HIV infection among young men who have sex with men in China: comparison of risks among students and non-students

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Research article

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Abstract

Background The human immunodeficiency virus (HIV) epidemic has been drastically increasing among men who have sex with men (MSM) in China over the past decade. More so, the number of HIV infections among young adults in the country has also been on the rise, highlighting a unique sub-population, which may lead to increased incidence and transmission of the disease. This study aimed to determine the HIV infection rate amongst student and non-student young men who have sex with men (YMSM) in three regions in China and factors associated with their HIV infection. Methods A cross-sectional study was conducted from 1 September to 6 September 2017 in Beijing, Sichuan, and Guangzhou). Participants were recruited through a popular Chinese gay social networking application, as well as several college-based youth associations. Univariate and multivariate logistic regression analyses were conducted to assess factors associated with HIV infection. Results The HIV infection rate among non-student YMSM was significantly higher than that of student YMSM (10.3% versus 5.3%, $\chi 2trend=17.34$, $P<0.001$). The multivariate logistic regression analysis showed that YMSM self-identifying as homosexual (AOR=2.81, 95%CI=1.40-5.66, P=0.004) and perceived themselves at risk for HIV (AOR=3.08, 95:CI:1.33-7.15, P=0.009) had a 3 times increased odds of being HIV positive. Additionally, participants whom reported not always using condoms with sex partners in the past six months (AOR=1.69, 95%CI=1.17-2.44, P=0.006) were at increased odds of HIV infection. Conclusions Young men who have sex with men, particularly those identifying as homosexual and not always using condoms during intercourse, are at increased odds of HIV infection in China. Promoting comprehensive sexual education to youth and other measures aimed at improving HIV knowledge could help control HIV transmission among this key sub-population.

Background

Men who have sex with men (MSM) are a high-risk group for human immunodeficiency virus (HIV) infection and a key population for HIV transmission [1–6]. MSM are at an increased risk for HIV infection due to their often-stigmatized status and sexual preferences [1]. Due to biological, behavioral, and other sociocultural factors, MSM are more than 25 times more likely to acquire HIV than the general population [7]. More so, this group accounted for more than half of new infections in Western Europe and North America, and a fourth of new infections in the Asia and Pacific region [7]. This population epidemic is echoed in China, where homosexual transmission of HIV has been increasing at an alarming rate in recent years [8,9]. The overall HIV prevalence amongst MSM increased from 0.9% in 2003 to 8.0% in 2015 according to sentinel surveillance data [10,11]. Rates of infection are not constant across the MSM population however; as previous studies have shown that HIV prevalence amongst MSM varies by demographic characteristics, such as age and education level [12]. HIV infection amongst the sub-group of young men who have sex with men (YMSM) has thus far received little attention [13]. One recent study found that among students aged 15 years and older, the number of HIV infections increased significantly in a 6-year period, from 527 cases in 2008 to more than 2,600 cases in 2014, with male-to-male sexual transmission found to be the main driver of these cases [14]. These findings are reflected in a recent meta-analysis, which showed the prevalence of HIV infection among student men having sex with men in China to have increased from 3.0% in 2003 to more than 5% in 2016 [15]. Further efforts aimed at identifying these high-risk individuals and understanding the drivers of this increasing transmission could help inform targeted strategies aimed at controlling HIV among young men who have sex with men.

Previous studies have identified that young men who have sex with men exhibit high risk-sexual behaviors, such as having multiple sexual partners, having older partners, and low rates of condom use, all of which can lead to

the ongoing transmission of HIV [16–19]. Understanding these main drivers of HIV transmission in students across the country can help inform strategies aimed at curbing the ongoing occurrence of these high-risk behaviors amongst YMSM in China. This study aimed to estimate the HIV infection rate of student and non-student YMSM in three regions in China and provide scientific evidence for the development of HIV prevention and control measures targeting current student and non-student YMSM aged 18–25 years old.

Methods

Design

A cross-sectional study was conducted from 1 September to 6 September 2017 in Beijing, Sichuan, and Guangzhou, China, during which an online questionnaire amongst YMSM was carried out.

The participants were recruited through a popular Chinese gay networking application (APP), Blued, as well as several college associations (two colleges in Beijing, one in Sichuan and one in Guangzhou). The online survey was advertised via the APP, using online banners and startup screen advertisements. The survey was also advertised at some events organized by the college associations, using posters with QR codes, which potential participants could scan to join the survey. Inclusion criteria were: a) provided informed consent; b) had had sexual intercourse with men in their lifetime; c) aged between 18 to 25 years old.

