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HIV/AIDS

Increasing prevalence of HIV and syphilis but decreasing rate of self-reported unprotected anal intercourse among men who had sex with men in Harbin, China: results of five consecutive surveys from 2006 to 2010

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Background To monitor the prevalence of HIV and syphilis as well as behaviours, a sentinel site for men who have sex with men was established in Harbin in 2002. With additional funding, the sentinel surveillance evolved into annual cross-sectional surveys since 2006.

Methods Behavioural and serological data collected in five consecutive cross-sectional surveys were analysed. SPSS 13.0 was applied to compare prevalence of HIV and syphilis as well as behavioural variables over time by demographic variables, bivariate and multivariate analysis.

Results The prevalence of HIV and syphilis increased from 1.0% in 2006 to 7.5% in 2010 and from 9.2% in 2006 to 22.4% in 2009, respectively, whereas the rate of unprotected anal intercourse decreased from 61.3% in 2006 to 47.1% in 2010. Syphilis positivity and HIV infection are independently associated with each other across years. The rate of unprotected anal sex remains high although it has decreased over the years.

Conclusion Findings support an increasing prevalence of HIV and syphilis among men who have sex with men in Harbin. Targeted behavioural intervention and syphilis treatment are urgently needed to prevent the epidemic from growing.

Keywords HIV, syphilis, unprotected anal intercourse, men who have sex with men, Harbin, China

Introduction

In 2009, China's Ministry of Health estimated 4.8 million new HIV infections, of which 32.5% were due to transmission among men who have sex with men (MSM). This proportion had increased from 12.5% in 2007.[1] The MSM population in China is estimated by various studies to range from 5 to 20 million.[2,3] As growing public acceptance in China is allowing MSM to better connect with each other and meet a greater number of sex partners through the internet and a

growing number of gay bars, clubs and other venues, there is potential for rapid spread of HIV across the population. Results of a survey of the MSM populations in 61 cities carried out in 2008–09 showed that the rate of positive HIV antibody test results among MSM populations in these 61 selected cities had reached an average of 5%.[4] Surveillance and survey data also found increasing HIV prevalence among MSM in big cities such as Beijing, Chongqing, Guangzhou, Nanjing and Shenzhen, and second tier cities such as Jinan, Suzhou and Yangzhou.[5–18] China experienced the first wave of its HIV epidemic among injection drug users in southern China during the late 1980s and early 1990s, and the second wave among former plasma donors in the 1990s.[19] The MSM epidemic has the potential to be the next big wave.

Harbin is the capital city of the northeastern Heilongjiang Province, with a population of 9.9 million at the end of 2009. It is also the economic and cultural centre in the northeastern region of China. In 2006–2009, the MSM population was estimated at around 40 000 people (range 24 300–48 600), most of whom reside in urban districts. Culturally, as more and more gay cruising venues have been established over the years, Harbin has become the centre for gay gatherings in the region (personal communication K Wang, based on the baseline reports for the Global Fund and for the Gates Foundation projects).

Since 2002, the Chinese Center for Disease Control and Prevention (CDC) has established and operated a sentinel site for MSM in the city according to China national surveillance guidelines.[20] With continuous serological and behavioural data, the city was able to monitor the trends of behavioural, HIV and syphilis prevalence over time.[21] Since 2006, with additional support from the Global Fund and the Bill & Melinda Gates Foundation, the city expanded the sentinel surveillance into periodic surveys with a larger sample size. The same group of interviewers at the same interviewing site ensured a consistent sampling method.

Previous analyses of local data found the HIV prevalence fluctuated ~0.9–2.3% during 2002 and 2006 whereas the syphilis prevalence increased from 2.7% in 2004 to 11.8% in 2005.[18] The present article analysed the data collected from 2006 through 2010, to examine the trends of HIV and syphilis epidemics as well as major behaviours among MSM in Harbin.

Methods

Subjects and interview site

Subjects included in the surveys were men who had anal or oral sex with men in the 12 months before the time when the survey was conducted. Participants were at least 18 years old and had resided in the city of Harbin for >6 months. Participants were surveyed by the same trained interviewers using the same structured questionnaires at the voluntary counselling and testing clinic (VCT) of Harbin CDC. Written informed consent was obtained from each of the subjects before completing the questionnaire and blood drawing. The survey protocol, which included human subjects' approval, was developed and approved by the National Center for AIDS/STD Prevention and Control (NCAIDS), China CDC.

