Associated factors for HIV and syphilis infection among men who have sex with men only and men who have sex with both men and women in cities of China

M She, H Zhang, J Wang, J Xu, Z Zhang, Y Fan, Y Sun and C Zhang

Int J STD AIDS 2013 24: 293 originally published online 19 June 2013
DOI: 10.1177/0956462412472820

ORIGINAL RESEARCH ARTICLE

Associated factors for HIV and syphilis infection among men who have sex with men only and men who have sex with both men and women in cities of China

M She MD*, **H Zhang** MD*, **J Wang** PhD*, **J Xu** PhD†, **Z Zhang** MD*, **Y Fan** PhD*, **Y Sun** PhD* and **C Zhang** MD*

*School of Public Health, Anhui Medical University, 81 Meishan Road, Hefei 230032, Anhui Province; †National Center for AIDS/STD Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing 102206, People's Republic of China

Summary: The aims of this paper were to find out the status of HIV and syphilis infection and to examine the sexual behaviours between men who have sex with men only (MSM/M) and men who have sex with both men and women (MSM/W), as well as to determine the correlates for HIV and syphilis infection among MSM/M and MSM/W, respectively. Among 1693 MSM who participated in the study, the proportions of MSM/M and MSM/W were 82.1% and 17.9%, respectively. The prevalences of HIV infection were 7.0% in MSM/M and 6.6% in MSM/W and the prevalences of syphilis infection were 11.9% and 13.2%, respectively. Among the MSM/M subset, the correlates both for HIV and syphilis infection included having more sexual partners, and being receptive or both insertive and receptive for anal sex. Among the MSM/W subset, living in Chengdu was associated with HIV infection and using condoms inconsistently during anal sex was associated with syphilis infection. The findings of this survey call for interventions tailored according to the needs of different subsets of MSM.

Keywords: HIV, AIDS, sexually transmitted infections, men who have sex with men, MSM, bisexual men, syphilis, risk factors, China

INTRODUCTION

Previous studies show that HIV infection among men who have sex with men (MSM) increased rapidly in recent years in some Asian countries. In Thailand, the prevalence of HIV infection among MSM increased from 17.3% in 2003 to 30.8% in 2007.[1] HIV diagnoses in the Philippines have increased by 114% and 214%, respectively, among bisexual and homosexual men from 2003–2008.[2] In China, several epidemiological studies among MSM have demonstrated an increase in HIV infection in recent years.[3–5] The Chinese Ministry of Health estimated that by the end of 2009, MSM accounted for 14.7% of the 740,000 cumulative HIV cases in China.[5] During 2005–2009, the proportion of newly-reported HIV cases attributed to MSM behaviour increased from 0.3% to 8.6%, and the proportion of the estimated newly-acquired HIV occurring in MSM increased from 12.2% in 2007 to 32.5% in 2009.[3,5] Rising prevalence of HIV in samples of MSM populations has been reported in some of the largest cities, including Beijing (from 0.4% in 2004 to 5.8% in 2006), Chengdu (from 1.1% in 2004 to 8.0% in 2007) and Chongqing (from 10.4% in 2006 to 15.8% in 2008).[6–8] In a survey from 2008 to 2009 conducted in 61 cities of China, average HIV prevalence among MSM reached up to 5.0%, and in some southwest cities, including Guiyang, Kunming, Chongqing and Chengdu, HIV prevalence was higher than 10% among MSM.[5]

Some studies have shown that syphilis prevalence among MSM was also high and rising in China. One survey found that syphilis prevalence was 8.4% from 2006 to 2007 in Chongqing, and another survey revealed that syphilis prevalence was 28.1% among MSM in 2007 in Chengdu.[9,10] The studies found that syphilis prevalence increased from 4.5% in 2004 to 12.4% in 2005 and 19.8% in 2007 among MSM in Beijing.[6,11]

Homosexual and bisexual behaviours were frequently reported in studies among Chinese MSM. A previous review has shown that approximately 2–5% of the adult male population is homosexual;[12] this gives an estimate of more than 10 million MSM in China. MSM in China may experience great pressures to marry women and have children due to the emphasis of marriage and traditional family structure within Chinese culture.[13–15] A previous study reported that 78.4% of MSM had sex with men only (MSM/M), and 21.6% had sex with both men and women (MSM/W) in the past six months in Chongqing.[16] In all, 39.5% of MSM had sex with male and female partners in four cities in Shandong province,[17] and 17.9% of MSM had wives in Guangzhou.[18] A meta-analysis of HIV risk behaviour in China showed that 31.2% of Chinese MSM engaged in bisexual behaviour, and these MSM/W were more likely to acquire HIV infection than MSM only.[19] A study across four cities in China showed that the proportion

Correspondence to: H Zhang
Email: zhb62@yahoo.com.cn

of unprotected anal sex (including insertive and receptive) with men was higher in married than unmarried MSM, and the proportions of unprotected vaginal sex were 82.8% and 65.6% among married and unmarried MSM, respectively.[20] A survey of 1000 participants of MSM in a city of China found that 47.3% never used condoms, and 30.5% used condoms sometimes when having sex with women during the past six months.[21] A high proportion of engaging in bisexual behaviour and low rates of condom use among MSM/W, therefore, might act as a bridging population for transmitting HIV and other sexually transmitted infections (STIs) to their female partners in China.