Questionnaire

An online questionnaire was used to assess HIV sexual risk behaviors amongst YMSM. The questionnaire was developed by Blued and has been previously used by the Chinese Center for Disease Control and Prevention (China CDC) for HIV sentinel surveillance. The questionnaire consisted of the following sections: a) demographic characteristics; b) sexual orientation and sexual behaviors; c) HIV testing behaviors; d) attitudes toward HIV; e) results of the participants' most recent HIV test; and f) HIV-related knowledge scale. This scale, which includes an eight-item list, was developed by the China CDC to evaluate the level of HIV/acquired immune deficiency syndrome (AIDS) knowledge and has been used for more than ten years.

Measures

Participants were categorized as student or non-student YMSM. The students were defined as those who were registered as full-time students in school when the survey was conducted. Non-students were defined as those whose occupation were not full-time students in school. The student and non-student YMSM were also referred to as YMSM "on and off" campus. Demographic characteristics, including age and relationship status (defined as either single or not single) were collected. HIV-related knowledge and attitudes towards HIV were assessed by ten issues, with each issue worth a score of ten points, and the score out of 100. The higher the score the participant received, the better the awareness of HIV-related knowledge. Attitudes toward HIV included risk perception of HIV infection (i.e., risky, no risk) and willingness to communicate with people living with HIV (i.e., willing, unwilling, unsure). Sexual orientation (i.e., non-homosexual, homosexual) and sexual behaviors were collected. Sexual behaviors included unprotected, insertive sexual intercourse ever in their lifetime, number of sex partners in the past six months, and condom use with sexual partners in the past 6 months (i.e., always, not always). Lastly,HIV testing behaviors were assessed by asking participants the following questions: "Have you ever had HIV testing?", "have you ever had HIV testing in the past six months", "where do you most often get tested for HIV?"

(i.e., hospital/community health service center/CDC, non-governmental organizations (NGOs), self-testing, other ways), and “what was the result of your most recent HIV test?” (i.e., HIV positive, HIV negative, unsure).

Statistical Analysis

The data were analyzed using SPSS 19.0 software (IBM Corp. Released 2010. IBM SPSS Statistics for Windows, Version 19.0. Armonk, NY: IBM Corp.). Descriptive statistics including number and percent were used to describe the demographic characteristics, HIV-related knowledge, attitudes toward HIV, and HIV testing behaviors of participants. Chi-square tests were used to examine differences in demographic characteristics, HIV-related knowledge, attitudes toward HIV, and HIV testing behaviors between student and non-student YMSM. Univariate and multivariate logistic regression models were used to assess factors associated with HIV infection among YMSM, producing adjusted odds ratios (AOR) and 95% confidence intervals (95% CI). All p-values were two-sided and $p<0.05$ was considered statistically significant.

Ethics

The Institutional Review Board of the National Centre for AIDS/sexually transmitted diseases (STD) Control and Prevention, Chinese Centre for Disease Control and Prevention approved this study. Informed consent was obtained electronically for all participants prior to the start of the online survey. No personally identifying information was collected. All data were administrator, password protected.

Results

A total of 7,391 participants were recruited via the Blued APP and the college associations, of which 438 (5.9%) did not provide informed consent. 6,953 (94.1%) potential participants were screened and completed the online survey. Among them, 1,459 (21.0%) had not had sexual intercourse with men in their lifetime and 2,490 (35.8%) were not aged between 18–25 years old. A total of 3,004 (43.2%) were included in the final study.

Participants

Among the 3,004 study participants, a little less than half (1,390, 46.3%) were students, while 1,614 (53.7%) were non-students (Table 1). The majority of participants identified as homosexual (79.8%), single (70.1%), perceived the risk of HIV infection (83.9%), and were willing to communicate with people living with HIV (60.1%). A greater proportion of student YMSM had more knowledge of HIV-related factors (59.1% versus 54.2%, $P = 0.007$). As seen in Table 1, there were statistically significant differences between student and non-student YMSM in regards to sexual risk behaviors including unprotected insertive intercourse, number of sexual partners, and condom use. A larger number of non-student YMSM had unprotected, insertive sexual intercourse ever in their lifetime (74.0% versus 62.8%, $P<0.001$), while a greater proportion of student YMSM reported always using condoms with sex partners in the past six months (70.0% versus 64.4%, $P = 0.003$). Additionally, a more non-student YMSM had two or more sex partners in the past six months (48.8% versus 41.2%, $P<0.001$), while a larger number of student YMSM had a stable sex partner in the past 6 months. In regards to HIV testing behaviors, more non-student YMSM had HIV testing in their lifetime (71.5% versus 64.4%, $P<0.001$).

