AIDS Behav (2013) 17:2395–2404
DOI 10.1007/s10461-012-0334-7

ORIGINAL PAPER

Prevalence and Correlates of HIV Infection and Unrecognized HIV Status Among Men Who Have Sex with Men and Women in Chengdu and Guangzhou, China

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Published online: 17 October 2012

Abstract To know the status of HIV infection and the correlates for HIV infection among MSMW in China. This research examined the risks for HIV in 600 MSMW in Chengdu and Guangzhou, China. Participants completed a structured behavioral risk survey and were tested for HIV status. Overall, 26.2 % ($n = 157$) of the sample were HIV-positive, and 7 % ($n = 41$) were newly diagnosed and previously unaware of their HIV-positive status. Independent correlates of new HIV infection were Chengdu residence, being currently married, and sometimes using condoms during anal intercourse. Compared with previously diagnosed participants, newly diagnosed participants were more likely to have unprotected sex in the anal and vaginal sexes. Given the high risk for HIV in MSMW in these Chinese cities, public health interventions are needed to promote frequent HIV testing and to address sexual risk behaviors with both male and female partners.

Keywords China · MSMW · HIV · Unprotected sex

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Introduction

Epidemiological studies in China have demonstrated a growing trend in HIV infection among men who have sex with men (MSM) [1, 2]. According to the Chinese Ministry of Health, by the end of 2009 MSM accounted for 14.7 % of the estimated 740,000 cumulative HIV cases in China [2]. Between 2007 and 2009, the proportion of newly diagnosed HIV cases attributable to MSM behavior increased from 12.2 to 32.5 % [1, 2]. Rising HIV prevalence in samples of MSM have been observed in several major cities including Beijing (an increase from 0.4 % in 2004 to 5.2 % in 2006), Chongqing (an increase from 10.4 % in 2006 to 12.5 % in 2007), and Chengdu (an increase from 1.06 % in 2004 to 11.2 % in 2008) [3–5]. A 2008 survey conducted in 61 cities in China revealed 5.0 % HIV prevalence among MSM [2]. A review of 94 articles found that the HIV prevalence among MSM in China has increased from 1.4 % in 2001 to 5.3 % in 2009 [6]. The number of new HIV infections attributable to MSM behavior has surpassed the number of infections due to injection drug use, leading to a greater prioritization of HIV prevention and testing among MSM populations in China in recent years [1].

Bisexual behavior is frequently reported in studies of Chinese MSM. Cultural beliefs in China emphasize marriage and traditional family structures, and MSM may experience great pressures to marry and to have children [7–9]. Consequently, many MSM have female partners

(wives, girlfriends) yet engage in sex with other men. Men who have sex with men and women (MSMW) might operate as a bridge population for transmission of HIV and other STIs. A review of 33 articles on MSM in China indicated that these men frequently were married and had engaged in concurrent sexual relationships with both men and women [10]. Previous study conducted across four cities in China documented that HIV prevalence was higher among married MSM (8.8 %) compared with unmarried MSM (6.0 %) [11], and that the rates of unprotected sex were significantly higher among currently married MSM than non-married MSM [12]. A meta-analysis of HIV risk behavior surveys conducted in China estimated an overall 31.2 % prevalence of bisexual behavior among MSM in China; MSMW had a 30 % greater odds of HIV infection compared with MSM [13].

In addition to having unprotected anal sex with men, unprotected vaginal sex has been frequently reported in studies of Chinese MSMW [14–16]. Indeed, research conducted in settings outside of China has indicated that MSMW are less likely to use condoms with female partners than with male partners [17, 18]. Furthermore, research has suggested that MSMW might be less likely to use HIV prevention or testing services than MSM [19–21]. MSMW who are unaware of their HIV status might place their female and male partners at greater risk.

Although previous studies of Chinese MSM have included measures of heterosexual behavior, few known studies have explicitly targeted Chinese MSMW as a population of interest. This paper reports findings from a survey of MSMW recruited from two cities in southern China: Chengdu in Southwest China and Guangzhou in Southeast China. Chengdu is the largest city in Sichuan province, notable for its proximity to opium trafficking routes from Thailand, Laos, and Burma which facilitated an earlier HIV epidemic among IDUs in neighboring Yunnan province [22, 23]. Guangzhou is the largest city in Guandong province, notable for its rapid economic growth. It has a relatively tolerant multicultural environment, job opportunities and a large population of MSM [24], which had contributed to attracts MSM from all over China. Moreover, the health centers in both Chengdu and Guangzhou had successful experiences in conducting AIDS related prevention programs among MSM population. Given these advantages, both cities provide compelling environments and conditions for studying HIV risk in MSMW.

