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## **Missed opportunities for HIV and syphilis testing among men who have sex with men in China: a cross-sectional study**

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## **Short summary**

A study of men who have sex with men in China revealed 35% had never tested for HIV/syphilis, and amongst HIV testers, only 51% had ever tested for syphilis.

## **ABSTRACT**

### **Background**

Men who have sex with men(MSM) are at high risk of HIV/syphilis. To inform strategies for dual testing, we describe patterns of HIV/syphilis testing, and examine factors associated with never testing for HIV/syphilis in China.

### **Methods**

An online survey(2016) was completed by MSM from eight cities: men born biologically male, age  $\geq 16$  years, and had sex with another man at least once during their lifetime. Demographic, sexual behavioural and HIV/syphilis testing data were collected. Multivariable multinomial logistic regression identified characteristics associated with men who never tested for HIV/syphilis, compared to men who ever tested for both infections.

### **Results**

Overall, 2,105 men participated. Among them, 35.1%(738/2105) never tested for HIV/syphilis, and in those ever tested for HIV, only half (54.0%,709/1312) had tested for syphilis. Relative to men who had ever tested for both infections, those with increased probability of never testing for HIV/syphilis include non-gay sexual identity (prevalence odds ratio(POR) 1.86, 95%CI[1.45-2.37]), not disclosed their sexuality/sexual history with men other than their regular partner (POR 2.22, [1.75-2.78]) or with health professionals (POR 11.11, [7.69-14.29]), no condomless sex with casual partners in the last three months (POR 1.89, [1.37-2.56]), no community

engagement in sexual health (POR 15.16, [9.40-24.45]), and mainly met partners offline (POR 1.49, [1.16-1.92]).

### **Conclusion**

There are significant gaps in lifetime testing for HIV/syphilis amongst Chinese MSM. Strategies to target never testers and integrate syphilis testing within HIV testing services are urgently needed. Future opportunities include point-of-care dual test kits, and testing in China's expanding primary healthcare system.

**Key words:** HIV, syphilis, China, men who have sex with men

## INTRODUCTION

HIV and syphilis syndemics remain pervasive issues against the backdrop of tremendous gains in public health in China(1). In particular, men who have sex with men (MSM) living in China continue to have disproportionately higher HIV and syphilis prevalence compared to others. There are an estimated 24 million Chinese MSM(2), with an HIV prevalence of approximately 7.7%(3) and syphilis prevalence of 13.5%(4). There are several drivers of the HIV/syphilis syndemic among MSM in China. First, both infections are inextricably linked by sexual transmission. As a result, the prevalence of syphilis is estimated to be 36.2% amongst Chinese MSM living with HIV(4) and MSM diagnosed with syphilis are 11 times more likely to become infected with HIV within 12 months(5). Second, compared with heterosexual males, MSM report higher numbers of sexual partners. On average, MSM in China report a mean of six anal sex partners in the last six months(6). Third, stigma and discrimination continue to affect health-seeking behaviors of MSM resulting in limited routine sexually transmitted infection (STI) screening(7).

Since 2003, China has significantly invested in expanding HIV testing through free voluntary counselling and testing (VCT), resulting in 25,762 testing sites across China at the end of 2014(3). These centres also offer syphilis testing, but not comprehensive STI testing. Men with STI symptoms or who require more comprehensive STI testing would attend dermatovenerology or STI clinics based in hospitals. However, uptake of syphilis testing in STI clinics may be limited by patient disclosure of sexual risk behaviours. In recent years, greater emphasis has been placed on expanding syphilis testing through VCTs, drug rehabilitation centers, hospitals and clinics dealing with STIs(9).

Screening for both HIV and syphilis is a high priority in WHO guidelines(13). The prevalence of syphilis and HIV may be reduced by regular screening amongst asymptomatic MSM(10, 11). Recent research to show the accuracy of point of care dual test kits have made this goal even more achievable(12) but more research is needed regarding the feasibility of offering these kits through testing providers in China. These kits allow simultaneous detection of two pathogens(12). Whilst much published literature has reported HIV and syphilis testing separately(4, 14), limited research has been published amongst MSM in China to examine syphilis testing amongst HIV testers, and vice versa. This study focused on describing the patterns of HIV and syphilis testing in Chinese MSM, and examine the factors which are associated with men who have never tested for HIV or syphilis, those who ever tested for HIV only and those who ever tested for both HIV and syphilis.