The general HIV-related knowledge among all participants is summarized in Table 2. The overall score of HIV-related knowledge of the two groups was 75.75±16.05 out of 100. As shown in Table 2, the average score of HIV-related knowledge for student YMSM was 77.38±14.65, while it was somewhat lower for non-student YMSM, at

74.34±17.03. Awareness of HIV-related knowledge was statistically different between the student and non-student groups on a handful of questions. More students answered correctly on questions related to infection route and reducing risk behaviors ("is it possible to get infected with HIV by eating with people whom have HIV? 97% vs. 94.3%, P<0.001; which of the following behaviors can effectively reduce the risk of HIV infection? 73.3% vs. 64.1%, P<0.001). However on one question, "do other STDS increase the risk of HIV infection?", more non-student YMSM answered correctly than student YMSM (67.5% versus 61.4%, P<0.001).

[Insert Table 1 here - *Table 1. Characteristics of all participants on and off campus]*

[Insert Table 2 here - *Table 2. Awareness of HIV-related knowledge]*

Stratified analysis of HIV infection

A total of 2,049 (68.2%) YMSM had ever been tested for HIV, including 895 students and 1,154 non-students (Table 3). The overall HIV infection rate in the study was 8.1%, with a statistically higher prevalence amongst non-student YMSM (10.3%) compared to student YMSM (5.3%), ($\chi 2_{trend}$ = 17.34, P<0.001).

The HIV infection rate among student YMSM and non-student YMSM was significantly different by sexual orientation (χ^2 = 15.55, P<0.001), risk perception of HIV infection (χ^2 = 19.65, P<0.001), unprotected, insertive sexual intercourse ever in lifetime (χ^2 = 13.47, P<0.001), sex partners (χ^2 = 7.56, P = 0.006; χ^2 = 10.18, P<0.001) and HIV testing in the past six months (χ^2 = 18.19, P<0.001).

[Insert Table 3 here - *Table 3. Stratified analysis of HIV infection.]*

Factors associated with HIV infection

As shown in Table 4, non-students (AOR = 2.12, 95%CI = 1.42–3.19, P<0.001), self-identifying as homosexual (AOR = 2.81, 95%CI = 1.40–5.66, P = 0.004) YMSM were at increased odds of being HIV positive. Those whom perceived the risk of HIV infection (AOR = 3.08, 95%CI = 1.33–7.15, P = 0.009) were also at increased odds of being HIV positive. Additionally, YMSM whom reported not always using condoms with sex partners in the past six months (AOR = 1.69, 95%CI = 1.17–2.44, P = 0.006) had higher odds of HIV infection. YMSM population whom reported never having unprotected insertive sexual intercourse in their lifetime had reduced odds of HIV infection (AOR = 0.16, 95%CI = 0.07–0.37, P<0.001).

[Insert Table 4 here - *Table 4. Factors associated with HIV infection.]*

Discussion

Men who have sex with men continue to be a high-risk group for HIV infection throughout China [20]. Previously, the epidemic was transmitted primarily through injection drug use; however, this has shifted drastically in recent years, where the primary mode of HIV infection in China is now sexual transmission [10]. Reducing high-risk