The aims of this paper were to (1) estimate the prevalence of HIV infection in MSMW in Chengdu and Guangzhou; (2) examine the related factors for new HIV infection; (3) compare the differences on sociodemographic and sexual behaviors between unrecognized and recognized HIV-positive MSMW. Findings from this paper can offer an important step forward in developing HIV prevention interventions for MSMW in China.

Methods

Participants

From July 2010 to February 2011, 300 participants were recruited using snowball sampling in Chengdu and Guangzhou, respectively (total sample = 600). Eligibility criteria were men who were 18 years or older; who had anal sex with another man in the past 12 months; and who had vaginal sex with a woman in the past 12 months or who were currently married to a woman. Surveys were conducted in a private room at collaborating non-governmental organizations (NGOs) that worked with MSM populations in both cities (Chengdu Tongle Consulting Center and Guangzhou Xiaoqi solutions). Due to the hard-to-reach and secretive nature of the population, as well as an absence of a population sampling frame, we used snowball sampling to recruit participants. Initial "seed" participants were identified through contacts provided by NGO staff members. Each initial seed was invited to participate in the research study and then each seed provided study referrals to other men in their networks who were screened for eligibility and invited to participate if eligible. All subsequent participants were asked to refer other MSMW to the study. Recruitment continued until 300 participants were enrolled at each city.

Procedures

Study procedures were approved by the Anhui Medical University IRB. After confirming their eligibility and providing informed consent, participants completed behavioral surveys which were administered verbally by a staff member trained in survey implementation procedures (e.g., minimizing social desirability, minimizing incomplete data, maximizing fidelity). Participants were then tested for HIV by a medical doctor from the local CDC using two sequentially using two rapid tests to screen for HIV antibodies (RT-1, Shanghai Kehua Biotechnology Co., Ltd., Shanghai, China; RT-2, Hangzhou ACON Biotechnology Cl., Ltd., Hangzhou China). An enzyme-linked immunosorbent assay was used to retest for HIV antibodies (ELISA; Shanghai Kehua Biotechnology Co., Ltd., Shanghai China) and a western blot immune assay (WB; Singapore MP Biomedical Asia Pacific Ltd Singapore, Singapore) was used for HIV-1/2a confirmation. If the first rapid test was negative, the participant's HIV status was negative. Otherwise the participant would receive the second rapid test. If the second rapid test was also positive, the participants would receive a Western Blot immune assay. If the second rapid test was negative, the participants would receive an enzyme-linked immunosorbent assay. If the result of ELISA was negative, then we can make sure

this participant was HIV-negative. If the result of ELISA was positive, the participant would finally receive a WB assay to make sure the status of HIV. If participants had previously been diagnosed as HIV-positive, we will confirmed their HIV status in the AIDS network information system(a national database maintained by the CDC), and if they had previously tested positive, these individuals were not re-tested, but they received standardized risk reduction AIDS counseling. Participants who underwent testing received standard pre- and post-test HIV along with their HIV test results. Pre-test counseling focused on the national/local HIV epidemic, risk behaviors, and the HIV test process. Post-test counseling focused on the result of HIV testing and behavioral risk reduction strategies. Participants who tested positive were immediately referred to treatment and care services in CDC. All participants received 50 RMB for participating in the survey.

Measures

The questionnaire included social demographic characteristics (age, education, marital status, possession of a residence card, sexual orientation, etc.); sexual behavior with male partners during the past 6 months (number of male partners, anal sex with boyfriend [defined as a primary partner with whom the participant has a strong affection], anal sex with primary male partner[defined as any male partner with whom the participant had usually sex with but without strong affection], anal sex with a casual partner, anal sex with a commercial male partner, frequency of condom use, condom use in the last 3 anal sex episodes, condom use during in the last anal sex episode); and sexual behavior with female partners during the past 12 months (vaginal sex with wife, vaginal sex with girlfriend, vaginal sex with casual female partner, vaginal sex with commercial female partner, frequency of condom use, condom use in the last 3 vaginal sex episodes, condom use in the last vaginal sex episode). The recall period of 6 months window for male partners is consistent with previous studies conducted among MSM. We used different (12 months) recall period for female compared with male partners because prior studies of MSM in China indicated that a low volume of heterosexual behaviors during past 6 months [9, 12].