## **METHODS**

An online study among MSM living in eight cities from two provinces in China (Guangzhou, Jiangmen, Zhuhai, Shenzhen in Guangdong province, and Yantai, Jinan, Qingdao, Jining in Shandong province) was conducted from July to August 2016. This was a baseline survey of a randomized controlled trial (Trial number: NCT02796963). Men were recruited through an event notification message containing the survey link sent to active registered users in the eight cities through Blued (Blue Brother, Beijing, China), a gay social networking mobile phone application with 26 million users. Eligibility screening questions were initially asked to assess their inclusion criteria of being a man born biologically male, aged 16 years and older, and had oral or anal sex with another man at least once during their lifetime. If eligible, participants viewed the consent document for participation in the trial online, and clicked “I agree” if they were willing to

participate in the survey. The survey link was opened 39,764 times: 3,009 men were eligible and 2,105 men completed the survey.

The main outcome variables of lifetime HIV/syphilis testing history were a composite of two questions of men who answered whether they had ever tested for HIV and/or ever tested for syphilis in their lifetime (yes/no). Demographic variables included age (continuous), education (high school or lower, college or above), annual income ( $\leq$  \$2500, 2501-8500, 8501-14000,  $>$ 14000 USD) and household registration status (rural, urban). Sexual history included their sexual identity (gay, non-gay), disclosure of sexuality or sexual history with men other than usual partner (yes/no), disclosure of sexuality or sexual history with healthcare providers (yes/no), where they usually met their sexual partners (online (i.e. social media/websites) or offline (i.e. friends, pub/disco/clubs, spa/bath house/sauna, park/public restroom/public lawn)), consistency of condom use when having anal sex with casual partners in the preceding 3 months (always use, not always), and transactional sex (i.e. whether they had ever exchanged gifts/money for sex - yes/no). We asked men if they had any condomless sex with a casual partner in the last 3 months. The level of community engagement in sexual health was defined through six questions related to involvement of specific activities(15). HIV stigma was assessed through seven questions, and presented as a mean score on a scale between 1 to 4, with higher scores indicating greater HIV stigma(16).

### **Statistical analysis**

Descriptive analysis was used to describe the testing history. We compared the demographics and sexual behavioral characteristics of men, according to their lifetime HIV/syphilis testing



history. We excluded men who ever tested for syphilis only as the numbers were too small (n=55) and did not have enough variability for later multivariable regression analysis. To test for statistical differences between men in the three testing groups, chi-square tests were used for categorical data and ANOVA for continuous data. Multivariable multinomial logistic regression was used to identify demographic and sexual behavioural characteristics associated with men's testing history. The dependent variable was categorized into three groups (i.e. men who never tested for HIV or syphilis, and those who tested for HIV only, and men who ever tested for both HIV and syphilis) with the last group as the reference group. Results are presented as prevalence odds ratios (POR) with 95% confidence intervals and p values. We adjusted for age, education, annual income and household registration status. All analyses were conducted in STATA 13.1 (StataCorp, College Station, TX, USA).

Ethics approval was obtained from the ethics review committees at the Guangdong Provincial Center for Skin Diseases and STI Control, the University of North Carolina at Chapel Hill, and the University of California, San Francisco.

## **RESULTS**

A total of 2,105 men who completed the survey: approximately a third of men had never tested for HIV or syphilis (35.1%, n=738), a third had ever tested for either tested for HIV or syphilis (31.3%, n=658) and a third had ever tested for both HIV and syphilis (33.7%, n=709). Of note, almost all men (92.8%, 709/764) who had ever tested for syphilis had also tested for HIV, but only 54% (709/1312) of men who had ever tested for HIV, had also tested for syphilis.

Table 1 shows the differences in the demographics, sexual identity, sexual behaviors, community engagement and anticipated HIV stigma, according to the man's HIV and syphilis testing history. Table 2 shows the significant factors associated with the man's testing history from the multivariable multinomial logistic regression analysis.

## **DISCUSSION**

There are significant gaps in lifetime testing for HIV and syphilis amongst MSM in China. A third of men had never tested for both HIV and syphilis. Our study contributes to previous studies emphasizing the need for expanding HIV and syphilis testing(14, 17) and adds to this growing literature by demonstrating that amongst HIV testers, only half reported ever testing for syphilis. This highlights the missed opportunities and urgent need to integrate syphilis testing within HIV prevention programs. Whilst HIV testing sites like VCTs or methadone maintenance sites have integrated syphilis testing with HIV testing, further strategies must be considered for men presenting to other settings like dermatovenereology/STI clinics/general practice. For example, using computer alerts for clinicians or an opt-out syphilis test have been shown to increase syphilis testing rates(18, 19).

