

Sexually Transmitted Infection Testing and Associated Factors Among Men Who Have Sex with  
Men in China

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**Abstract**

Sexually Transmitted Infection Testing and Associated Factors Among Men Who Have Sex with Men in China

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**OBJECTIVE:** Sexually transmitted infection (STI) testing allows timely diagnosis and treatment and is therefore an effective STI prevention strategy. Yet, little is known about sexually transmitted infection (STI) testing rates and behaviors among men who have sex with men (MSM) in China. This study sought to examine the prevalence of recent STI testing and associated factors among HIV-negative/unknown Chinese MSM and compare recent STI and HIV testing.

**METHODS:** An online cross-sectional survey was conducted among users of a gay geosocial networking app in April 2018 in 4 Chinese provinces. For this analysis, we included cis-gender men who were 18 years and older without a prior HIV diagnosis who reported anal sex with a man in the past 6 months. We used log-binomial regression models to identify sociodemographic and behavioral correlates of STI testing in the last 6 months (recent STI testing) and McNemar's test to compare recent STI vs. HIV testing.

**RESULTS:** Of 2,872 HIV-negative/unknown cis-MSM, 962 (33.5%) reported recent STI testing, of whom 13% reported being diagnosed with an STI, including 6.4% with syphilis, 1.5% gonorrhea, 0.5% chlamydia, 5.4% HPV/genital warts, and 1.1% other STIs. In multivariate analysis, recent STI testing was associated with being older (>45 years old vs. 18-24), being employed, more frequent condom use during anal sex, being in an ongoing sexual relationship with an HIV-positive partner or a monogamous relationship with an recently tested HIV-negative partner, and substance use in the past 6 months ( $p<0.05$  for all). Men were more likely to have tested recently for HIV than for STIs (50% vs 34%) with only 57% of those testing recently for HIV also testing for STIs and 84% of those testing recently for HIV also testing for HIV ( $p<0.0001$ ).

**CONCLUSION:** Only a third of geosocial network app-using Chinese MSM reported testing for any STI in the last 6 months, with even lower testing reported by young MSM and students, and significant missed opportunities for concurrent HIV and STI testing. Integrating HIV and STI testing has potential to increase STI testing among Chinese MSM, and additional efforts are needed to reach young MSM with STI services.

## INTRODUCTION

Men who have sex with men (MSM) are disproportionately affected by sexually transmitted infections (STIs) globally<sup>1</sup>. In China, there is increasing concern about STIs among MSM. Over the last two decades, studies among Chinese MSM have found that the prevalence of STIs other than HIV are consistently greater than among the general population, although these prevalences have varied widely across studies. Two meta-analyses provided pooled estimates for gonorrhea of 1.9%, chlamydia 6.3%, syphilis 13.5%, human papillomavirus 66.3%, and herpes simplex virus type 2 of 10.6%<sup>2,3</sup>. More recent studies of bacterial STIs have found a prevalence of 12.5% and 18.1% for gonorrhea and chlamydia, respectively<sup>4</sup>, and syphilis ranging from 5.8-19.2% and an incidence rate of 3.9 and 7.8 per 100 person-years<sup>5-10</sup>. Of concern, a cross-sectional study in seven cities in China showed that only 35.7% of the participants with suspected STIs sought treatment in clinics within 12 months of symptom onset<sup>11</sup>. Identifying MSM with STIs and ensuring their successful linkage to care are critical to controlling STI transmission.

Promoting regular STI testing is an efficient strategy for screening potential cases among individuals at risk<sup>12</sup>. A mathematical modeling study in the U.S. suggested that increasing STI testing frequency could reduce the incidence of several infections among MSM<sup>13</sup>. In many industrialized areas such as the United States, Australia, and Europe, public health guidelines recommend that MSM test for syphilis, gonorrhea, and chlamydia at least annually<sup>12,14,15</sup>. In the U.S., those who have multiple or anonymous partners, with a prior STI diagnosis, or take HIV pre-exposure prophylaxis should test more frequently<sup>13</sup>. To date, there are no formal STI testing guidelines for MSM in China.

In recent years, interventions such as social media campaigns, engaging communities in public health interventions, and online distribution of HIV self-tests have shown to successfully increase HIV testing among Chinese MSM<sup>16-18</sup>. A systematic review of studies from 2000 to 2011 on HIV testing among MSM in China found that the rate of lifetime HIV testing had increased from 21% to 38%<sup>19</sup>. However, interventions to increase HIV testing rarely address other STIs and the uptake of STI testing remains low. In many cases, MSM in China need to attend dermatovenerology or STD clinics in hospitals with full registration to receive comprehensive STI testing. Recent studies found that only about 30% of MSM had ever been tested for STIs, whereas almost four-fifths (79.2%) had tested for HIV<sup>20-23</sup>. In a population with high STI incidence, lifetime testing is insufficient. Moreover, prior research has generally focused on STI testing or diagnosis as potential predictors of HIV-related outcomes rather than as primary health outcomes. As a result, significant gaps remain in our understanding of STI testing behaviors among Chinese MSM, including sociodemographic characteristics and other behaviors. Identifying correlates of recent STI testing can identify subgroups of MSM in need of targeted STI prevention services and inform the development of strategies to increase STI testing.