Analysis

Descriptive results were tabulated, and associations between HIV-status, participant characteristics, and sexual behaviors were examined using Chi-square tests. Differences in sexual behaviors according to HIV-status were examined two ways. First, we examined differences between newly diagnosed HIV-positive participants versus HIV-negative participants. Second, we examined differences among HIV-positive participants by comparing those who were newly diagnosed as HIV-positive (and, consequently, who were unaware of their status) versus those who were already aware of their HIV-positive status prior to the study. Independent correlates of newly diagnosed HIV-positive were assessed using multiple logistic regressions. All analyses were conducted using Statistical Product and Service Solution 10.01 (SPSS Inc Chicago, IL).

Results

Participant Characteristics

Sociodemographic data are presented in Table 1. The average age was 34.3 years (SD = 9.5). Approximately two-thirds (62.5 %) were currently married. The majority (58.3 %) did not have a residence card, indicating they were undocumented migrants. More than half of participants (57 %) had a high school/vocational school education or less. Approximately three-fourths of the participants (75.2 %) earned less than 4000 Chinese RMB (roughly $630 USD) monthly. Half of the participants (50 %) identified themselves as bisexual, 42.3 % identified themselves as homosexual, and 7.7 % identified themselves as heterosexual or unsure.

Overall, 26.2 % ($n = 157$) of the sample were HIV positive which included 39 (13 %) HIV positive in Guangzhou and 118 (39.3 %) HIV-positive in Chengdu. Of those who were HIV-positive, 26.1 % ($n = 41$) were newly diagnosed in this study (8.5 % of the 484 participants who had not previously tested positive before our study). The prevalence of new HIV diagnosis in Guangzhou and Chengdu was 3.0 % (8/269) and 15.3 % (33/215), respectively.

The Factors Associated with New HIV Infection

The association of new HIV infection of participants with demographic characters was shown in Table 1. In the univariate analysis, among participants only living in Chengdu and lower monthly income were significantly associated with HIV infection. The association of new HIV infection of participants with sexual behavior and condom use in the past 6 or 12 months was shown in Table 2. In the univariate analysis there were no variables associated with new HIV infection.

Table 3 showed the outcome of multivariate logistic regression. We included seven variables (age, marital status, city, education level, monthly income, the number of

Table 1 Sociodemographic characteristics among 600 MSMW and the association of unrecognized HIV infection of 484 MSMW with sociodemographic characteristics ($N1 = 484$)

Variables	N (%)	Unrecognized HIV+		
		$N1$ (%)	n ($n/N1$ %)	p value
Age group (years)				0.17
18–25	117 (19.5)	97 (20.0)	7 (7.2)	
26–35	231 (38.5)	190 (39.3)	12 (6.3)	
36–45	188 (31.3)	146 (30.2)	14 (9.6)	
>45	64 (10.7)	51 (10.5)	8 (15.7)	
Marital status				0.17
Currently married	375 (62.5)	294 (60.7)	29 (9.9)	
Single	225 (37.5)	190 (39.3)	12 (6.3)	
Have a Chengdu or Guangzhou residence card				
Yes	250 (41.7)	183 (37.8)	18 (9.8)	0.40
No	350 (58.3)	301 (62.2)	23 (7.6)	
City				<0.01
Guangzhou	300 (50.0)	269 (55.6)	8 (3.0)	
Chengdu	300 (50.0)	215 (44.4)	33 (15.3)	
Education level completed				0.11
Junior high school or less	123 (20.5)	90 (18.6)	11 (12.2)	
High school or vocational school	216 (36.0)	181 (37.4)	18 (9.9)	
College/university or higher	261 (43.5)	213 (44.0)	12 (5.6)	
Monthly income (RMB)				<0.01
<1000	49 (8.2)	41 (8.5)	8 (19.5)	
1000–1999	148 (24.7)	101 (20.9)	13 (12.9)	
2000–3999	254 (42.3)	208 (43.0)	15 (7.2)	
>4000	149 (24.8)	134 (27.7)	5 (3.7)	
Sexual orientation identity				0.97
Homosexual	254 (42.3)	190 (39.3)	16 (8.4)	
Bisexual	300 (50.0)	254 (52.5)	22 (8.7)	
Heterosexual/ Undecided	46 (7.7)	40 (8.3)	3 (7.5)	