Integrating STI testing with HIV testing is recommended by the World Health Organization(21). Unlike high-income countries where MSM specific services offer free, comprehensive STI testing (including HIV, syphilis, chlamydia, gonorrhoea) routinely, this is not the case in China where HIV and STI testing services are often disconnected. In Australia, the increase of syphilis testing among MSM in the last decade has resulted in increased detection of asymptomatic infectious syphilis and reductions in secondary syphilis diagnoses(22). This suggests the

opportunity for China to continue to leverage the existing HIV testing infrastructure to include additional syphilis testing. To simplify testing for both infections, there are promising advances in point-of-care (POC) testing technologies that enable dual testing with the same blood sample. These immunochromatographic assays detect HIV and syphilis antibodies concurrently and are fast (i.e. receiving a result within 20 minutes), accurate, inexpensive and do not require trained personnel or refrigeration(23). In recent years, several dual HIV and syphilis tests using blood from a finger-prick are available(24), enabling decentralized testing (e.g. from the community-based organizations(8). But before POC tests can be scaled up for MSM, there is a need to develop highly sensitive non-treponemal specific and treponemal specific POC tests to distinguish past from active syphilis infection in MSM(27). Another opportunity lies in leveraging the expanding network of primary care physicians in China to test for HIV and syphilis routinely. Since 2009, nearly 9,000 community health centers was established by 2014(28). A recent nationwide study of primary care clinics in China reported that primary care physicians were willing to provide STI testing and management(29).

We found a third of MSM had never tested for HIV or syphilis, consistent with other Chinese research(14, 17). Men who had never tested for HIV or syphilis compared with men who had tested for both HIV and syphilis were less likely to disclose their sexuality/sexual behaviors to others and to health professionals. However we did not find anticipated HIV stigma to be a significant mediator of the likelihood to test. It may be possible that other factors such as the perceived lack of confidentiality and the inconvenience of testing continue to drive MSM away from public clinics that offer free HIV and syphilis testing(30). To address these issues, innovative service delivery models to promote HIV/STI testing are underway. This includes

promoting HIV self-testing using social entrepreneurship(31), offering community-based testing services(8, 30), promoting testing services through the internet (32) and utilizing participatory approaches for HIV test promotion(33). Other significant factors affecting a man's testing history were non-gay sexual identity, and the lack of community engagement in sexual health. Together this suggest a group of men that may be disconnected from the gay community and thereby, less likely to be impacted by public health campaigns aimed at the gay community in China. Further research, for example. using discrete choice experiments to elicit their heterogenous preferences, is needed to inform alternate strategies to promote HIV and syphilis testing among this group. Further, men who mainly met partners offline and did not have condomless anal sex with casual partners were less likely to test for HIV and syphilis. This may reflect a group of men who perceive themselves as having less risk of being infected with an STI, thereby influencing their decision not to test. Similarly, campaigns should be directed at improving their sexual health knowledge, and advise for an annual comprehensive STI test for sexually active MSM.

The findings of this study should be read in light of some limitations. First, although we were successful in reaching over 2000 MSM via an online survey, it may not be generalizable to all MSM in China. Second, we do not know the timing of testing for HIV and syphilis, i.e. whether HIV and syphilis were conducted during the same visit or separately. Ideally, MSM should be offered comprehensive testing which should include at least an annual HIV and syphilis test(21). Third, for blood tests, self-reported testing may be an underestimate if a man was not aware of all the tests ordered by the clinician. Last, social desirability bias may have influenced the result although this would be minimized from the anonymous nature of the survey.

## CONCLUSION

Despite policy changes in China within the last decade to improve HIV and syphilis testing, there remains a significant proportion of MSM who have never tested for HIV and/or syphilis. In particular, there are missed opportunities to test for syphilis amongst MSM who are already testing for HIV. Continued efforts should be made to integrate syphilis testing within current HIV testing infrastructure. In addition, employing dual POC testing as technology continues to develop, and harnessing the growing and improved primary health care system in China may provide the opportunity to curb this syndemic of HIV and syphilis.

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**Table 1 – Demographics of an online survey of men who have sex with men, who never tested for HIV/syphilis, ever tested for HIV and who ever tested for both HIV and syphilis, China in 2016.**

Variable	Never tested for HIV/ syphilis (n=738) n (%)	Ever tested for HIV only (n=603) n (%)	Ever tested for both HIV and syphilis (n=709) n (%)	P value <sup>\$</sup>
Mean age $\pm$ standard deviation	24.1 $\pm$ 6.1	26.0 $\pm$ 6.3	27.7 $\pm$ 6.3	<0.001
<i>Household registration status</i>				
- Rural	362 (49.0)	258 (42.8)	288 (40.6)	
- Urban	376 (51.0)	345 (57.2)	421 (59.4)	0.004
<i>Highest education level attained</i>				
- High School or lower	314 (42.5)	181 (30.0)	229 (32.3)	
- College or higher	424 (57.5)	422 (70.0)	480 (67.7)	<0.001
<i>Annual Income (\$USD)</i>				
- $\leq$ 2500	204 (27.6)	115 (19.1)	65 (9.2)	
- 2501-8500	393 (53.3)	321 (53.2)	371 (52.3)	
- 8501-14000	93 (12.6)	110 (18.2)	169 (23.8)	
- > 14000	48 (6.5)	57 (9.5)	104 (14.7)	<0.001
<i>Sexual identity</i>				
- gay	485 (65.7)	452 (75.0)	550 (77.6)	
- non-gay	253 (34.3)	151 (25.0)	159 (22.4)	<0.001
<i>Disclosed sexuality or sexual history with men other than usual partner</i>				
- Yes	444 (60.2)	427 (70.8)	524 (73.9)	
- No	294 (39.8)	176 (29.2)	185 (26.1)	<0.001
<i>Disclosed sexuality or sexual history with</i>				