sexual behaviors, particularly among vulnerable populations such as men who have sex with men, is necessary if the disease burden is to be managed. While programs exist targeting adult MSM, little has been done in China to target youth-identifying MSM. This study serves as one of the first analyses aimed at identifying the population of YMSM and their associated risk factors of HIV infection in multiple regions in China. In this study, the HIV infection rate among all YMSM participants was 8.1%, which was higher than the prevalence among the general MSM population [9–11, 20] and the YMSM population reported in two previous studies [21,22]. More so, the HIV infection rate among non-student YMSM was significantly higher than that among student YMSM, which is consistent with previous research [13]. In China, HIV infections among youth have been on the rise. According to case reporting data, though young adults (15–24 years) made up 6% of all diagnosed HIV cases in 2018, they made up 11% of all new diagnoses in the same year (unpublished surveillance data). This is a notable challenge, highlighting the growing number of HIV infections among youth in China. The results of this study thus signify the ongoing threat of HIV amongst this key population and the need for innovative strategies to curtail potential on-going transmission of HIV in YMSM. Qualitative studies, which aim to understand the unique barriers of HIV care and treatment for YMSM should be explored in order to create optimal, targeted services for these students and non-students. To note, the HIV infection rate in this survey was collected via on-site HIV testing, but was self-reported by the YMSM participants. As such, the HIV prevalence estimate may be biased, resulting in an underestimation of the true HIV infection rate amongst YMSM, if they wished to conceal their HIV status due to fear of discrimination or stigma. Of concern however, is that these high rates of HIV reported amongst student and non-student YMSM signal a potential increase in transmission among MSM in China and in particular, a potential epidemic amongst YMSM. Follow up testing to confirm HIV status is needed in order to identify the true rates of HIV infection in this population. In this study, participants identifying as homosexual were at increased odds of being positive for HIV (Table 4). As previously discussed, MSM are more vulnerable to HIV infection and transmission and face structural, cultural, and psychological barriers when it comes to accessing HIV prevention and treatment services [4,5]. Coupled with a lack of age-specific HIV prevention and programming, young men who have sex with men are at increased risk of exposure to HIV, which if not addressed, could lead to continued transmission and an surge in new infections. Additionally, research has shown that youth lack sufficient knowledge regarding safe sexual practices and are more likely to engage in risk-taking sexual activity. Recent research has indicated that almost half of all college students received sexual education, which usually do not include discussions on HIV and sexually transmitted diseases prevention, nor homosexuality and HIV infection [23, 24] This was evident from out study, which found that although student and non-student YMSM had baseline knowledge of HIV, there were still a high proportion of YMSM engaging in high-risk sexual behaviors (e.g., inconsistently using condoms with sex partner and having multiple sexual partners). This suggests a dissonance between what is being taught and actual comprehension of risk factors amongst young students and non-students. Other studies have supported a similar inconsistency between cognition and sexual behaviors amongst MSM [25–26]. Current interventions may not be inclusive of YMSM and may not be designed specifically for the needs of YMSM. Integrating age and population specific education into school and non-school settings aimed at normalizing same-sex sexual behavior and reducing stigma may be warranted to reduce these high-risk sexual behaviors. This study had several limitations. First, there is possibility that the Blued APP users were not necessarily MSM, and as such, the representativeness of the sample may be limited, although efforts were made to recruit a diverse sample of YMSM in multiple cities from multiple venues. Second, since this was a cross-sectional study, causality could not be assessed. Further longitudinal studies could identify the on-going risks and current trends of HIV infection among young men who have sex with men. Third, the use of a questionnaire to assess sexual behaviors over the past six months may lead to recall bias. Moreover, because of stigma faced

by MSM in China, self-reported responses to questions related to sexual behavior and the results of the latest HIV test, in particular, might be subject to social desirability bias. An online questionnaire was used to reduce such social desirability bias, though it may not have been completely eliminated. Similarly, the HIV infection rate was a self reported indicator and may not represent the true prevalence amongst this group. The Blued APP is a common social networking tool among the MSM community throughout China, which has also been supportive of many public health interventions for MSM. The use of this APP, along with the support of local student associations, created a trusting environment for the participants, thus lessening this bias. Confirmatory testing however should be introduced in order to identify the true HIV positive rate amongst this group.