male anal sexual partners, and frequency of condom use in anal sex) whose p value <0.2 in the univariate analysis into multivariate logistic regression. The results showed that the risky factors associated with new HIV infection included living in Chengdu (vs. Guangzhou, OR = 9.03, 95 % confidence interval [CI]) = 3.93–20.77), having been married (OR = 2.57, 95 % CI = 1.21–5.47), during past 6 months sometimes using condoms in the anal sex (vs. always using condom, OR = 3.40, 95 % CI = 1.48–7.80).

Sexual Behaviors

Sexual behaviors with male partners in the past 6 months are shown in Table 2. The majority (90.8 %) of participants had anal sex with a man in the past 6 months, and 72.8 % had anal sex with more than two men in the past 6 months. One quarter (24.5 %) had anal sex with a boyfriend, 30.0 % had anal sex with a primary male partner, 59.2 % had anal sex with a casual male partner, and 10.8 % had anal sex with a commercial male partner during the past 6 months. About half (46.6 %) had anal sex without a condom during the past 6 months, and over one-quarter (27.8 %) had unprotected anal sex during their last sexual episode with a man.

Sexual behaviors with female partners during the past 12 months are also shown in Table 2. Overall, 86.0 % of participants had vaginal sex with a woman in the past 12 months: half (49.5 %) had vaginal sex with a wife, 28.5 % with a girlfriend, 12.7 % with a casual female partner, and 4.5 % with a commercial female partner. More than half (54.2 %) had vaginal sex without a condom during the past 12 months, 43.8 % reported not using use a condom during their last vaginal sex episode, and 36.5 % did not use a condom during their last three vaginal sex episodes.

The Differences on the Sociodemographic Characteristics and Sexual Behaviors between Unrecognized HIV-Positive and Recognized HIV-Positive

The differences on the sociodemographic characteristics and sexual behaviors between unrecognized HIV-positive and recognized HIV-positive were reported in Table 4. There were no significant differences on the sociodemograhpic characteristics between unrecognized and recognized HIV-positive. Interesting differences in sexual behaviors were found between HIV-positive participants who were unaware of their status versus those who already knew their HIV status (see Table 4). HIV-positive participants who were unaware of their status were more likely than participants who were previously diagnosed to never use condoms with male partners during the past 6 months (22 vs. 4.3 %), $\chi^2 = 17.32$, $p < 0.05$; not use condoms during last anal sex episode with a male partner (34.1 vs. 17.2 %), $\chi^2 = 6.65$, $p < 0.05$; never use condoms with female partners during the past 12 months (46.3 vs. 12.9 %), $\chi^2 = 19.96$, $p < 0.05$; not use condoms during the last three vaginal sex episodes with a female partner (46.3 vs. 12.1 %), $\chi^2 = 22.78$, $p < 0.05$; and not use condoms during the last vaginal sex episode with a female partner (46.3 vs. 20.7 %), $\chi^2 = 10.03$, $p < 0.05$.

Table 2 Sexual behaviors and condom use among 600 MSMW and the association of unrecognized HIV infection among 484 MSMW with sexual behaviors and condom use