Sampling method and subject recruitment

Snowball sampling was used to recruit the participants. Community-based MSM organizations in Harbin assisted identification, screening and recruitment of the first group of MSM individuals as 'seeds'. The seeds were diverse in terms of educational attainment, marital status, occupation, income and venues where they found or met with partners. After a 'seed' completed a questionnaire interview and blood drawing, he was asked to invite three or more eligible peers from his circle to participate in the survey. In turn, those subsequent participants were asked to invite their eligible peers to participate in the survey until the predefined sample size was met. Recruitment did not intentionally exclude those subjects who participated in the previous surveys or knew their HIV positive status. As incentive for participation, all participants were given 10 Chinese Yuan cash (approximately US$ 1.5) and condoms in 2006 and 2007, and 20 Chinese Yuan (approximately US$ 3) plus condoms in 2008–10.

The sample size was estimated based on the prevalence of syphilis among MSM through sentinel surveillance at 11.8% in 2005, an MSM population size of 40 000, an alpha value of 0.05 and a power of 85%. Given these conditions, 387 subjects were required. Considering that non-probability sampling was used, and because syphilis prevalence among MSM in 2005 was calculated from a small sample of 203, the sample size was increased to 400 to allow for greater representativeness and possible refusals.

Behavioural and serological measurements

After eligibility screening and informed consent, each subject provided 5 ml intravenous blood before an anonymous face-to-face questionnaire interview in a private room. Items in the questionnaire included demographic information, knowledge and attitudes towards HIV/AIDS, access to HIV prevention services, sexual behaviour with men and women, drug use and sexually transmitted infection (STI) symptoms and treatment.

Specimens were tested for HIV antibody and syphilis antibody. HIV screening was conducted using a rapid test or an enzyme-linked immunosorbent assay (ELISA) (SD Bioline HIV-1/23.0, Standard Diagnostics Inc., Kyonggi-do, South Korea; Livzon Group Reagent Factory, Zhuhai, China). If the result of one rapid test or ELISA was positive, a western blot test was conducted for confirmation (MP Biomedicals

Asia Pacific Pte Ltd, Singapore). If the western blot was positive, the sample was defined as positive. If the western blot was negative or indeterminate, the subject was followed up every 3–6 months. Syphilis screening was performed by rapid plasma regain (RPR; Shanghai Kehua Bioengineering Co. Ltd, Shanghai, China). Specimens testing positive for syphilis antibody were confirmed by the treponema pallidum particle agglutination test (TPPA; Livzon Group Reagent Factory, Zhuhai, China).

Data analysis

Although a non-probability sampling method was used, the sample size was considered large enough to be representative of the population. The data were analysed using probability sampling statistical tests using SPSS 13.0. In this study, unprotected anal intercourse (UAI) was defined as failure to consistently use a condom during the past 6 months when having anal sex. Having no anal sex was considered to be safe. UAI was categorized as 'No' if there was no anal intercourse or used a condom every time, and 'Yes' if never or occasionally used a condom. Coverage of prevention services was defined as receiving any services including condom distribution, lubricant distribution, peer education, STI diagnosis or treatment, HIV counselling or testing, or AIDS/STI educational materials in the past year. The factors associated with HIV or syphilis infection were assessed first using univariate logistic regression models. The trend analysis was performed using chi square linear by linear. Multivariate forward stepwise analysis was then used to assess the factors associated with HIV or syphilis infection, with year as a dummy variable. For multivariate analysis, the variables input in the regression model included HIV or syphilis prevalence, age group, marital status, residency (Hukou), ethnicity, education level, income, sexual orientation, venues for meeting partners, sex with male partners, commercial sex with males, sex with females, HIV tests and preventive intervention services received. All statistical significance test results are reported as *P*-values.

Results

Five surveys were conducted from April to June in 2006, 2007, 2008, 2009 and 2010, with 400, 419, 451, 450 and 413 subjects, respectively, being recruited and completing the survey. The composition of key demographic and behavioural variables is presented in Table 1. Major variables are different across years without a clear trend. In the samples over the years, older age groups, more migrants with Hukou outside Harbin, more bathhouse frequenters, less self-perceived homosexual groups and less internet surfers were recruited. More subjects claimed they had their first anal sex intercourse with a male when they were 19 years old or older.

