV infection (adjusted OR 12.37, 95% CI 2.94-51.97) (Table 2)¹⁴.

Factors associated with HIV infection among community-based IDUs recruited from a drop-in center and its neighboring area

Among community-based IDUs, the prevalence of HIV infection was associated with the number of incarcerations and with the total length of incarcerations in a dose-dependent manner. Those who reported having injected a drug inside prison using a shared injection tool had a significantly higher prevalence of HIV compared to those who did not (36% v 20%, $P < 0.05$)¹⁵.

In the multivariable analysis controlling for basic socio-demographics, it was shown that HIV infection was associated with a history of sharing drug injection

tools inside prison (adjusted OR, 2.3 ; 95% CI, 1.0-5.2) and of having had multiple incarcerations (adjusted OR, 3.1 ; 95% CI, 1.1-8.9) (Table 3)¹⁵.

Discussion

Despite the increasing number of HIV/AIDS cases in Middle Eastern countries, there have been few epidemiological studies providing evidence relating to the prevalence of HIV infection and characteristics of at-risk populations in this region²⁰. Through these studies, we investigated HIV prevalence and risk characteristics of IDUs recruited from drug treatment centers and those from a community-based drop-in center and its neighboring parks and streets in Tehran, Iran. Both studies showed that HIV infection was already prevalent among both groups at alarming levels and the infection was strongly associated with a history of sharing drug injection tools while inside prison.

The increased risk of HIV infection among incarcerated drug users is not confined to Iran and has been reported in several other countries. Similar findings have been reported in Thailand, where drug in-

jecting inside prison was shown to be a potent correlate of HIV infection among incarcerated drug users²¹. In Berlin, IDUs were recruited from different settings and data on risk behavior were obtained along with serological markers including that for HIV infection. In this study, it was found that a history of syringe sharing in prison was potentially associated with HBV, HCV and HIV infection²². In 1993, Taylor *et al.* conducted an investigation in response to an HIV outbreak in Glenochil Prison in Scotland that indicated some of HIV transmissions definitely occurred within that prison²³. The authors, who were examining one of the first outbreaks of HIV infection occurring within a prison, concluded that restricted access to injecting equipment resulted in random sharing and placed injectors at high risk of becoming infected with HIV²³.

The association between HIV infection and a history of shared drug tools inside prison in Iran is also supported by our qualitative data which showed that while drugs can be found in some prisons, they are much more expensive than those purchased outside prison in Iran. Having obtained an expensive drug inside prison, the most cost effective way of drug use is by injection. On the other hand, lack of sterile needles/syringes inside prisons may lead IDUs to share hand-assembled injecting tools with a large number of partners²⁴. This intense sharing practice with hand-assembled injection tools that can be hard to disinfected can put incarcerated IDUs at a great risk of HIV infection as well as other blood-borne infections such as HBV and HCV²⁵.

Our findings strongly suggest that the Iranian government should be compelled to undertake HIV preventive interventions for incarcerated drug users, given the high prevalence of HIV infection among those IDUs who reported sharing drug injection tools inside prison. Cumulative evidence from other countries and that of national studies in Iran showed a greater risk of HIV infection for incarcerated drug users needs urgent and comprehensive attention^{14,15}. In January 2005, in response to increasing concern over HIV transmission among IDUs and prisoners, the head of the Iranian judiciary issued an executive order to judges in all courts of justice in favor of further provision of sterile injection equipment and MMT for IDUs and incarcerated people²⁶. Authorities in the judiciary system and its sub-division Prison Organization have, in fact, adopted harm reduction policies and practices for drug using inmates in Iran. As a result, the Iran Prison Organization has started comprehensive HIV prevention interventions for drug using inmates in many provinces in Iran including epidemiological surveillance, educational programs, research activities, and prevention programs. One of the key elements of prevention programs inside prisons in Iran is to reduce HIV-related

harm through MMT⁸. While the Iran Prison Organization is intensively scaling up its prevention interventions for drug using inmates, it is very important that these interventions become available in all prisons in Iran and that they become more coordinated with and integrated into existing public health interventions for drug users and ex-prisoners in the community outside of prisons.

These two studies had some limitations. Firstly, our participants are unlikely to be representative of the general drug using population as they were recruited from three treatment centers and from a drop-in center and its neighboring area in Tehran. We mainly relied on self-reported risk behaviors which could be biased as a result of recall ability, or social desirability^{27,28} given the social context where many of the HIV risk behaviors are highly stigmatized.

Conclusions

Our findings show that HIV prevalence has reached high proportions among community-based IDUs in Tehran with incarceration-related exposures revealed to be the main correlates of the infection. Urgent and comprehensive harm reduction programs for drug users in prison as well as those in the community are needed if the epidemic among IDUs in Iran is to be controlled.

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