The epidemic of HIV and other STIs among MSM has attracted increasing attention in China. However, few studies have targeted MSM/M and MSM/W. This study conducted a cross-sectional survey from April to August in 2008 in four large cities of China to determine the prevalence of HIV and syphilis infection and high-risk sexual behaviours and to examine the risk factors associated with HIV and syphilis infection among MSM/M and MSM/W.

METHODS

Study sites

This study was conducted among MSM in four urban cities of China: Beijing, Harbin, Zhengzhou and Chengdu. Beijing is the capital of China (MSM sex is the dominant mode of HIV transmission). Harbin, Zhengzhou and Chengdu are the capitals of Heilongjiang (where sex behaviour including heterosexual and MSM sex were the dominant modes of HIV transmission), Henan (where illegal blood plasma donation was the dominant mode of HIV transmission) and Sichuan province (where injection drug use was the dominant mode of HIV transmission), respectively. They are located in the northeast, middle and southwest of China, respectively.

Participants

Cross-sectional studies were conducted among MSM in Beijing, Harbin, Zhengzhou and Chengdu during April–August 2008. Eligibility criteria of participants were men who lived in the study cities, were 18 years or older and had anal sex with another man in the past six months. Participants were recruited using snowball sampling by CDC and non-governmental organizations (NGOs) that worked with MSM populations in Beijing, Harbin, Zhengzhou and Chengdu. After the introduction of explaining the study purpose and obtaining informed consent, structured questionnaire-based interviews were administered by the health professional in a single private room. The information was collected anonymously and remained confidential. Initial 'seed' participants were recruited by NGO volunteers from MSM venues and were identified by CDC staff with a screening form. 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 MSM to the study.

Measures

The questionnaire included sociodemographic characteristics (age, possession of a residence card, education, monthly income and sexual orientation); sexual behaviour during the past six months (the number of male partners, usual anal sex positioning, frequency of condom use for anal sex, vaginal sex with female partners, frequency of condom use for vaginal sex), the types of sexual partner (including boyfriend, steady male sexual partners, casual male sexual partners and commercial male sexual partners) and the place for searching for sexual partner (including gay bar/tea bar/clubhouse, bath/sauna/pedicure/massage, public park/restrooms/greensward, through Internet and daily activity places). The study was approved by the China CDC Institutional Review Board.

Laboratory testing

Blood samples were collected from all eligible participants for HIV and syphilis testing. Two rapid tests were used to screen HIV antibody (RT-1, Shanghai Kehua Biotechnology Co. Ltd, Shanghai, China; RT-2, Hangzhou ACON Biotechnology Co. Ltd, Hangzhou, China). An enzyme-linked immunosorbent assay was used to retest for HIV antibody (ELISA, Shanghai Kehua Biotechnology Co. Ltd) and a Western blot immune assay (WB, Singapore MP Biomedical Asia Pacific Ltd, Singapore, Singapore) was used for HIV-1/2a confirmation. Syphilis infection was tested by rapid plasma reagin (RPR, Shanghai Kehua Biotechnology Co. Ltd) and a Passive Particle Agglutination Test for detection of antibodies to *Treponema pallidum* (TPPA, Singapore MP Biomedical Asia Pacific Ltd).

Analysis

EpiData 3.0 (The EpiData Association, Odense, Denmark) software was used to input the original data and Statistical Product and Service Solution 10.0 (SPSS Inc., Chicago, IL, USA) was used to analyse the data. Descriptive analyses were conducted to describe the demographic characteristics and the prevalences of HIV and syphilis. Fitting unconditional logistic regression was applied for univariate and multivariate analysis of related factors for HIV and syphilis infection among MSM/M and MSM/W, respectively.

RESULTS

MSM/M and MSM/W sample characteristics and HIV and syphilis infection

A total of 1693 participants were enrolled in the study: 463 (33.3%), 335 (24.1%), 308 (22.2%) and 284 (20.4%) participants in Beijing, Chengdu, Harbin and Zhengzhou, respectively. Of all participants, 82.1% (1390) only had anal sex with men (MSM/M) and 17.9% (303) both had anal sex with men and vaginal sex with women (MSM/W) during the past six months. Average age of MSM/W was older than MSM/M (28.3 ± 8.6 versus 31.4 ± 8.7 years, $t = -5.65$, $P < 0.05$). The proportions of MSM/W who identified themselves as bisexual orientation and homosexual orientation were 64.0% and 27.7%, respectively, while those of MSM/M were 20.5% and 76.2%, ($P < 0.01$). More MSM/M had completed college or higher education (50.2%) than MSM/W (32.7%) ($P < 0.01$) and MSM/M monthly earnings were lower than those of MSM/W ($P < 0.01$) (Table 1).