There is a decrease in the rate of UAI over the years from 61.3% in 2006 to 47.1% in 2010, with a concurrent increase in the rate of HIV testing during past 12 months and in the coverage of any intervention (Table 1).

HIV prevalence increased steadily from 1.0% in 2006 to 7.5% in 2010 (Table 2). The increase is found among such subgroups as those aged 20–39 years old, single, self-perceived as bisexual, looking for partners in bathhouses and gay bars, aged 19 years or older when having first sex with another man and/or who haven't had an HIV test in the past 12 months. In most of the 5 years, a higher HIV prevalence can be found among older age groups, the widowed or divorced, those with UAI, those without an HIV test, those not covered with any preventive intervention programme and those who are syphilis positive, although there were fluctuations during the period.

Syphilis prevalence increased from 9.2% in 2006 to 22.4% in 2009, but dropped to 15.7% in 2010 (Table 3). A similar trend was found across subgroups, with the highest prevalence found in 2009. Increases were found among such subgroups as those aged >30 years, self-perceived as homosexual and bisexual, having more than two sex partners in the past 6 months, covered with any preventive intervention, without self-reported STI symptoms in the past 12 months, and having a negative HIV test result.

Factors associated with HIV infection and syphilis positivity are different (Tables 4 and 5). Being syphilis positive and HIV infected are consistently positively associated with each other. A history of an HIV test in the past 12 months was positively associated with syphilis positivity but negatively associated with HIV infection. Having more than two male partners in the past 6 months is positively associated with HIV infection. Being older than 20 years old, having higher education than junior high school, meeting sexual partners in bathhouses and public toilets and being covered by any intervention programme are independent risk factors for syphilis positivity.

Discussion

The results from five consecutive cross-sectional surveys revealed a steady increase in HIV prevalence among MSM in Harbin from 2006 to 2010, which is a further increase from 2002 and 2004.[18] This increase coincides with increases in the other cities in China as well as in the greater Asia region.[6–8,12,15,16,22–24] Harbin was a historically low-prevalence city,[25] but now has a concentrated epidemic among MSM. An increase in syphilis prevalence was also found in surveys from 2006 to 2009. This increase is consistent with other surveys in China and in Asia.[6,11,22,23,26–28]

Table 1 Demographic characteristics and key behaviours of MSM in Harbin, China, 2006–2010