Diagnosis with STIs has long been associated with HIV diagnosis and acquisition, and people living with HIV remain at high risk for bacterial STIs<sup>24-27</sup>. As a result, the point at which individuals seek HIV testing is an opportunity to offer STI testing particularly for those at higher risk for both infections and vice versa. Yet, services for HIV testing and STI testing are rarely co-located or integrated in China and many other settings<sup>28</sup>. Comparing histories of recent HIV

and STI testing can quantify missed opportunities and perhaps motivate the integration of these services.

In 2018, a cross-sectional survey was conducted among users of Blued, the largest gay geosocial networking mobile application in China, to gauge willingness to use HIV prevention interventions among Chinese MSM. Using data from this survey, the current study seeks to examine STI testing behaviors among Chinese MSM, identify sub-groups of MSM for whom additional STI testing services are needed, and quantify missed opportunities for concurrent HIV/STI testing.

## **METHODS**

### ***Study design and participant recruitment***

We conducted secondary analyses using data from an online cross-sectional survey conducted among MSM living in four provinces of China (Beijing, Tianjin, Yunan, and Sichuan) in April 2018. Men were recruited using pop-up messages, advertising, and point-to-point notifications on Blued, a geosocial networking mobile application popular among MSM in China. Eligibility criteria for the survey included: reporting male sex at birth, aged 18 and older, a current Blued user, and residing in the four provinces. If eligible, participants were asked to view the consent document and click “I agree” if they were willing to participate in the online survey. The survey was conducted in Mandarin Chinese using Sojump ([www.sojump.com](http://www.sojump.com)), or “Wenjuanxing”, a Chinese language survey platform. No personal identifiers were collected or stored. For the current analysis, participants were restricted to cis-gender men who reported having had anal sex with a male partner in the past 6 months and never having tested HIV positive.

### *Study measures*

The survey collected information on sociodemographic characteristics including age, area of residence, education, and income level, as well as sexual behaviors, substance use, and HIV/STI testing and prevention. The primary outcomes of interest for this analysis were self-reported STI testing and diagnoses in the past 6 months. An STI diagnosis was defined as having been told by a healthcare provider that they had at least one of the following STIs: syphilis, gonorrhea, chlamydia, HPV/genital warts, and others. Separately, respondents were asked if they had ever tested for HIV and, if so, when their most recent HIV test occurred.

### *Analysis*

First, we described the proportion of participants who reported testing for STIs and being diagnosed with an STI in the past 6 months. Second, we examined associations between sociodemographic characteristics, sexual behaviors, and substance use with recent STI testing using bivariate logistic regression models. Results were reported as prevalence ratios (PRs) with corresponding 95% confidence intervals (95% CI). All variables that were significant at  $p < 0.05$  in bivariate analyses except income were included in a multivariate logistic regression model to identify independent correlates of recent STI testing. Income level and employment status were strongly correlated in our population, and employment is directly linked to requirements for STI screening as well as insurance coverage for STI testing in China. We therefore excluded income level from the multivariate model to reduce issues related to multicollinearity. Third, in order to identify missed opportunities for concurrent HIV/STI testing, we assessed the association between recent STI testing and time since most recent HIV test using Pearson's chi-square test

and the association between recent STI testing and HIV testing in the last 6 months using McNemar's test. Data were analyzed using R software.

### ***Ethical statement***

The study protocol and procedures were approved by Emory University Institutional Review Board and by the IRB for the National Center for AIDS/STD Control and Prevention in China.

## **RESULTS**

### ***Participant characteristics***

Overall, 4,627 participants completed the survey, of whom 4,203 (90.8%) reported being HIV-negative or of unknown HIV status. Among the 4,203, 3,912 (84.5%) identified as cis-gender men and 2,872 (62.1%) reported having had anal sex with a man in the past 6 months and were thus included in our analyses. The mean age of these participants was 28.9 years old, ranging from 18 to 77 years (Table 1). A majority were Han ethnicity (92.6%), had at least a college degree (82.3%), and were employed (73.9%). Nineteen percent were current students, and 59.1% had a monthly income of 7,000 CNY (about 1,000 USD) or less. Most participants identified as homosexual/gay (73.3%) or bisexual (25.8%), while 0.9% identified as heterosexual or other sexual orientations. Three-quarters (74.6%) had ever tested for HIV, and half (49.7%) reported receiving an HIV test in the past 6 months. More than half (55.8%) reported always using condoms during anal sex in the past 6 months, while only 8.2% said they never used condoms. Forty-two percent had a history of substance use in the past 6 months, 96.8% of whom reported using rush poppers.