Overall, the HIV and syphilis prevalences of participants were 6.9% and 12.2%, respectively. The HIV prevalence was 7.0% (97/1390) and 6.6% (20/303) among MSM/M and

Table 1 **Characteristics and HIV/syphilis infection between MSM/M and MSM/W**

Characteristic	MSM/M (*N* = 1390) *n* (%)	MSM/W (*N* = 303) *n* (%)	χ^2	*P* value
Age group (years)				
18–24	587 (42.2)	82 (27.1)	42.944	<0.001
25–34	537 (38.6)	115 (38.0)		
≥35	266 (19.1)	106 (35.0)		
Education level				
Junior high school or less	235 (16.9)	91 (30.0)	39.964	<0.001
High school or vocational	457 (32.9)	113 (37.3)		
College or higher	698 (50.2)	99 (32.7)		
Monthly income (RMB)				
No income	307 (22.1)	32 (10.6)	21.396	<0.001
≤1000	195 (14.0)	43 (14.2)		
1001–3000	650 (46.8)	166 (54.8)		
≥3001	238 (17.1)	62 (20.5)		
Sexual orientation identity				
Homosexual	1059 (76.2)	84 (27.7)	270.196	<0.001
Bisexual	285 (20.5)	194 (64.0)		
Heterosexual	10 (0.7)	9 (3.0)		
Undecided	36 (2.6)	16 (5.3)		
HIV infected	97 (7.0)	20 (6.6)	0.055	0.814
Syphilis infected	166 (11.9)	40 (13.2)	0.369	0.544

MSM/M = men who have sex with men only; MSM/W = men who have sex with both men and women; RMB = renminbi

MSM/W, respectively, while syphilis was diagnosed in 11.9% (166/1390) and 13.2% (40/303), respectively. The prevalences of HIV and syphilis infection were not different significantly between MSM/M and MSM/W (Table 1).

Sexual behaviours and condom use among MSM/M and MSM/W participants

MSM/M and MSM/W who had six or more sexual partners accounted for 16.9% and 28.7%, respectively ($P < 0.01$). MSM/M were more likely to have steady male sexual partners than MSM/W (67.9% versus 49.2%, $P < 0.01$), while MSM/W were more likely to have commercial male sexual partners than MSM/M (20.5% versus 9.9%, $P < 0.01$). Compared with MSM/M, MSM/W were more likely to find sexual partners in gay bar/clubhouse (22.4% versus 15.4%, $P < 0.01$), bathhouse/sauna/massage (31.0% versus 16.9%, $P < 0.01$), and home party/school/workplace (27.8% versus 16.8%, $P < 0.01$), while MSM/M were more likely to find sexual partners through the Internet (62.1% versus 37.3%, $P < 0.01$). During anal sex with men, MSM/M were more likely to act as receptive partner only than MSM/W (17.6% versus 6.9%, $P < 0.01$), while MSM/W were more likely to act as insertive partner only than MSM/M (33.7% versus 25.4%, $P < 0.01$). The proportion of inconsistent condom use during anal sex with men was 54.0% among MSM/M and 54.8% among MSM/W ($P > 0.05$). Of MSM/W participants, 68.6% used condoms inconsistently during vaginal sex with women (Table 2).

Independent factors associated with HIV infection among MSM/M and MSM/W

Bivariate logistic regressions were conducted to examine risk factors of HIV status (dependent variable = HIV positive versus negative; $n = 1390$ of MSM/M and 303 of MSM/W, respectively.). Among MSM/M, living in Chengdu (OR = 2.58), migrant status (OR = 1.91), having six or more sexual partners in the past six months (versus 1–5 sexual partners, OR = 2.01), searching for sex partners in bathhouse/sauna/massage during the past six months (OR = 2.93), acting as receptive or both receptive and insertive partner during anal sex (versus insertive only, OR = 2.25 and 2.63, respectively), and syphilis infection (OR = 2.84) were positively associated with HIV infection, while educational level and monthly income were negatively associated with HIV infection (Table 3). Among MSM/W, only living in Chengdu (versus Beijing, OR = 4.47) was associated with increased risk of HIV infection.

In the multivariate unconditional logistic regression analysis, living in Chengdu (versus Beijing, OR = 2.70), searching for sex partners in bathhouse/sauna in the past six months (OR = 3.61), receptive or both receptive and insertive anal sex position (versus insertive only, OR = 2.33 and 2.42, respectively), and syphilis infection (OR = 2.90) were significantly associated with HIV infection. Among MSM/W, living in Chengdu (versus Beijing, OR = 4.47) was significantly associated with HIV infection (Table 3).

Independent factors associated with syphilis infection among MSM/M and MSM/W

Bivariate logistic regressions were conducted to examine risk factors of syphilis status (dependent variable = syphilis positive versus negative; $n = 1390$ of MSM/M and 303 of MSM/W, respectively). In univariate logistic analysis, independent correlated factors for syphilis infection are shown in Table 4. Among MSM/M, living in Harbin (versus Beijing, OR = 1.57), older than 34 years (versus 18–24 years, OR = 2.18), having six or more sexual partners during the past six months (versus 1–5 sexual partners, OR = 1.81), searching for sex partner in bathhouse/sauna/massage during the past six months (OR = 1.68) and in public park/restrooms/greensward (OR = 2.27), receptive or both receptive and insertive anal sex position (versus insertive only, OR = 2.10 and 1.92, respectively), having used condoms inconsistently during anal sex in the past six months (OR = 1.55), and HIV infection (OR = 2.84) were positively associated with syphilis infection. While searching for sex partner through Internet (OR = 0.67), educational level (college or higher versus Junior high school or less, OR = 0.38), monthly income (higher than 3000 versus no income, OR = 0.51) were negatively associated with syphilis infection. Among MSM/W, having used condoms inconsistently during anal sex in the past six months (OR = 2.12) were positively related with syphilis status.