Characteristic	2006 (*N* = 401) *N* (%)	2007 (*N* = 419) *N* (%)	2008 (*N* = 451) *N* (%)	2009 (*N* = 450) *N* (%)	2010 (*N* = 413) *N* (%)	*P*-value
Age group (years)						
18–19	46 (11.5)	39 (9.3)	63 (14.0)	39 (8.7)	39 (9.4)	0.037*
20–29	225 (56.1)	258 (61.6)	239 (53.0)	253 (56.2)	238 (57.6)	
30–39	95 (23.7)	74 (17.7)	79 (17.5)	88 (19.6)	77 (18.6)	
40–79	35 (8.7)	48 (11.5)	70 (15.5)	70 (15.6)	59 (14.3)	
Marital status						
Single	308 (76.8)	353 (84.2)	353 (78.3)	349 (77.6)	311 (75.3)	0.029
Married or cohabiting	70 (17.5)	55 (13.1)	72 (16.0)	72 (16.0)	68 (16.5)	
Divorced or widowed	23 (5.7)	11 (2.6)	26 (5.8)	29 (6.4)	34 (8.2)	
Residency (Hukou)						
Harbin	314 (78.3)	324 (77.3)	284 (63.0)	289 (64.2)	244 (59.1)	0.000
Outside Harbin	87 (21.7)	95 (22.7)	167 (37.0)	161 (35.8)	169 (40.9)	
Ethnicity						
Han Chinese	374 (93.3)	394 (94.0)	424 (94.0)	420 (93.3)	390 (94.4)	0.949
Others	27 (6.7)	25 (6.0)	27 (6.0)	30 (6.7)	23 (5.6)	
Education level						
Primary school	5 (1.2)	3 (0.7)	35 (7.8)	17 (3.8)	14 (3.4)	0.000*
Junior high school	65 (16.2)	47 (11.2)	136 (30.2)	108 (24.0)	91 (22.0)	
Senior high school	144 (35.9)	116 (27.7)	152 (33.7)	133 (29.6)	119 (28.8)	
College or higher	187 (46.6)	253 (60.4)	128 (28.4)	192 (42.7)	189 (45.8)	
Self-perceived sexual orientation						
Homosexual	277 (69.8)	321 (76.6)	250 (55.4)	265 (58.9)	221 (53.5)	0.000
Heterosexual	4 (1.0)	1 (0.2)	23 (5.1)	10 (2.2)	11 (2.7)	
Bisexual	105 (26.4)	91 (21.7)	154 (34.1)	157 (34.9)	157 (38.0)	
Uncertain	11 (2.8)	6 (1.4)	24 (5.3)	18 (4.0)	24 (5.8)	
Venues for meeting partners						
Bar, disco, teahouse or club	61 (15.3)	67 (16.0)	126 (27.9)	84 (18.8)	112 (27.1)	0.000
Bathhouse, sauna or massage	18 (4.5)	66 (15.8)	77 (17.1)	90 (20.1)	67 (16.2)	
Park, public toilet	23 (5.8)	67 (16.0)	37 (8.2)	38 (8.5)	18 (4.4)	
Internet	279 (69.8)	219 (52.3)	167 (37.0)	157 (35.0)	177 (42.9)	
Other	19 (4.8)	0 (0.0)	44 (9.8)	79 (17.6)	39 (9.4)	
Age of first sex with male						
<19	186 (48.3)	178 (42.5)	204 (45.2)	141 (31.4)	136 (32.9)	0.000*
$\geqslant 19$	199 (51.7)	241 (57.5)	247 (54.8)	308 (68.6)	277 (67.1)	
Number of male partners in past 6 months						
0	0 (0.0)	0 (0.0)	0 (0.0)	6 (1.6)	37 (9.0)	0.001*
1	90 (27.8)	152 (41.8)	119 (30.4)	116 (30.4)	135 (32.7)	
2	71 (21.9)	84 (23.1)	76 (19.4)	68 (17.8)	87 (21.0)	
$\geqslant 3$	163 (50.3)	128 (35.1)	196 (50.2)	191 (50.2)	154 (37.3)	
UAI	196 (61.3)	232 (63.7)	227 (58.2)	210 (55.9)	157 (47.1)	0.000*
UVI	59 (67.0)	51 (76.1)	92 (57.9)	67 (64.4)	73 (52.5)	0.009*
HIV test in the past 12 months	105 (26.2)	130 (31.0)	167 (37.0)	254 (56.4)	195 (47.2)	0.000*
Coverage of any intervention	195 (48.6)	320 (76.4)	311 (69.0)	369 (82.0)	257 (62.2)	0.000*
STI symptoms in the past 12 months	65 (16.2)	30 (7.2)	44 (9.8)	55 (12.2)	62 (15.0)	0.553*

UAI, unprotected anal intercourse; UVI, unprotected vaginal intercourse; STI, sexually transmitted infections.
*Chi-square linear by linear.

Table 2 HIV prevalence by demographic characteristics and sexual behaviours among MSM in Harbin, China, 2006–2010