Variables	*N* (%)	Unrecognized HIV+		
		*N*1 (%)	*n* (*n*/*N*1 %)	*p* value
Sexual behavior with male partners, past 6 months				
Anal sex with male				0.54
Yes	545 (90.8)	438 (90.5)	36 (8.2)	
No	55 (9.2)	46 (9.5)	5 (10.9)	
The number of male anal sexual partners				0.06
≤1	163 (27.2)	138 (28.5)	13 (9.4)	
2∼4	269 (44.8)	219 (45.2)	12 (5.5)	
≥5	168 (28.0)	127 (26.2)	16 (12.6)	
Engaged in anal sex with boyfriend				0.35
Yes	147 (24.5)	124 (25.6)	8 (6.5)	
No	453 (75.5)	360 (74.4)	33 (9.2)	
Engaged in anal sex with primary male partner				0.70
Yes	180 (30.0)	141 (29.1)	13 (9.2)	
No	420 (70.0)	343 (70.9)	28 (8.2)	
Engaged in anal sex with casual partner(s)				0.75
Yes	355 (59.2)	283 (58.5)	23 (8.1)	
No	245 (40.8)	201 (41.5)	18 (9.0)	
Engaged in anal sex with commercial partner(s)				0.26
Yes	65 (10.8)	48 (9.9)	2 (4.2)	
No	535 (89.2)	436 (90.1)	39 (8.9)	
Frequency of condom use in anal sex				0.08
Never	47 (7.8)	42 (8.7)	4 (9.5)	
Sometimes	233 (38.8)	200 (41.3)	23 (11.5)	
Always	265 (44.2)	196 (40.5)	9 (4.6)	
No anal sex	55 (9.2)	46 (9.5)	5 (10.9)	
Condom use in the last three anal sex episodes				0.84
None	81 (13.5)	71 (14.7)	8 (11.3)	
Once	65 (10.8)	53 (11.0)	4 (7.5)	
Twice	85 (14.2)	77 (15.9)	6 (7.8)	
Three times	314 (52.3)	237 (49.0)	18 (7.6)	
No anal sex	55 (9.2)	46 (9.5)	5 (10.9)	
Condom use in the last anal sex				0.65
Yes	378 (63.0)	291 (60.1)	22 (7.6)	
No	167 (27.8)	147 (30.4)	14 (9.5)	
No anal sex	55 (9.2)	46 (9.5)	5 (10.9)	
Sexual behaviors with female partners, past 12 months				
Vaginal intercourse				0.90
Yes	516 (86.0)	422 (87.2)	36 (8.5)	
No	84 (14.0)	62 (12.8)	5 (8.1)	
Vaginal intercourse with wife				0.38
Yes	297 (49.5)	240 (49.6)	23 (9.6)	
No	303 (50.5)	244 (50.4)	18 (7.4)	
Vaginal intercourse with girlfriend				0.82
Yes	171 (28.5)	149 (30.8)	12 (8.1)	
No	429 (71.5)	335 (69.2)	29 (8.7)	
Vaginal intercourse with casual female sexual partners				0.65
Yes	76 (12.7)	58 (12.0)	4 (6.9)	
No	524 (87.3)	426 (88.0)	37 (8.7)	

Table 2 continued

Variables	*N* (%)	Unrecognized HIV+		
		*N*1 (%)	*n* (*n*/*N*1 %)	*p* value
Vaginal intercourse with commercial female sexual partners				0.44
Yes	27 (4.5)	24 (5.0)	1 (4.2)	
No	573 (95.5)	460 (95.0)	40 (8.7)	
Frequency of condom use in vaginal intercourse				0.46
Never	198 (33.0)	183 (37.8)	19 (10.4)	
Sometimes	127 (21.2)	102 (21.1)	5 (4.9)	
Always	191 (31.8)	137 (28.3)	12 (8.8)	
No vaginal intercourse	84 (14.0)	62 (12.8)	5 (8.1)	
Condom use in the last three vaginal intercourse episodes				0.92
None	219 (36.5)	205 (42.4)	19 (9.3)	
Once	36 (6.0)	25 (5.2)	1 (4.0)	
Twice	38 (6.3)	31 (6.4)	3 (9.7)	
Three times	223 (37.2)	161 (33.3)	13 (8.1)	
No vaginal intercourse	84 (14.0)	62 (12.8)	5 (8.1)	
Condom use in the last vaginal intercourse				0.88
Yes	253 (42.2)	183 (37.8)	17 (9.3)	
No	263 (43.8)	239 (49.4)	19 (7.9)	
No vaginal intercourse	84 (14.0)	62 (12.8)	5 (8.1)	

Discussion

This research study brings attention to MSMW in China as a group with potentially high risk for HIV that might contribute to disease transmission within and between populations in China. Overall, 26 % of this MSMW sample was HIV positive and over one-fourth of these HIV-positive individuals were previously unaware of their status. Except 116 recognized HIV-positive before our survey the new HIV diagnosis among 484 MSMW was 8.5 % which was lower than that (16.1 %) in the survey of 366 MSMW in Chongqing [25]. The prevalence of new HIV diagnosis was 3.0 and 15.3 % in Guangzhou and Chengdu, respectively. A cross-sectional survey in 2007 in Chengdu found that the HIV prevalence is 9.1 % among 538 men who have sex with men [26]. Xu et al [27] found that in 2008 HIV prevalence in Chengdu among MSM was 11.1 %. Therefore, we can see that the HIV prevalence among MSMW in Chengdu was higher than that among MSM. However, the HIV prevalence in Guangzhou among MSMW was lower than that (5.7 %) found in 2010 [28].