In the multivariate unconditional logistic regression analysis, living in Harbin (versus Beijing, OR = 1.75), having six or more sexual partners during the past six months (versus 1–5 sexual partners, OR = 1.68), having commercial male sexual partners (OR = 0.48), searching for sex partner in public park/restrooms/greensward (OR = 2.06), receptive or both receptive and insertive anal sex position (versus insertive only, OR = 2.11 and 1.84, respectively), having used condoms inconsistently during anal sex in the past six months (OR = 1.54), and HIV infection (OR = 2.75) were positively associated with syphilis infection among MSM/M, while having commercial male sexual partners (OR = 0.48) was negatively associated with

Table 2 **Sexual behaviours and condom use among MSM/M and MSM/W**

Characteristic	MSM (*N* = 1390) *n* (%)	MSM/W (*N* = 303) *n* (%)	χ^2	*P* value
Had sexual partners in the past 6 months				
Total number of sexual partners				
1–5	1155 (83.1)	216 (71.3)	22.514	<0.001
6+	235 (16.9)	87 (28.7)		
Had steady male sexual partners	938 (67.5)	149 (49.2)	36.279	<0.001
Had casual male sexual partners	727 (52.3)	168 (55.4)	0.986	0.321
Had commercial male sexual partners	138 (9.9)	62 (20.5)	26.498	<0.001
Searched for sexual partners in the past 6 months				
Seeking sexual partners in gay bar/tea bar/clubhouse	214 (15.4)	68 (22.4)	8.898	0.003
Seeking sexual partners in bathhouse/sauna/massage	235 (16.9)	94 (31.0)	31.664	<0.001
Seeking sexual partners at gay corner of park/toilet/grassland	212 (15.3)	60 (19.8)	3.820	0.051
Seeking sexual partners through Internet	863 (62.1)	113 (37.3)	62.631	<0.001
Seeking sexual partners at home party/school/workplace	233 (16.8)	84 (27.8)	19.904	<0.001
Usual anal sex position with men				
Insertive	353 (25.4)	102 (33.7)	8.653	0.003
Receptive	245 (17.6)	21 (6.9)	21.488	<0.001
Both	792 (57.0)	180 (59.4)	0.600	0.439
Condom use in the past 6 months				
Condom used in the last anal sex episodes with men	1013 (72.9)	205 (67.7)	3.359	0.067
Condom use when had anal sex with men:				
Never	120 (8.6)	31 (10.2)	0.782	0.676
Sometimes	630 (45.3)	135 (44.6)		
Always	640 (46.0)	137 (45.2)		
Condom used in the last vaginal sex episodes with women	–	120 (39.6)	–	
Condom use when had vaginal sex with women:				
Never	–	136 (44.9)	–	
Sometimes	–	72 (23.8)	–	
Always	–	95 (31.4)	–	

MSM/M = men who have sex with men only; MSM/W = men who have sex with both men and women

syphilis infection. Having six or more sexual partners during the past six months (versus 1–5 sexual partners, OR = 2.41), having used condoms inconsistently during vaginal sex with female partners in the past six months (OR = 2.22) were positively related with syphilis infection among MSM/W, while searching for sex partners in gay bar/tea bar/clubhouse in the past six months (OR = 0.36) was negatively related with syphilis infection (Table 4).

DISCUSSION

Studies in recent years have indicated that HIV and syphilis infection have increased dramatically in China.[6–8] Owing to differences in sexual behaviours between subsets of MSM/M and MSM/W, this study examines the prevalence and correlates of HIV and syphilis infection among MSM/W and MSM/M, as well as the roles MSM/M and MSM/W play in HIV and syphilis transmission between MSM and their female sexual partners.

Findings of the present study indicate that the prevalence of HIV and syphilis infections has reached high levels in cities of China. The HIV-positive participants among MSM/M and MSM/W accounted for 7.0% and 6.6%, respectively, and syphilis prevalences were 11.9% and 13.2%, respectively. The rates of HIV and syphilis infections among MSM/M and MSM/W were significantly different in the four cities: HIV prevalence was highest in Chengdu and syphilis prevalence was highest in Harbin. Findings of the study call for further intervention programmes targeted towards subgroups of MSM/M and MSM/W to prevent the spread of HIV and syphilis.

The present study also found differences in sociodemographic characteristics and sexual behaviours between MSM/M and MSM/W. MSM/W were older, had less education and earned more than MSM/M. The proportion of bisexual identification among MSM/W was higher than that of MSM/M, which is inconsistent with studies conducted in Chongqing, China and Bangkok, Thailand.[16,22] Compared with MSM/M, MSM/W were less likely to have steady male sexual partners, and more likely to have commercial male sexual partners and find sexual partners in gay bars/tea bars/clubhouses and bathhouses/saunas/massages.