<i>health providers</i>				
- Yes	63 (8.5)	173 (28.7)	355 (50.1)	
- No	675 (91.5)	430 (71.3)	354 (49.9)	<0.001
<i>Condomless sex with casual partner in the last 3 months</i>				
- Yes	77 (10.4)	92 (15.3)	137 (19.3)	
- No	661 (89.6)	511 (84.7)	572 (80.7)	<0.001
<i>Ever had sex with female</i>				
- Yes	156 (21.1)	136 (22.6)	184 (26.0)	
- No	582 (78.9)	467 (77.4)	525 (74.0)	0.086
<i>Transactional sex</i>				
- Yes	86 (11.7)	80 (13.3)	88 (12.4)	
- No	652 (88.3)	523 (86.7)	621 (87.6)	0.671
<i>Community engagement in sexual health*</i>				
- Substantial	138 (18.7)	143 (23.7)	266 (37.5)	
- Moderate	251 (34.0)	319 (52.9)	378 (53.3)	
- Minimal	153 (20.7)	66 (11.0)	40 (5.6)	
- No engagement	196 (26.6)	75 (12.4)	25 (3.5)	<0.001
<i>Mainly meet partners</i>				
- Online	528 (71.5)	455 (75.5)	569 (80.3)	
- Offline	210 (28.5)	148 (24.5)	140 (19.7)	0.001
<i>Anticipated HIV stigma<sup>#</sup> (mean ± standard deviation)</i>	2.03 ± 0.64	2.00 ± 0.65	2.06 ± 0.65	0.267

\*Community engagement in sexual health as defined by six questions(15); <sup>#</sup> Score ranges from 1-4 with a higher number associated with higher anticipated stigma to HIV(16)

<sup>§</sup> The p values indicate whether at least one of the groups was significantly different from the others (p<0.05).

**Table 2 – Multinomial logistic regression of MSM who never tested for syphilis or HIV, or ever tested for either HIV or syphilis, compared to men who had ever tested for both HIV and syphilis, China (2016)**

Characteristic	Never tested vs. ever tested for both HIV and syphilis Adjusted POR# (95% CI)	P value	Ever tested HIV only vs. ever tested for both HIV and syphilis Adjusted POR# (95% CI)	P value
<i>Sexual identity</i>				
- gay	Reference		Reference	
- non-gay	1.86 (1.45-2.37)***	<0.001	1.16 (0.90-1.51)	0.25
<i>Disclosed sexuality or sexual history with men (other than usual partner)</i>				
- Yes	Reference		Reference	
- No	2.22 (1.75-2.78)***	<0.001	1.26 (0.98-1.61)	0.07
<i>Disclosed sexuality or sexual history with health providers</i>				
- Yes	Reference		Reference	
- No	11.11 (7.69-14.29)***	<0.001	2.95 (2.25-3.88)***	<0.001
<i>Condomless sex with casual partner in the last 3 months</i>				
- Yes	Reference		Reference	
- No	1.89 (1.37-2.56)***	<0.001	1.29 (0.96-1.73)	0.09
<i>Ever had sex with female</i>				
- Yes	Reference		Reference	
- No	1.27 (0.97-1.66)	0.09	1.06 (0.81-1.40)	0.66

<i>Transactional sex</i>				
- Yes	Reference		Reference	
- No	0.93 (0.67-1.30)	0.68	0.86 (0.62-1.20)	0.38
<i>Community engagement in sexual health</i>				
- Substantial engagement	Reference		Reference	
- Moderate engagement	1.39 (1.06-1.82)*	0.02	1.63 (1.26-2.10)***	<0.001
- Minimal engagement	6.93 (4.56-10.52)***	<0.001	2.96 (1.89-4.62)***	<0.001
- No engagement	15.16 (9.40-24.45)***	<0.001	5.62 (3.40-9.27)***	<0.001
<i>Mainly meet partners</i>				
- online	Reference		Reference	
- offline	1.49 (1.16-1.92)**	<0.01	1.28 (0.98-1.67)	0.07
<i>Anticipated HIV stigma</i>	0.85 (0.72-1.01)	0.06	0.86 (0.73-1.03)	0.10

# adjusted for age, education, income, household registration status, \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ , POR= prevalence odds ratio, 95% CI = 95% confidence interval