Characteristic	2006 (*N* = 401) *N* (%)	2007 (*N* = 419) *N* (%)	2008 (*N* = 451) *N* (%)	2009 (*N* = 450) *N* (%)	2010 (*N* = 413) *N* (%)	*P*-value*
Overall	4 (1.0)	12 (2.9)	16 (3.5)	23 (5.1)	31 (7.5)	0.000
Age group						
18–19	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (5.1)	0.029
20–29	4 (1.8)	8 (3.1)	12 (5.0)	9 (3.6)	17 (7.1)	0.007
30–39	0 (0.0)	2 (2.7)	2 (2.5)	8 (9.1)	8 (10.4)	0.000
40–79	0 (0.0)	2 (4.2)	2 (2.9)	6 (8.6)	4 (6.8)	0.074
Marital status						
Single	3 (1.0)	10 (2.8)	13 (3.7)	17 (4.9)	23 (7.4)	0.000
Married or cohabiting	1 (1.4)	1 (1.8)	2 (2.8)	3 (4.2)	5 (7.4)	0.049
Divorced or widowed	0 (0.0)	1 (9.1)	1 (3.8)	3 (10.3)	3 (8.8)	0.210
Residency (Hukou)						
Harbin	1 (0.3)	10 (3.1)	12 (4.2)	17 (5.9)	17 (7.0)	0.000
Outside Harbin	3 (3.4)	2 (2.1)	4 (2.4)	6 (3.7)	14 (8.3)	0.022
Ethnicity						
Han Chinese	4 (1.1)	11 (2.8)	15 (3.5)	21 (5.0)	29 (7.4)	0.000
Others	0 (0.0)	1 (4.0)	1 (3.7)	2 (6.7)	2 (8.7)	0.138
Education level						
Primary school	0 (0.0)	0 (0.0)	1 (2.9)	1 (5.9)	1 (7.1)	0.399
Junior high school	2 (3.1)	2 (4.3)	3 (2.2)	12 (11.1)	7 (7.7)	0.036
Senior high school	1 (0.7)	4 (3.4)	7 (4.6)	8 (6.0)	12 (10.1)	0.000
College or higher	1 (0.5)	6 (2.4)	5 (3.9)	2 (1.0)	11 (5.8)	0.008
Self-perceived sexual orientation						
Homosexual	2 (0.7)	11 (3.4)	9 (3.6)	16 (6.0)	12 (5.4)	0.001
Heterosexual	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Bisexual	2 (1.9)	1 (1.1)	6 (3.9)	5 (3.2)	18 (11.5)	0.000
Uncertain	0 (0.0)	0 (0.0)	1 (4.2)	2 (11.1)	1 (4.2)	0.464
Venues for meeting partners						
Bar, disco, teahouse or club	0 (0.0)	2 (3.0)	4 (3.2)	2 (2.4)	5 (4.5)	0.002
Bathhouse, sauna or massage	0 (0.0)	2 (3.0)	3 (3.9)	10 (11.1)	6 (9.0)	0.028
Park, public toilet	1 (4.3)	1 (1.5)	0 (0.0)	2 (5.3)	2 (11.1)	0.167
Internet	3 (1.1)	7 (3.2)	7 (4.2)	4 (2.5)	16 (9.0)	0.084
Other	0 (0.0)	0 (0.0)	2 (4.5)	5 (6.3)	2 (5.1)	0.381
Age of first sex with male						
<19	2 (1.1)	7 (3.9)	9 (4.4)	5 (3.5)	5 (3.7)	0.231
$\geqslant 19$	2 (1.0)	5 (2.1)	7 (2.8)	18 (5.8)	26 (9.4)	0.000
Number of male partners in past 6 months						
0	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (13.5)	0.588
1	1 (1.1)	0 (0.0)	1 (0.8)	3 (2.6)	5 (3.7)	0.019
2	0 (0.0)	2 (2.4)	3 (3.9)	2 (2.9)	8 (9.2)	0.005
$\geqslant 3$	3 (1.8)	7 (5.5)	9 (4.6)	16 (8.4)	13 (8.4)	0.004
UAI						
Yes	4 (2.0)	5 (2.2)	9 (4.0)	15 (7.1)	16 (10.2)	0.000
No	0 (0.0)	4 (3.0)	4 (2.5)	5 (3.0)	10 (5.7)	0.011

(continued)

Table 2 Continued

Characteristic	2006 (*N* = 401) *N* (%)	2007 (*N* = 419) *N* (%)	2008 (*N* = 451) *N* (%)	2009 (*N* = 450) *N* (%)	2010 (*N* = 413) *N* (%)	*P*-value*
UVI						
Yes	1 (1.7)	1 (2.0)	3 (3.3)	0 (0.0)	5 (6.8)	0.201
No	1 (3.4)	0 (0.0)	2 (3.0)	3 (8.1)	3 (4.5)	0.461
HIV test in the past 12 months						
Yes	1 (1.0)	3 (2.3)	7 (4.2)	9 (3.5)	7 (3.6)	0.215
No	3 (1.0)	9 (3.1)	9 (3.2)	14 (7.1)	24 (11.0)	0.000
Coverage of any intervention						
Yes	2 (1.0)	7 (2.2)	12 (3.9)	15 (4.1)	17 (6.6)	0.000
No	2 (1.0)	5 (5.1)	4 (2.9)	8 (9.9)	14 (9.0)	0.000
STI symptoms in the past 12 months						
Yes	2 (3.1)	2 (6.7)	3 (6.8)	2 (3.6)	7 (11.3)	0.151
No	2 (0.6)	10 (2.6)	13 (3.2)	21 (5.3)	24 (6.8)	0.000
Syphilis test result						
Positive	1 (2.7)	7 (10.8)	9 (13.8)	15 (14.9)	12 (18.5)	0.025
Negative	3 (0.8)	5 (1.4)	7 (1.8)	8 (2.3)	19 (5.5)	0.000