In general, findings of the study also showed that multiple sexual partners and unprotected sexual behaviours among MSM/M and MSM/W played vital roles for HIV and syphilis transmission within MSM and between MSM and their female sexual partners. During the past six months, 16.9% of MSM/M had 6 or more sexual partners and 52.3% had casual male sexual partners. Furthermore, 54.0% had not consistently used condoms for anal sex with men. This evidence demonstrates that having multiple sexual partners with inconsistent condom use is a potential risk for HIV or other STIs. Among MSM/W, over half (55.4%) had casual male sexual partners, and more than a quarter (28.7%) had six or more sexual partners. In addition, 54.8% and 68.6% of MSM/W had used condoms inconsistently in anal sex with men and vaginal sex with women, respectively, which implied that high-risk bisexual behaviour increased HIV spread not only among MSM but also among the general population.

Furthermore, the present study found that the correlates of HIV infection among MSM/M and MSM/W may be

Table 3 **Factors associated with HIV infection among MSM/M and MSM/W**

Characteristic	MSM/M Total *N* (%)	MSM/M HIV+ *n* (*n*/*N*%)	MSM/M Univariate OR 95% CI	MSM/M Multivariate OR 90% CI	MSM/W Total *N* (%)	MSM/W HIV+ *n* (*n*/*N*%)	MSM/W Univariate OR 95% CI	MSM/W Multivariate OR 90% CI
Overall	1390 (100)	97 (7.0)			303 (100)	20 (6.6)		
Study city								
Beijing	463 (33.3)	25 (5.4)	Ref	Ref	70 (23.1)	3 (4.3)	Ref	Ref
Chengdu	335 (24.1)	43 (12.8)	2.58 (1.54–4.32)***	2.70 (1.71–4.25)***	60 (19.8)	10 (16.7)	4.47 (1.17–17.08)**	4.47 (1.45–13.77)**
Harbin	308 (22.2)	14 (4.5)	0.83 (0.43–1.63)	0.55 (0.30–1.01)	70 (23.1)	3 (4.3)	1.00 (0.20–5.13)	1.00 (0.25–3.95)
Zhengzhou	284 (20.4)	15 (5.3)	0.98 (0.51–1.89)	0.61 (0.34–1.11)	103 (34.0)	4 (3.9)	0.90 (0.20–4.16)	0.90 (0.25–3.26)
Residency								
Local	585 (42.1)	33 (5.6)	Ref		111 (36.6)	7 (6.3)	Ref	
Other city in the same province	332 (23.9)	34 (10.2)	1.91 (1.16–3.14)**		96 (31.7)	7 (7.3)	1.17 (0.40–3.46)	
Other province	473 (34.0)	30 (6.3)	1.131 (0.68–1.89)		96 (31.7)	6 (6.3)	0.99 (0.32–3.06)	
Education level								
Junior high school or less	235 (16.9)	22 (9.4)	Ref		91 (30.0)	4 (4.4)	Ref	
High school or Vocational	457 (32.9)	39 (8.5)	0.90 (0.52–1.56)		113 (37.3)	10 (8.8)	2.11 (0.64–6.97)	
College or higher	698 (50.2)	36 (5.2)	0.53 (0.30–0.92)**		99 (32.7)	6 (6.1)	1.40 (0.38–5.14)	
Monthly income (RMB)								
No income	307 (22.1)	22 (7.2)	Ref		32 (10.6)	1 (3.1)	Ref	
≤1000	195 (14.0)	21 (10.8)	1.56 (0.84–2.93)		43 (14.2)	4 (9.3)	3.18 (0.34–29.91)	
1001–3000	650 (46.8)	47 (7.2)	1.01 (0.60–1.71)		166 (54.8)	12 (7.2)	2.42 (0.30–19.26)	
≥3001	238 (17.1)	7 (2.9)	0.39 (0.17–0.94)**		62 (20.5)	3 (4.8)	1.58 (0.16–15.79)	
Total number of sexual partners in the past 6 months								
1–5	1155 (83.1)	70 (6.1)	Ref		216 (71.3)	16 (7.4)	Ref	
6+	235 (16.9)	27 (11.5)	2.01 (1.26–3.21)***		87 (28.7)	4 (4.6)	0.60 (0.20–1.86)	
Search for sexual partners in bath/sauna in the past 6 months								
No	1155 (83.1)	63 (5.5)	Ref		209 (69.0)	14 (6.7)	Ref	
Yes	235 (16.9)	34 (14.5)	2.93 (1.88–4.57)***	3.61 (2.40–5.43)***	94 (31.0)	6 (6.4)	0.95 (0.35–2.55)	
Usual anal sex position in the past 6 months								
Insertive	353 (25.4)	12 (3.4)	Ref		102 (33.7)	7 (6.9)		
Receptive	245 (17.6)	18 (7.3)	2.25 (1.07–4.77)**	2.33 (1.22–4.47)**	21 (6.9)	2 (9.5)	1.43 (0.28–7.42)	
Both	792 (57.0)	67 (8.5)	2.63 (1.40–4.92)***	2.42 (1.40–4.18)***	180 (59.4)	11 (6.1)	0.88 (0.33–2.36)	
Syphilis antibody								
Negative	1224 (88.1)	72 (5.9)	Ref		263 (86.8)	16 (6.1)	Ref	
Positive	166 (11.9)	25 (15.1)	2.84 (1.74–4.62)***	2.90 (1.88–4.47)***	40 (13.2)	4 (10.0)	1.72 (0.54–5.42)	