In present study, we found the related factors for new HIV infection, such as living in Chengdu, currently being married and not consistently using condoms in anal sexes. MSMW who were living in Chengdu were more likely to be HIV infected than that living in Guangzhou, which was consistent with the HIV prevalence among MSM in Chengdu and Guangzhou [26–28]. Moreover, MSMW who had been currently married to a woman were more likely to be HIV-positive indicating complexity in their sexual networks as well as a potential for transmission of HIV and other infectious diseases between MSM and heterosexual networks. Compared with consistently using condoms, MSMW who only sometimes used condoms in anal sexes during past 6 months were more likely to be infected with HIV. Therefore improved efforts are urgently needed to test Chinese MSMW for HIV, refer them to treatment if needed, and counsel them to reduce sexual risk behavior with both male and female partners.

Table 3 Logistic regression: independent correlates of new HIV infection

Variable	*B*	Wald	*p* value	OR	95 % CI
City					
Guangzhou				1.0	
Chengdu	2.20	26.828	<0.01	9.03	3.93–20.77
Marital status					
Single				1.0	
Currently married	0.95	6.06	0.01	2.57	1.21–5.47
Frequency of condom use in anal sex					
Always				1.0	
Sometimes	1.22	8.37	<0.01	3.40	1.48–7.80
Never	0.84	1.62	0.20	2.31	0.64–8.41
No anal sex	1.15	3.48	0.06	3.16	0.94–10.57

Table 4 Comparison on sociodemographic characteristics and sexual behaviors between unrecognized and known HIV positive MSMW ($N = 157$)

Variables	N (%)	Unrecognized HIV+ ($N1 = 41$) $n1$ ($n1/N1$ %)	Known HIV+ ($N2 = 116$) $n2$ ($n2/N2$ %)	p value
Age group (years)				0.60
18–25	27 (17.2)	7 (17.1)	20 (17.2)	
26–35	53 (33.8)	12 (29.3)	41 (35.3)	
36–45	56 (35.7)	14 (34.1)	42 (36.2)	
>45	21 (13.4)	8 (19.5)	13 (11.2)	
Marital status				0.91
Currently married	110 (70.1)	29 (70.7)	81 (69.8)	
Single	47 (29.9)	12 (29.3)	35 (30.2)	
Have a Chengdu or Guangzhou residence card				0.13
Yes	85 (54.1)	18 (43.9)	67 (57.8)	
No	72 (45.9)	23 (56.1)	49 (42.2)	
City				0.36
Guangzhou	39 (24.8)	8 (19.5)	31 (26.7)	
Chengdu	118 (75.2)	33 (80.5)	85 (73.3)	
Education level completed				0.24
Junior high school or less	44 (28.0)	11 (26.8)	33 (28.4)	
High school or vocational school	53 (33.8)	18 (43.9)	35 (30.2)	
College/university or higher	60 (38.2)	12 (29.3)	48 (41.4)	
Monthly income (RMB)				0.14
<1000	16 (10.2)	8 (19.5)	8 (6.9)	
1000–1999	60 (38.2)	13 (31.7)	47 (40.5)	
2000–3999	61 (38.9)	15 (36.6)	46 (39.7)	
>4000	20 (12.7)	5 (12.2)	15 (12.9)	
Sexual orientation identity				0.20
Homosexual	80 (51.0)	16 (39.0)	64 (55.2)	
Bisexual	68 (43.3)	22 (53.7)	46 (39.7)	
Heterosexual/Undecided	9 (5.7)	3 (7.3)	6 (5.2)	
Sexual behavior with male partners, past 6 months				
Anal sex with male				0.39
Yes	143 (91.1)	36 (87.8)	107 (92.2)	
No	14 (8.9)	5 (12.2)	9 (7.8)	
The number of male anal sexual partners				0.24
≤1	38 (24.2)	13 (31.7)	25 (21.6)	
2∼4	62 (39.5)	12 (29.3)	50 (43.1)	
≥5	57 (36.3)	16 (39.0)	41 (35.3)	
Engaged in anal sex with boyfriend				0.97
Yes	31 (19.7)	8 (19.5)	23 (19.8)	
No	126 (80.3)	33 (80.5)	93 (80.2)	
Engaged in anal sex with primary male partner				0.82
Yes	52 (33.1)	13 (31.7)	39 (33.6)	
No	105 (66.9)	28 (68.3)	77 (66.4)	
Engaged in anal sex with casual partner(s)				0.50
Yes	95 (60.5)	23 (56.1)	72 (62.1)	
No	62 (39.5)	18 (43.9)	44 (37.9)	
Engaged in anal sex with commercial partner(s)				0.10
Yes	19 (12.1)	2 (4.9)	17 (14.7)	
No	138 (87.9)	39 (95.1)	99 (85.3)	