UAI, unprotected anal intercourse; UVI, unprotected vaginal intercourse; STI, sexually transmitted infections.
*Chi-square linear by linear

Table 3 Syphilis prevalence by demographic characteristics and sexual behaviours among MSM in Harbin, China, 2006–2010

Characteristic	2006 (*N* = 401) *N* (%)	2007 (*N* = 419) *N* (%)	2008 (*N* = 451) *N* (%)	2009 (*N* = 450) *N* (%)	2010 (*N* = 413) *N* (%)	*P*-value*
Overall	37 (9.2)	65 (15.5)	65 (14.4)	101 (22.4)	65 (15.7)	0.000
Age group						
18–19	2 (4.3)	3 (7.7)	2 (3.2)	3 (7.7)	0 (0.0)	0.481
20–29	22 (9.8)	31 (12.0)	25 (10.5)	39 (15.4)	32 (13.4)	0.111
30–39	8 (8.4)	13 (17.6)	20 (25.3)	31 (35.2)	19 (24.7)	0.000
40–79	5 (14.3)	18 (37.5)	18 (25.7)	28 (40.0)	14 (23.7)	0.458
Marital status						
Single	29 (9.4)	49 (13.9)	41 (11.6)	70 (20.1)	42 (13.5)	0.016
Married or cohabiting	6 (8.6)	15 (27.3)	20 (27.8)	19 (26.4)	12 (17.6)	0.216
Divorced or widowed	2 (8.7)	1 (9.1)	4 (15.4)	12 (41.4)	11 (32.4)	0.005
Residency (Hukou)						
Harbin	25 (8.0)	55 (17.0)	45 (15.8)	64 (22.1)	37 (15.2)	0.002
Outside Harbin	12 (13.8)	10 (10.5)	20 (12.0)	37 (23.0)	28 (16.6)	0.072
Ethnicity						
Han Chinese	35 (9.4)	57 (14.5)	59 (13.9)	90 (21.4)	63 (16.2)	0.000
Others	2 (7.4)	8 (32.0)	6 (22.2)	11 (36.7)	2 (8.7)	0.581
Education level						
Primary school	1 (20.0)	1 (33.3)	4 (11.4)	4 (23.5)	5 (35.7)	0.226
Junior high school	7 (10.8)	8 (17.0)	18 (13.2)	38 (35.2)	20 (22.0)	0.003

(continued)