MSM/M = men who have sex with men only; MSM/W = men who have sex with both men and women; OR = odds ratio; CI, confidence interval; RMB = renminbi
*$P < 0.10$, **$P < 0.05$, ***$P \leq 0.01$

Table 4 **Associated factors for syphilis infection among MSM/M and MSM/W**

Characteristic	MSM/M				MSM/W			
	Total *N* (%)	Syphilis+ *n* (*n*/*N*%)	Univariate OR 95% CI	Multivariate OR 90% CI	Total *N* (%)	Syphilis+ *n* (*n*/*N*%)	Univariate OR 95% CI	Multivariate OR 90% CI
Overall	1390	166 (11.9)			303	40 (13.2)		
Study location								
Beijing	463 (33.3)	54 (11.7)	Ref	Ref	70 (23.1)	11 (15.7)	Ref	
Chengdu	335 (24.1)	30 (9.0)	0.75 (0.47–1.19)	0.78 (0.51–1.20)	60 (19.8)	4 (6.7)	0.38 (0.12–1.27)	
Harbin	308 (22.2)	53 (17.2)	1.57 (1.05–2.37)**	1.75 (1.21–2.52)**	70 (23.1)	15 (21.4)	1.46 (0.62–3.46)	
Zhengzhou	284 (20.4)	29 (10.2)	0.86 (0.53–1.39)	0.91 (0.59–1.40)	103 (34.0)	10 (9.7)	0.58 (0.23–1.44)	
Age group (years)								
18–24	587 (42.2)	55 (9.4)	Ref		82 (27.0)	11 (13.4)	Ref	
25–34	537 (38.6)	62 (11.5)	1.26 (0.86–1.85)		115 (38.0)	8 (7.0)	0.48 (0.19–1.26)	
35+	266 (19.2)	49 (18.4)	2.18 (1.44–3.31)***		106 (35.0)	21 (19.8)	1.60 (0.72–3.53)	
Education level								
Junior high school or less	235 (16.9)	45 (19.1)	Ref		91 (30.0)	10 (11.0)	Ref	
High school or vocational	457 (32.9)	63 (13.8)	0.68 (0.44–1.03)		113 (37.3)	20 (17.7)	1.74 (0.77–3.94)	
College or higher	698 (50.2)	58 (8.3)	0.38 (0.25–0.58)***		99 (32.7)	10 (10.1)	0.91 (0.36–2.30)	
Monthly income (RMB)								
No income	307 (22.1)	36 (11.7)	Ref		32 (10.6)	2 (6.3)	Ref	
≤1000	195 (14.0)	27 (13.8)	1.21 (0.71–2.07)		43 (14.2)	7 (16.3)	2.92 (0.56–15.10)	
1001–3000	650 (46.8)	88 (13.5)	1.18 (0.78–1.78)		166 (54.8)	23 (13.9)	2.41 (0.54–10.79)	
≥3001	238 (17.1)	15 (6.3)	0.51 (0.27–0.95)**		62 (20.5)	8 (12.9)	2.22 (0.44–11.15)	
Total number of sexual partners in the past 6 months								
1–5	1155 (83.1)	124 (10.7)	Ref	Ref	216 (71.3)	24 (11.1)	Ref	
6+	235 (16.9)	42 (17.9)	1.81 (1.24–2.65)***	1.68 (1.19–2.38)**	87 (28.7)	16 (18.4)	1.80 (0.91–3.59)	2.41 (1.30–4.46)**
Had commercial sexual partners in the past 6 months								
No	1252 (90.1)	155 (12.4)	Ref	Ref	241 (79.5)	34 (14.1)	Ref	
Yes	138 (9.9)	11 (8.0)	0.61 (0.32–1.16)	0.48 (0.27–0.84)**	62 (20.5)	6 (9.7)	0.65 (0.26–1.63)	
Searched for sexual partners in bar/club in the past 6 months								
No	1176 (84.6)	139 (11.8)	Ref		235 (77.6)	36 (15.3)	Ref	
Yes	214 (15.4)	27 (12.6)	1.08 (0.69–1.67)		68 (22.4)	4 (5.9)	0.35 (0.12–1.01)	0.36 (0.14–0.92)*
Searched for sexual partners in bath/sauna in the past 6 months								
No	1155 (83.1)	126 (10.9)	Ref		209 (69.0)	31 (14.8)	Ref	
Yes	235 (16.9)	40 (17.0)	1.68 (1.14–2.47)***		94 (31.0)	9 (9.6)	0.61 (0.28–1.33)	
Searched for sexual partners in public park/restrooms in the past 6 months								
No	1178 (84.7)	122 (10.4)	Ref	Ref	243 (80.2)	30 (12.3)	Ref	
Yes	212 (15.3)	44 (20.8)	2.27 (1.55–3.32)***	2.06 (1.46–2.92)***	60 (19.8)	10 (16.7)	1.42 (0.65–3.10)	
Searched for sexual partners through the Internet in the past 6 months								
No	527 (37.9)	77 (14.6)	Ref		190 (62.7)	23 (12.1)	Ref	
Yes	863 (62.1)	89 (10.3)	0.67 (0.49–0.93)**		113 (37.3)	17 (15.0)	1.29 (0.65–2.53)	