Table 4 continued

Variables	*N* (%)	Unrecognized HIV+ (*N*1 = 41) *n*1 (*n*1/*N*1 %)	Known HIV+ (*N*2 = 116) *n*2 (*n*2/*N*2 %)	*p* value
Frequency of condom use in anal sex				<0.01
Never	9 (5.7)	9 (22.0)	5 (4.3)	
Sometimes	56 (35.7)	4 (9.8)	33 (28.4)	
Always	78 (49.7)	23 (56.1)	69 (59.5)	
No anal sex	14 (8.9)	5 (12.2)	9 (7.8)	
Condom use in the last three anal sex episodes	18 (11.5)	8 (19.5)	10 (8.6)	0.08
None	16 (10.2)	4 (9.8)	12 (10.3)	
Once	14 (8.9)	6 (14.6)	8 (6.9)	
Twice	95 (60.5)	18 (43.9)	77 (66.4)	
Three times	14 (8.9)	5 (12.2)	9 (7.8)	
No anal sex				
Condom use in the last anal sex	109 (69.4)	22 (53.7)	87 (75.0)	0.04
Yes	34 (21.7)	14 (34.1)	20 (17.2)	
No	14 (8.9)	5 (12.2)	9 (7.8)	
No anal sex				
Sexual behaviors with female partners, past 12 months				
Vaginal intercourse				0.32
Yes	130 (82.8)	36 (87.8)	94 (81.0)	
No	27 (17.2)	5 (12.2)	22 (19.0)	
Vaginal intercourse with wife				0.44
Yes	80 (51.0)	23 (56.1)	57 (49.1)	
No	77 (49.0)	18 (43.9)	59 (50.9)	
Vaginal intercourse with girlfriend				0.17
Yes	34 (21.7)	12 (29.3)	22 (19.0)	
No	123 (78.3)	29 (70.7)	94 (81.0)	
Vaginal intercourse with casual female sexual partners				0.36
Yes	22 (14.0)	4 (9.8)	18 (15.5)	
No	135 (86.0)	37 (90.2)	98 (84.5)	
Vaginal intercourse with commercial female sexual partners				0.96
Yes	4 (2.5)	1 (2.4)	3 (2.6)	
No	153 (97.5)	40 (97.6)	113 (97.4)	
Frequency of condom use in vaginal intercourse				<0.01
Never	34 (21.7)	19 (46.3)	15 (12.9)	
Sometimes	30 (19.1)	5 (12.2)	25 (21.6)	
Always	66 (42.0)	12 (29.3)	54 (46.6)	
No vaginal intercourse	27 (17.2)	5 (12.2)	22 (19.0)	
Condom use in the last three vaginal intercourse episodes				<0.01
None	33 (21.0)	19 (46.3)	14 (12.1)	
Once	12 (7.6)	1 (2.4)	11 (9.5)	
Twice	10 (6.4)	3 (7.3)	7 (6.0)	
Three times	75 (47.8)	13 (31.7)	62 (53.4)	
No vaginal intercourse	27 (17.2)	5 (12.2)	22 (19.0)	
Condom use in the last vaginal intercourse				0.01
Yes	87 (55.4)	17 (41.5)	70 (60.3)	
No	43 (27.4)	19 (46.3)	24 (20.7)	
No vaginal intercourse	27 (17.2)	5 (12.2)	22 (19.0)	

There were no significant differences on the sociodemographic characteristics between the known and unrecognized HIV-positive MSMW, as well as the number and the type of male and female sexual partners. This indicates that MSMW who already knew their HIV-positive still had complex sexual networks. However, we found that there were enormous differences on the condom use during sexual behaviors between these two groups of participants. It is clearly to find that HIV-positive MSMW were significantly more likely than HIV-negative MSMW to report using a condom in anal and vaginal intercourse. This finding may reflect that HIV-positive MSMW who were already aware of their status may have been using risk-reduction strategies to prevent transmission to their male and female partners. Indeed, we found greater levels of unprotected anal and vaginal sex among those HIV-positive men who were unaware of their status compared with men who were previously diagnosed. This might suggest that previously diagnosed HIV-positive men were strategically using condoms to minimize transmission to their male and female partners. Efforts to promote sexual risk reduction in HIV-positive MSMW are critical to reduce heterosexual bridging of HIV and other sexually transmitted infections.