Table 3 Continued

Characteristic	2006 (*N* = 401) *N* (%)	2007 (*N* = 419) *N* (%)	2008 (*N* = 451) *N* (%)	2009 (*N* = 450) *N* (%)	2010 (*N* = 413) *N* (%)	*P*-value*
Senior high school	12 (8.3)	24 (20.7)	24 (15.8)	29 (21.8)	19 (16.0)	0.067
College or higher	17 (9.1)	32 (12.6)	19 (14.8)	30 (15.6)	21 (11.1)	0.368
Self-perceived sexual orientation						
Homosexual	27 (9.7)	50 (15.6)	40 (16.0)	59 (22.3)	27 (12.2)	0.057
Heterosexual	0 (0.0)	0 (0.0)	1 (4.3)	0 (0.0)	0 (0.0)	1.000
Bisexual	7 (6.7)	14 (15.4)	23 (14.9)	35 (22.3)	34 (21.7)	0.001
Uncertain	1 (9.1)	1 (16.7)	1 (4.2)	7 (38.9)	4 (16.7)	0.233
Venues for meeting partners						
Bar, disco, teahouse or club	7 (11.5)	7 (10.4)	8 (6.3)	17 (20.2)	20 (17.9)	0.865
Bathhouse, sauna or massage	1 (5.6)	9 (13.6)	21 (27.3)	36 (40.0)	22 (32.8)	0.000
Park, public toilet	0 (0.0)	10 (14.9)	10 (27.0)	10 (26.3)	3 (16.7)	0.036
Internet	28 (10.0)	39 (17.8)	18 (10.8)	20 (12.7)	14 (7.9)	0.209
Other	1 (5.3)	0 (0.0)	8 (18.2)	18 (22.8)	6 (15.4)	0.286
Age of first sex with male						
<19	15 (8.1)	30 (16.9)	25 (12.3)	25 (17.7)	11 (8.1)	0.751
$\geqslant 19$	19 (9.5)	35 (14.5)	40 (16.2)	76 (24.7)	54 (19.5)	0.000
Number of male partners in past 6 months						
0	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (21.6)	0.334
1	7 (7.8)	11 (7.2)	13 (10.9)	18 (15.5)	20 (14.8)	0.013
2	10 (14.1)	12 (14.3)	10 (13.2)	14 (20.6)	10 (11.5)	0.974
$\geqslant 3$	14 (8.6)	26 (20.3)	32 (16.3)	56 (29.3)	27 (17.5)	0.002
UAI						
Yes	24 (12.2)	27 (11.6)	38 (16.7)	55 (26.2)	30 (19.1)	0.000
No	8 (6.5)	22 (16.7)	17 (10.4)	32 (19.3)	22 (12.5)	0.131
UVI						
Yes	4 (6.8)	9 (17.6)	12 (13.0)	15 (22.4)	12 (16.4)	0.092
No	3 (10.3)	2 (12.5)	9 (13.4)	12 (32.4)	12 (18.2)	0.138
HIV test in the past 12 months						
Yes	6 (5.7)	25 (19.2)	38 (22.8)	63 (24.8)	32 (16.4)	0.038
No	31 (10.5)	40 (13.8)	27 (9.5)	38 (19.4)	33 (15.1)	0.039
Coverage of any intervention						
Yes	14 (7.2)	52 (16.3)	56 (18.0)	86 (23.3)	45 (17.5)	0.000
No	23 (11.2)	13 (13.1)	9 (6.4)	15 (18.5)	20 (12.8)	0.446
STI symptoms in the past 12 months						
Yes	8 (12.3)	6 (20.0)	9 (20.5)	19 (34.5)	15 (24.2)	0.265
No	29 (8.6)	59 (15.2)	56 (13.8)	82 (20.8)	50 (14.2)	0.005
HIV test result						
Positive	1 (25.0)	7 (58.3)	9 (56.3)	15 (65.2)	12 (38.7)	0.564
Negative	36 (9.1)	58 (14.3)	56 (12.9)	86 (20.1)	53 (13.9)	0.004

UAI, unprotected anal intercourse; UVI, unprotected vaginal intercourse; STI, sexually transmitted infections.
*Chi-square linear by linear

Table 4 Factors associated with HIV infection by multivariate logistic regression analysis among MSM in Harbin, China, 2006–2010

Factors	Independent variables	B	SE	Wald Chi- Sq	df	*P*-value	OR	95% CI for OR	
Number of male partners in past 6 months	<3						1.000		
	⩾3	0.740	0.261	8.051	1	0.005	2.096	1.257	3.496
HIV test in past 12 months	Yes						1.000		
	No	0.798	0.273	8.511	1	0.004	2.221	1.299	3.795
Syphilis antibody test result	Negative						1.000		
	Positive	1.839	0.259	50.392	1	0.000	6.288	3.785	10.446
	Constant	−5.749	0.601	91.616	1	0.000	0.003		

Table 5 Factors associated with syphilis infection by multivariate logistic regression analysis among MSM in Harbin, China, 2006–2010

Factors	Independent variables	B	SE	Wald Chi-Sq	df	*P*-value	OR	95% CI for OR	
Age group	18–19			39.080	3	0.000	1.000		
	20–29	0.869	0.364	5.716	1	0.017	2.385	1.170	4.865
	30–39	1.401	0.380	13.575	1	0.000	4.060	1.927	8.554
	40–79	1.885	0.388	23.549	1	0.000	6.587	3.076	14.104
Education level	College or higher			12.857	3	0.005	1.000		
	Primary school	0.627	0.351	3.200	1	0.074	1.873	0.942	3.725
	Junior high school	0.638	0.185	11.903	1	0.001	1.893	1.317	2.720
	Senior high school	0.292	0.173	2.857	1	0.091	1.339	0.955	1.879
Venues for meeting partners	Bar, disco, teahouse or club			13.101	4	0.011	1.000		
	Bathhouse, sauna or massage	0.820	0.232	12.452	1	0.000	2.270	1.440	3.580
	Park, public toilet	0.292	0.302	0.934	1	0.334	1.339	0.741	2.420
	Internet	0.411	0.203	4.083	1	0.043	1.508	1.012	2.246
	Other	0.383	0.287	1.775	1	0.183	1.467	0.835	2.576
HIV test in the past 12 months	No						1.000		
	Yes	0.484	0.164	8.704	1	0.003	1.623	1.176	2.238
Coverage of any intervention	No						1.000		
	Yes	0.378	0.190	3.944	1	0.047	1.459	1.005	2.120
HIV antibody test result	Negative						1.000		
	Positive	1.880	0.266	49.814	1	0.000	6.554	3.888	11.047