Usual anal sex position in the past 6 months								
Insertive	353 (25.4)	26 (7.4)	Ref		Ref	102 (33.7)	12 (11.8)	Ref
Receptive	245 (17.6)	35 (14.3)	2.10 (1.23–3.58)***		2.11 (1.33–3.35)***	21 (6.9)	3 (14.3)	1.25 (0.32–4.88)
Both	792 (57.0)	105 (13.3)	1.92 (1.23–3.01)***		1.84 (1.25–2.73)***	180 (59.4)	25 (13.9)	1.21 (0.58–2.53)
Insisted on condom use for anal sex in the past 6 months								
Yes	640 (46.0)	61 (9.5)	Ref		Ref	137 (45.2)	12 (8.8)	Ref
No	750 (54.0)	105 (14.0)	1.55 (1.17–2.05)**		1.54 (1.15–2.06)**	166 (54.8)	28 (16.9)	2.12 (1.16–3.86)**
Insisted on condom use for vaginal sex in the past 6 months								
Yes	–	–	–			95 (31.4)	12 (12.6)	Ref
No	–	–	–			208 (68.6)	28 (13.5)	1.08 (0.59–1.98)
HIV antibody								2.22 (1.19–4.16)**
Negative	1293 (93.0)	141 (10.9)	Ref		Ref	283 (93.4)	36 (12.7)	Ref
Positive	97 (7.0)	25 (25.8)	2.84 (1.74–4.62)***		2.75 (1.78–4.25)***	20 (6.6)	4 (20.0)	1.72 (0.54–5.42)

MSM/M = men who have sex with men only; MSM/W = men who have sex with both men and women; OR = odds ratio; CI, confidence interval; RMB = renminbi
*$P < 0.10$, **$P < 0.05$, ***$P \leq 0.01$

substantially different. Therefore, in order to develop effective interventions and strategies to control the spread of HIV among MSM and from MSM to the general population, we should take these differences into consideration in the future. Among MSM/M, the correlates of HIV infection included having no residency card of the study city, lower education level and less monthly income, which suggested that MSM/M with these demographic characteristics are vulnerable to HIV infection. The risk factors for HIV infection including having six or more sexual partners, searching for sexual partners in bathhouse/sauna/massage, being receptive only or both insertive and receptive during anal sex with men, suggesting that we should strengthen interventions in such venues in the future and increase the rates of condom use among such MSM/M. Syphilis infection also increased the risk of HIV infection, which indicated that prompt and effective treatment of STIs may decrease the risk of HIV infection among MSM/M. In addition, we also found that living in Chengdu was associated with HIV infection among both MSM/M and MSM/W. The Chinese Ministry of Health reported that Sichuan was one of the most drug use-affected provinces in China and estimated that more than 10,000 HIV infections were attributed to injection drug use,[5] but the previous study in MSM showed that 5.4% of MSM were drug users and 7.3% of them had injected drugs in the past six months.[9] Therefore, perhaps a few MSM whose HIV infection was caused by injection drug use transmitted HIV among MSM in earlier years.

Diaz *et al.*[23] found that the probability of being co-infected with HIV and syphilis was higher among Latin Americans, men with a history of previous STI, those reporting anal intercourse solely and those having sex with casual or several types of partners.[24] Our study showed that, among MSM/M and MSM/W, the factors associated with syphilis infection included having six or more sexual partners and not consistently using condoms during anal sex with men, suggesting that reducing the number of sexual partners and unprotected sexual behaviours may decrease the risk of syphilis infection. Having no income, searching for sexual partners in public parks/restrooms/greensward, being receptive only or both insertive and receptive during anal sex with men, and being HIV-positive were also independently associated with syphilis infection among MSM/M. Not searching for sex partners in gay bar/clubhouse, and having used condoms inconsistently during vaginal sex with women increased the risk of syphilis infection among MSM/W. Risk factors for syphilis infection differed between MSM/M and MSM/W. Therefore, we should develop effective interventions and strategies according to different risk factors among different subsets of MSM to control the spread of syphilis. It was surprising to find that having commercial sexual partners in the past six months decreased the risk of syphilis infection among MSM/M. The reason maybe that MSM who had commercial sexual partners had high levels of self-protection awareness.

There are some limitations in this research. Firstly, MSM are a hard-to-reach population in China, so we used convenience sampling based on the snowball sampling method. In this way the representative of the sample was limited. Secondly, the behavioural information was self-reported by the participants, so in our survey there may be existing social desirability bias, which might have affected accuracy in reporting. Thirdly, the cross-sectional nature of our study prevents ascertainment of causal or temporary associations between related variables and HIV or syphilis infection.

ACKNOWLEDGEMENT

This study was supported by the National Natural Science Foundation of China (grant no. 30771850).