### ***STI testing and diagnosis***

Of the 2,872 participants, 962 (33.5%) reported testing for STIs in the past 6 months. Of those who reported testing, 125 (13%) reported having been told by a health care worker that they had an STI, including 6.4% diagnosed with syphilis, 1.5% with gonorrhea, 0.5% with chlamydia, 5.4% with HPV/genital warts, and 1.1% with other STIs including urinary tract infection and genital herpes.

### ***Correlates of recent STI testing***

Correlates of recent (within past 6 months) STI testing among MSM in China are presented in Table 2. In bivariate analyses, recent STI testing was associated with older age, having higher income, being employed, using condoms more frequently during anal sex, substance use, and reporting being in an ongoing sexual relationship with an HIV-positive partner or a mutually monogamous relationship with an HIV-negative partner ( $p < 0.05$  for all). In the multivariate analysis, recent STI testing remained associated with being older (>45 years old vs. 18-24), being employed, more frequent condom use during anal sex, in an ongoing sexual relationship with an HIV-positive partner or a monogamous relationship with an HIV-negative partner, as well as a history of substance use ( $p < 0.05$  for all).

### ***Association between STI testing and HIV testing history***

Recent STI testing was strongly associated with more recent HIV testing; the percent of participants reporting STI testing in the last 6 months increased from 3.6% among participants who had never tested for HIV to 61.5% among those reporting an HIV test in the last 3 months ( $p < 0.0001$ , Table 3). Among the 1,428 who received an HIV test in the past 6 months, half

(49.7%) had tested for an STI during the same period (Table 4). Conversely, of the 962 who tested for STIs during the last 6 months, 84.4% had tested for HIV during the same period.

## **DISCUSSION**

In this study of HIV-negative/unknown Chinese MSM recruited on an LGBTQ geosocial networking app, a third of MSM reported STI testing in the past 6 months, similar to prevalences of lifetime STI testing reported by Chinese MSM in previous research<sup>20-23</sup>. Of those reporting recent STI testing, 13% had been diagnosed with at least one infection during this time period, in the center of the range of overall STI prevalences from prior studies in this population, which have varied from 1.9% to 19.2% depending in part on the population and infections studied<sup>2-10</sup>. Syphilis and human papillomavirus were the most commonly reported diagnoses; however, it was not possible to determine whether these reports reflect higher prevalence or more common testing and evaluation for these infections.

MSM who were older, employed, used condoms frequently, used illicit substances, and were in an ongoing relationship with either an HIV-positive partner or mutually monogamous HIV-negative partner were more likely to have tested for STIs in the last 6 months. The association between age, employment status and recent STI testing are consistent with findings among MSM in Singapore and the U.K.<sup>29,30</sup> In China, voluntary STI testing is generally not affordable and accessible to students, who tend to be younger and not covered by health insurance. It is therefore critical to identify effective interventions and programs to promote STI testing among students and other young MSM (YMSM). Notably, YMSM accounted for a considerable proportion of participants in this online survey. A recent study showed that YMSM in China

indicate high trustworthiness of STI information on MSM-dating apps and that their information seeking behaviors are associated with physician visits<sup>31</sup>. Taken together, the results indicate an opportunity to use online platforms to reach and disseminate sexual health information to Chinese MSM. Further research may examine the opportunities and barriers to STI testing among Chinese YMSM to enhance timely STI screening and treatment services.

The World Health Organization recommends integrating STI testing with HIV testing<sup>32</sup>.

Although recent HIV testing and STI testing were strongly associated in our study, fully half of the men who reported HIV testing in the last 6 months had not tested for STIs during this same period, and one in 6 men who reported an STI test had not tested for HIV. This represents significant missed opportunities for testing for both HIV and STIs, but particularly for STIs. In China, HIV and STI testing services are typically not well integrated. While robust efforts have been made to promote HIV testing in public hospitals, voluntary and counseling testing sites, community-based organizations (CBO), and through self-testing<sup>17,33,34</sup>, STI testing services are generally only available in hospital-based clinics. Due to stigma related to same-sex behavior and fear of disclosing these behaviors to providers, MSM often prefer to receive HIV testing services in MSM-friendly environments such as CBOs<sup>35</sup> where voluntary STI services are typically not available. Further, although combined HIV/syphilis testing is available in China, a recent study found that many MSM are unaware of the dual test, do not ask health care providers for the test, or perceived themselves to be at low risk for syphilis<sup>36</sup>. Our findings highlight the need to integrate HIV and STI testing services, including potentially expanding the use of dual HIV/STI tests and offering STI testing in more diverse settings. Furthermore, the correlates of recent STI testing we observed were similar to correlates of recent HIV testing in other studies of

Chinese MSM<sup>37,38</sup>, suggesting that men seeking HIV testing are similar to those who seek STI testing and that new efforts are needed to reach the sub-populations of MSM who are not being served by existing HIV or STI programs and campaigns.