Conclusion

Men who have sex with men continue to be a high-risk group for HIV infection throughout China [20]. Previously, the epidemic was transmitted primarily through injection drug use; however, this has shifted drastically in recent years, where the primary mode of HIV infection in China is now sexual transmission [10]. Reducing high-risk sexual behaviors, particularly among vulnerable populations such as men who have sex with men, is necessary if the disease burden is to be managed. While programs exist targeting adult MSM, little has been done in China to target youth-identifying MSM. This study serves as one of the first analyses aimed at identifying the population of YMSM and their associated risk factors of HIV infection in multiple regions in China. In this study, the HIV infection rate among all YMSM participants was 8.1%, which was higher than the prevalence among the general MSM population [9–11, 20] and the YMSM population reported in two previous studies [21,22]. More so, the HIV infection rate among non-student YMSM was significantly higher than that among student YMSM, which is consistent with previous research [13]. In China, HIV infections among youth have been on the rise. According to case reporting data, though young adults (15–24 years) made up 6% of all diagnosed HIV cases in 2018, they made up 11% of all new diagnoses in the same year (unpublished surveillance data). This is a notable challenge, highlighting the growing number of HIV infections among youth in China. The results of this study thus signify the ongoing threat of HIV amongst this key population and the need for innovative strategies to curtail potential on-going transmission of HIV in YMSM. Qualitative studies, which aim to understand the unique barriers of HIV care and treatment for YMSM should be explored in order to create optimal, targeted services for these students and non-students. To note, the HIV infection rate in this survey was collected via on-site HIV testing, but was self-reported by the YMSM participants. As such, the HIV prevalence estimate may be biased, resulting in an underestimation of the true HIV infection rate amongst YMSM, if they wished to conceal their HIV status due to fear of discrimination or stigma. Of concern however, is that these high rates of HIV reported amongst student and non-student YMSM signal a potential increase in transmission among MSM in China and in particular, a potential epidemic amongst YMSM. Follow up testing to confirm HIV status is needed in order to identify the true rates of HIV infection in this population. In this study, participants identifying as homosexual were at increased odds of being positive for HIV (Table 4). As previously discussed, MSM are more vulnerable to HIV infection and transmission and face structural, cultural, and psychological barriers when it comes to accessing HIV prevention and treatment services [4,5]. Coupled with a lack of age-specific HIV prevention and programming, young men who have sex with men are at increased risk of exposure to HIV, which if not addressed, could lead to continued transmission and an surge in new infections. Additionally, research has shown that youth lack sufficient knowledge regarding safe sexual practices and are more likely to engage in risk-taking sexual activity. Recent research has indicated that almost half of all college students received sexual education, which usually do not include discussions on HIV and sexually transmitted diseases prevention, nor homosexuality and HIV infection

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Abbreviations

HIV: human immunodeficiency virus

AIDS: acquired immune deficiency syndrome

MSM: men who have sex with men

YMSM: young men who have sex with men

App: application

China CDC: Chinese Center for Disease Control

AOR: adjusted odds ratio

CI: confidence interval

STD: sexually transmitted disease

NGO: non-governmental organization

Declarations

*Ethics approval and consent to participate:*This study received approval from the Institutional Review Board of the National Center for AIDS/STD Control & Prevention, China CDC.

Consent for Publication: All participants included in the study provided informed consent

Availability of data and material: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests: The authors declare that they have no competing interests.

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Author Contributions: JW conducted data analysis, contributed to results interpretation, and wrote the first draft of manuscript. ZC designed the questionnaire, made the electronic questionnaire. FY assisted in data arrangement and data analysis. YX assisted in data analysis. YM contributed to questionnaire design, conducted the delivery of questionnaire. GJ contributed to questionnaire design, collected the data.GM designed the study, contributed to questionnaire design, assisted in data analysis and results interpretation. SS assisted in writing the first draft of manuscript and revising the manuscript. ZW designed the study, supervised data analysis, contributed to results interpretation, and revised the manuscript. All authors read and approved the final manuscript.

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Tables

Table 1. Characteristics of all participants on and off campus. Characteristics of the entire study population, the student YMSM and non-student YMSM.