REFERENCES

1 van Griensven F, Varangrat A, Wimonsate W, *et al.* Trends in HIV prevalence, estimated HIV incidence, and risk behavior among men who have sex with men in Bangkok, Thailand, 2003–2007. *J Acquir Immune Defic Syndr* 2009;**53**:234–239
2 Farr AC, Wilson DP. An HIV epidemic is ready to emerge in the Philippines. *J Int AIDS Soc* 2010;**13**:16
3 State Council AIDS Working Committee Office, UN Theme Group on HIV/AIDS in China. *A Joint Assessment of HIV/AIDS Prevention, Treatment and Care in China*. Beijing, China: State Council AIDS Working Committee Office, 2007. See http://www.chinaids.org.cn/n16/n1657/n32569.files/n32570.pdf (last checked 1 December 2007)
4 Chinese Ministry of Health and UN Theme group on HIV/AIDS in China. *2005 Update on the HIV/AIDS Epidemic and Response in China. Beijing*, 2006. See http://www.chinapharm.com.cn/html/xxhc/1139992950890.html (last checked 24 January 2006)
5 Ministry of Health of the People's Republic of China, Joint United Nations Program on HIV AIDS (UNAIDS), World Health Organization. *2009 Report on the estimation of HIV/AIDS epidemic in China*. Beijing: Ministry of Health of China, 2010. See http://nano.nstl.gov.cn/aids/SPT-FullRecord.php?ResourceId=21003 (last checked 31 May 2010)
6 Ma XY, Zhang QY, He X, *et al.* Trends in prevalence of HIV, syphilis, hepatitis C, hepatitis B, and sexual risk behavior among men who have sex with men. *J Acquir Immune Defic Syndr* 2007;**45**:581–7
7 He QY, Wu XQ, Han DL, *et al.* HIV infection and risk behavior of men having sex with men in Chengdu City from 2004 to 2007. *J Occup Health Damage* 2008;**23**:222–4
8 Han M, Feng L-G, Jlang Y, *et al.* Surveillance on HIV-1 incidence among men who have sex with men in Chongqing, China, 2006–2008. *Chin J Epidemiol* 2009;**9**:878–81
9 Li C-M, Xiao Y, Liu J-B, *et al.* HIV and syphilis infections among men who have sex with men in Chongqing municipality, China. *Chin J Epidemiol* 2009;**2**:126–30
10 Yuji F, Zunyou W, Roger D, *et al.* HIV/STD prevalence among MSM in Chengdu, China and associated risk factors for HIV infection. *J Acquir Immune Defic Syndr* 2010;**53**:S74
11 Wang C, Li Ang H-Y, Yang Y, *et al.* A survey of HIV infections and related factors among men who have sex with men in Beijing. *Chin J AIDS STD* 2008;**6**:552–6
12 Zhang B, Chu Q, Li X. A review on the data about homosexual from 'Kinsey's report'. *Chin J Human Sex* 2008;**10**:7–9
13 Choi KH, Liu H, Guo Y, *et al.* Emerging HIV-1 epidemic in China in men who have sex with men. *Lancet* 2003;**361**:2125–6
14 Zhang K, Li D, Li H, *et al.* Changing sexual attitudes and behavior in China: implications for the spread of HIV and other sexually transmitted diseases. *AIDS Care* 1999;**11**:581–9
15 Feng Y, Wu Z, Detels R. Evolution of MSM community and experienced stigma among MSM in Chengdu, China. *J Acquir Immune Defic Syndr* 2010;**53**:S98–103
16 Li CM, Jia YJ, Ding XB, *et al.* HIV infections and heterosexual behaviors among men who have sex with men in Chongqing municipality, China. *Zhonghua Liu Xing Bing Xue Za Zhi* 2009;**30**:882–6
17 Liao M, Kang D, Jiang B, *et al.* Bisexual behavior and infection with HIV and syphilis among men who have sex with men along the east coast of China. *AIDS Patient Care STDS* 2011;**25**:683–91
18 Dai L-P, Jiang Y-H, Gong C-H, *et al.* The characteristic of behavior and HIV prevalence among 1 315 men who have sex with men in Guangzhou. *Chin J AIDS STD* 2011;**1**:35–7
19 Yun K, Xu JJ, Reilly KH, *et al.* Prevalence of bisexual behavior among bridge population of men who have sex with men in China: a meta-analysis of observational studies. *Sex Transm Infect* 2011;**87**:563–70
20 Xu J, Han D, Liu Z, *et al.* The prevalence of HIV infection and the risk factors among MSM in 4 cities.. *Chin J Prev Med* 2010;**44**:975–80
21 Yang X, Yi D, Ding X-B. Status of high risk behavior and infection of HIV/AIDS among 1 000 men who have sex with men in a city. *Acta Acad Med Militaris Tertiae* 2008;**3**:260–2
22 Li A, Varangrat A, Wimonsate W, *et al.* Sexual behavior and risk factors for HIV infection among homosexual and bisexual men in Thailand. *AIDS Behav* 2009;**13**:318–27
23 Diaz A, Junquera ML, Esteban V, *et al.* HIV/STI co-infection among men who have sex with men in Spain. *Euro Surveill* 2009;**14**:19426
24 Grosskurth H, Mosha F, Todd J, *et al.* Impact of improved treatment of sexually transmitted diseases on HIV infection in rural Tanzania: randomized controlled trial. *Lancet* 1995;**346**:530–6

(Accepted 11 October 2012)