The increase in the prevalence of HIV and syphilis is across subgroups, although the sample compositions are different over years. The prevalences of HIV and syphilis were consistently higher among groups aged older than 30 years, those meeting partners at bathhouses or toilets, those having more than two male partners during past 6 months, those with UAI and/or those who were syphilis or HIV positive. Syphilis positivity and HIV infection were found to be independently associated with each other across years. Consistently, being aged over 30 years was also found to be independently associated with syphilis infection. These findings are consistent with results from other studies in China.[8,11,29–32]

There were a few syphilis cases but no HIV cases found among subjects aged younger than 20 years from 2006 to 2009. Two HIV positive cases, both 19 years old, found in 2010, made their sexual debut at 17 years old. These two cases, together with the increased prevalence of HIV among MSM over the years, are a warning signal for a growing HIV epidemic among MSM in Harbin. The rate of UAI

remained constantly >50% in this age group across years whereas the proportion of HIV testing during the past 12 months among this group was the lowest among different age groups (data not shown).

A decrease in the rate of UAI was found over the period. However, the rate of UAI remained high and similar to the reported data in other Chinese cities.[8,9,11,13,14,25,29,32,33] The high rate of UAI may partially explain the increased prevalence of syphilis and self-reported symptoms in the past 12 months. The decrease in the rate of UAI is consistent with high coverage of intervention over the years, which is also self-reported. Recall bias may exist. However, the decrease in the rate of UAI is in line with the increased perception of risk for HIV as reflected in the increased proportion of those being tested for HIV in the past 12 months.

Our analysis is not without limitations. First, snowball sampling was conducted in this study. Consequently, sampling bias could exist, which could lead to heterogeneity or homogeneity of the sample. Accordingly, some statistical significance could be driven by the heterogeneity or homogeneity of the sample. However, the present analysis emphasizes the trends more than the results in a single year. Second, the refusal rate of subjects approached by peers was not collected during the recruitment. It is estimated that ~20% of subjects in the survey participated in surveys in previous years. The effect of this duplication on the trends of prevalence of HIV, syphilis and UAI is estimated to be minimal, although it is hard to quantify as this information was not systematically collected. Lastly, as common in many other behavioural surveys, information bias may exist, especially recall bias, as reflected in the fluctuations and inconsistencies of self-reported and sensitive variables. To minimize the bias, the same group of well-trained interviewers conducted the face-to-face interviews following an identical protocol at the same interview site. Despite these limitations our analysis is among the first to examine the trend of the prevalence of HIV and syphilis, and behaviours over a period of 5 years among MSM in China. Our findings suggest that targeted, culturally appropriate and innovative interventions to reduce UAI, and timely treatment of syphilis and other STIs should be top priorities in the fight against the HIV epidemic among MSM in Harbin and probably in other cities of China. MSM, especially those frequenting bathhouses and public toilets, and those with UAI should be among the key groups for targeted intervention.

In conclusion, data collected in five serial cross-sectional surveys supported an increasing trend of prevalence of HIV and syphilis and possibly a decreasing rate of UAI, although the results of self-reported variables should be interpreted with caution. However, the trend merits urgent action to adopt vigorous interventions targeting key subgroups in order to prevent HIV from spreading among MSM in China.

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KEY MESSAGE

- The HIV and syphilis epidemics among men who have sex with men are growing in Harbin, China. Interventions, targeting subjects who are ⩾30 years old, with more than two sexual partners during the past 6 months, and who frequent bathhouses and public toilets, are urgently needed.

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