Variables	All participants [N=3,004] n (%)	Students [N=1,390] n (%)	Non-students [N=1,614] n (%)	$\chi 2$	*P-value*
Sexual orientation				0.10	0.756
Non-homosexual	606 (20.2)	277 (19.9)	329 (20.4)		
Homosexual	2,398 (79.8)	1,113 (80.1)	1,285 (79.6)		
Relationship status				1.07	0.301
Single	2,107 (70.1)	962 (69.2)	1,145 (70.9)		
Not single	897 (29.9)	428 (30.8)	469 (29.1)		
Perceived risk of HIV infection				0.89	0.344
No	483 (16.1)	214 (15.4)	269 (16.7)		
Yes	2,521 (83.9)	1,176 (84.6)	1,345 (83.3)		
Willingness to communicate with people living with HIV				0.39	0.821
Willing	1,805 (60.1)	830 (59.7)	975 (60.4)		
Unwilling/unsure	1,199 (39.9)	560 (40.3)	639 (39.6)		
HIV-related knowledge				7.15	0.007
<80	1,308 (43.5)	569 (40.9)	739 (45.8)		
≥80	1,696 (56.5)	821 (59.1)	875 (54.2)		
Unprotected insertive sexual intercourse ever in lifetime				43.43	<0.001
Yes	2,067 (68.8)	873 (62.8)	1,194 (74.0)		
No	937 (31.2)	517 (37.2)	420 (26.0)		
Number of sex partners in the past 6 months				20.72	<0.001
0	476 (15.8)	220 (15.8)	256 (15.9)		
1	1,167 (38.8)	597 (42.9)	570 (35.3)		
≥2	1,361 (45.3)	573 (41.2)	788 (48.8)		
Condoms use with sex partners in the past 6 months				9.04	0.003
Always	1,693 (67.0)	819 (70.0)	874 (64.4)		
Not always	835 (33.0)	351 (30.0)	484 (35.6)		
Missing (No sex partners in the past 6 months)	476	—	—		
Have you ever had HIV testing?				17.42	<0.001
Ever in lifetime	2,049 (68.2)	895 (64.4)	1,154 (71.5)		
Never in lifetime	955 (31.8)	495 (35.6)	460 (28.5)		
Have you ever had HIV testing in the past 6 months?				1.13	0.288
Yes	1,476 (72.0)	634 (70.8)	842 (73.0)		
No	573 (28.0)	261 (29.2)	312 (27.0)		
Missing (never in lifetime)	955	—	—		
Where did you most often do the HIV testing?				3.56	0.314
Hospital/Community health service center/CDC	1,067 (52.1)	448 (50.1)	619 (53.6)		
NGOs	262 (12.8)	126 (14.1)	136 (11.8)		
Self-testing	702 (34.3)	313 (35.0)	389 (33.7)		
Other ways	18 (0.8)	8 (0.8)	10 (0.9)		
Missing (never in lifetime)	955	—	—		

CDC: Chinese Centre for Disease Control; NGOs: Non-Governmental Organizations; HIV: human immunodeficiency virus.

Table 2. Awareness of HIV-related knowledge. Awareness of HIV-related knowledge for the entire population, student YMSM, and non-student YMSM were assessed using 10 HIV-related questions.

HIV-related knowledge	Total		Students		Non-students		*P-value*
	correct n (%)	error/unknown n (%)	correct n (%)	error/unknown n (%)	correct n (%)	error/unknown n (%)	
a) Is it possible to judge from the appearance whether a person is infected with HIV?	2,617 (87.1)	387 (12.9)	1,260 (90.6)	130 (9.4)	1,357 (84.1)	257 (15.9)	<0.001
b) Is it possible to become infected with HIV by eating with people living with HIV?	2,870 (95.5)	134 (4.5)	1,348 (97.0)	42 (3.0)	1,522 (94.3)	92 (5.7)	<0.001
c) Does the use of new drugs (such as crystal meth and ecstasy) increase the risk of HIV infection?	2,503 (83.3)	501 (16.7)	1,175 (84.5)	215 (15.5)	1,328 (82.3)	286 (17.7)	0.099
d) Will mosquito bites spread AIDS?	2,498 (83.2)	506 (16.8)	1,188 (85.5)	202 (14.5)	1,310 (81.2)	304 (18.8)	0.002
e) Do other STDs increase the risk of HIV infection?	1,942 (64.6)	1,062 (35.4)	853 (61.4)	537 (38.6)	1,089 (67.5)	525 (32.5)	<0.001
f) Which of the following bodily fluids of HIV-infected people are contagious? (Blood, semen, prostatic fluid)	1,367 (45.5)	1,637 (54.5)	661 (47.6)	729 (52.4)	706 (43.7)	908 (56.3)	0.036
g) Which of the following behaviors can effectively reduce the risk of HIV infection? (have regular sex partner, take post-exposure prophylaxis, have HIV testing regularly)	2,054 (68.4)	950 (31.6)	1,019 (73.3)	371 (26.7)	1,035 (64.1)	579 (35.9)	<0.001
h) After the occurrence of high-risk sexual behavior, how many hours can one not exceed to adopt PEP?	1,087 (36.2)	1,917 (63.8)	544 (39.1)	846 (60.9)	543 (33.6)	1,071 (66.4)	0.002
i) Do you need immediate treatment if you are confirmed positive for HIV?	2,978 (99.1)	26 (0.9)	1,383 (99.5)	7 (0.5)	1,595 (98.8)	19 (1.2)	0.047
j) Does one need to bear legal liability if he spread HIV virus to others intentionally?	2,838 (94.5)	166 (5.5)	1,325 (95.3)	65 (4.7)	1,513 (93.7)	101 (6.3)	0.059
Overall score	75.75±16.05		77.38±14.65		74.34±17.03		

HIV: human immunodeficiency virus; AIDS: Acquired Immune Deficiency Syndrome; STDs: sexually transmitted diseases; PEP: Post Exposure Prophylaxis.