Over half (59 %) of MSMW in this sample were currently married and 29 % had a girlfriend. It is likely that the men in this study were engaging in same-sex behavior without the awareness of their female partners. We know very little about the female partners of MSMW, their level of knowledge and understanding of their male partner's MSM activity, and their comprehension about their personal risk for HIV and other STIs. Efforts are needed to learn more about the female partners of MSMW and design strategies for including them in HIV prevention and testing activities in China.

In addition to HIV testing and prevention interventions, programs to improve the social contexts for MSM in China are also warranted. Previous studies have claimed that many Chinese MSM enter into heterosexual partnerships due to cultural norms that encourage traditional marriage and that stigmatize homosexual behaviors and identities [7–9]. To promote the holistic health and well-being of Chinese men who are sexually and emotionally attracted to men, interventions can challenge homophobic stigma, internalized homophobia, and heterosexism in order to validate men's sexual orientations and preferences. Such efforts might, by extension, reduce the risk to women who might unknowingly have male partners that engage in secretive same-sex behavior. Although long-held traditional beliefs in China about sexuality may be hard to change, many urban settings in China are undergoing rapid development and cultural transition which present opportunities for promoting the sexual, social, and psychological health of MSM.

There are several limitations to this research. First, due to the hard-to-reach nature of the population, we used convenience sampling based on chain-referrals, which limits the generalizability of the findings. It introduced that the specific population subgroups were under-represented in the sample, such as MSMW who do not affiliate themselves with the larger MSM/MSMW communities or who have very clandestine social and sexual networks. Indeed, almost half of the men in our sample attained university education, indicating that the sample was highly educated compared with the general population. Sampling biases—which might have over-represented MSMW who are more open about their sexual behaviors, more educated, and more closely networked with other MSM/MSMW and with use of NGO services—might have contributed to higher estimates of HIV-positive status and risk behaviors. Second, the cross-sectional design does not allow for interpretations about temporality or causality. Third, detailed assessment of other risk behaviors, social factors, and partnership characteristics were not included in the survey due to time constraints. Further studies are needed to learn more about the general health and social risks of MSMW, and qualitative methodologies might be particularly useful to obtain in-depth narratives. Fourth, social desirability biases might have affected accuracy in reporting, especially in this cultural context where issues of pride and appropriateness are valued.

In summary, this study supports the necessity and feasibility of studying HIV among MSMW in China. As previous research has shown, behavioral bisexuality is common in China as elsewhere in the developing world [13–16]. Recent studies have estimated that approximately 2–4 % of males in China may be homosexual [29]—which equates to a conservative estimate of 9.6 million adult MSM in China—and that 30 % of these MSM might also have sex with women—which equates to an estimated 2.9 million MSMW in China. This is a potentially large risk group, and the female and male partners of these MSMW might also experience vulnerability for HIV and other STIs. As mentioned, recruitment of MSMW for this study relied on convenience sampling using personal referrals; additional efforts are needed to recruit extremely hidden and secretive MSMW into HIV prevention and testing services because these men might not be closely networked into more open MSM/MSMW subgroups. Given the complex sexual networks and relationship dynamics that might distinguish MSMW from other MSM, innovative public health strategies are needed to reach these men and address their unique health and social vulnerabilities that contribute to HIV transmission.

Acknowledgments This work was supported by Chinese Center for Disease Control and Prevention, AIDS Applied Research Project grant No. 2010146. We would like to thank Delin Han from Center

for Disease Control of Chengdu and Liping Dai from Center for Disease Control of Yuexiu district in Guangzhou for their aid in HIV testing, as well as MSM volunteers from Chengdu Tongle Consulting Center and Guangzhou Xiaoqi culture spread company for their aid in the data collection and HIV testing during our research.

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