Table 3. Stratified analysis of HIV infection. The HIV infection rate between student YMSM and non-student YMSM.

Variables	Students			Non-students			$\chi 2$	*P-value*
	Participants who have had HIV testing in lifetime	HIV positive	Infection rate (%)	Participants who have had HIV testing in lifetime	HIV positive	Infection rate (%)		
Total	895	47	5.3	1,154	119	10.3	17.34	<0.001
Sexual orientation								
Non-homosexual	150	3	2.0	200	10	5.0	2.16	0.142
Homosexual	745	44	5.9	954	109	11.4	15.55	<0.001
Relationship status								
Single	598	31	5.2	802	85	10.6	13.22	<0.001
Not single	297	16	5.4	352	34	9.7	4.13	0.042
Perceived the risk of HIV infection								
No	128	3	2.3	181	3	1.7	0.19	0.667
Yes	767	44	5.7	973	116	11.9	19.65	<0.001
HIV-related knowledge								
<80	301	8	2.7	456	45	9.9	14.48	<0.001
≥80	594	39	6.6	698	74	10.6	6.55	0.01
Unprotected insertive sexual intercourse ever in lifetime								
Yes	587	42	7.2	877	116	13.2	13.47	<0.001
No	308	5	1.6	277	3	1.1	0.32	0.574
Number of sex partners in the past 6 months								
0	123	12	9.8	169	20	11.8	0.32	0.575
1	361	13	3.6	393	33	8.4	7.56	0.006
≥2	411	22	5.4	592	66	11.1	10.18	0.001
Condoms use with sex partners in the past 6 months								
Always	555	16	2.9	656	49	7.5	12.45	<0.001
Not always	217	19	8.8	329	50	15.2	4.92	0.027
Missing (No sex partners in the past 6 months)	123			169				
Have you ever had HIV testing in the past 6 months?								
Yes	634	28	4.4	842	88	10.5	18.19	<0.001
No	261	19	7.3	312	31	9.9	1.26	0.262

HIV: human immunodeficiency virus.

Table 4. Factors associated with HIV infection. HIV infection and factors associated with HIV infection assessed by univariate and multivariate logistic regression modeling.

Variables	Participants who have had HIV testing in lifetime N	HIV positive N	Unadjusted		Adjusted	
			OR (95%CI)	*P-value*	OR (95%CI)	*P-value*
Occupation						
Students	895	47	1.00		1.00	
Non-students	1,154	119	2.07 (1.46-2.94)	<0.001	2.12 (1.42-3.19)	<0.001
Sexual orientation						
Non-homosexual	350	13	1.00		1.00	
Homosexual	1,699	153	2.57 (1.44-4.57)	0.001	2.81 (1.40-5.66)	0.004
Relationship status						
Single	1,400	116	1.00			
Not single	649	50	0.92 (0.65-1.31)	0.654		
Perceived risk of HIV infection						
No	309	6	1.00		1.00	
Yes	1,740	160	5.11 (2.24-11.66)	<0.001	3.08 (1.33-7.15)	0.009
HIV-related knowledge						
<80	757	53	1.00			
≥80	1,292	113	1.27 (0.91-1.79)	0.163		
Unprotected insertive sexual intercourse ever in lifetime						
Yes	1,464	158	1.00		1.00	
No	585	8	0.12 (0.06-0.24)	<0.001	0.16 (0.07-0.37)	<0.001
Number of sex partners in the past 6 months						
0	292	32	1.00			
1	754	46	0.53 (0.33-0.85)	0.008	1.00	
≥2	1,003	88	0.78 (0.51-1.20)	0.258	1.37 (0.94-2.01)	0.105
Condoms use with sex partners in the past 6 months						
Always	1,211	65	1.00		1.00	
Not always	546	69	2.55 (1.79-3.64)	<0.001	1.69 (1.17-2.44)	0.006
Missing (No sex partners in the past 6 months)	292	—				

95% CI: 95% confidence interval, P<0.05; HIV: human immunodeficiency virus.