There are several limitations to this study. First, MSM participating in this survey were recruited using the geosocial networking app Blued in four provinces in China; therefore, the generalizability of our findings to other geographic regions in China and to MSM who do not use Blued is uncertain. Second, our data relied on self-report and are therefore subject to social desirability bias and recall bias. Asking about testing in the last 6 months may reduce recall error but may not reflect testing frequency over a longer period of time. Also, questions about the timing of last HIV and STI test were not asked in the same way and were therefore not directly comparable. Lastly, the survey did not assess which STI(s) participants had been tested for, which may bias our estimates of recent STI diagnoses.

## **CONCLUSION**

Our study provides insight into STI testing behaviors and evidence to inform the development of interventions to promote STI testing among MSM in China. Recent STI testing among Chinese MSM is uncommon, especially among YMSM and students, indicating a need to improve STI services overall and specifically for these groups. In addition, there are substantial missed opportunities to provide comprehensive sexual health services, including integrated HIV and STI testing, when MSM seek either HIV or STI testing alone. Lessons from the successful HIV testing interventions of the last two decades and leveraging existing HIV testing services to offer STI testing have potential to increase STI testing. Further research should examine individual

and structural barriers and facilitators to STI testing and develop and evaluate strategies for increasing STI testing among Chinese MSM.

**Table 1. Characteristics of HIV-negative/unknown Blued users who reported anal sex in the past 6 months in China, 2018 (n=2,872)**

	n	%
<b>Sociodemographic Characteristics</b>		
Age		
18-24	1022	35.6
25-34	1231	42.9
35-44	429	14.9
>44	190	6.6
Province		
Beijing	1531	53.3
Tianjin	526	18.3
Sichuan	588	20.5
Yunnan	227	7.9
Ethnicity		
Han ethnicity	2659	92.6
Other ethnicities	213	7.4
Monthly income (CNY)		
<3,000	710	24.7
3,000-7,000	988	34.4
7,000-10,000	525	18.3
>10,000	649	22.6
Highest level of school completed		
Post-graduate and above	431	15.0
College	1935	67.3
High school and below	507	17.7
Employment status		
Employed	2122	73.9
Student	548	19.1
unemployed	93	3.2
other	109	3.8
Sexual orientation		
Homosexual or gay	2106	73.3
Heterosexual or straight	11	0.4
Bisexual	741	25.8
Other	14	0.5
<b>Sexual behaviors</b>		
Frequency of condom use during anal sex in the past 6 months		
Always	1603	55.8
Most of the time	729	25.4
Some of the time	316	11.0
Never	224	7.8
Anal sex with commercial partner(s) in the past 6 months		
	173	6.0
Partnership status		
In an ongoing sexual relationship with an HIV-positive partner	82	2.9
In a mutually monogamous relationship with a recently tested HIV-negative partner	573	20.0
Others	2217	77.1
Substance use in the past 6 months*		
Injected drugs that were not prescribed by a clinician in the past 6 months	1196	41.6
	10	0.3
<b>HIV/STI testing and diagnosis</b>		
Tested for STIs in the past 6 months		
	962	33.5
Told by a healthcare worker that they had an STI in the last 6 months (% among those tested for STIs)		
Syphilis	62	6.4
Gonorrhea	14	1.5
Chlamydia	5	0.5
HPV or genital warts	52	5.4
Others	11	1.1
At least one of the above STIs	125	13.0
HIV testing history		
Tested in last 3 months	1000	34.8
Tested 3-6 months ago	428	14.9
Tested 6-12 months ago	286	10.0
Tested more than 12 months ago	427	14.9
Never tested	731	25.4

\*Substance use includes any of the following: rush popper, meth, 0 capsule, G-spot liquid, K powder, Ecstasy, and "others".

**Table 2. Characteristics associated with STI testing in the past 6 months among HIV-negative/unknown Blued users in China, 2018 (n=2,872)**

	STI tested (N=962)		Not tested (N=1,910)		PR	95% CI	P-value	aPR	95% CI	P-value
	n	%	n	%						
<b>Sociodemographic characteristics</b>										
Age										
18-24	287	29.8	735	38.5						
25-34	424	44.1	807	42.2	1.23	1.06-1.42	0.0076	1.04	0.88-1.23	0.6432
35-44	171	17.8	258	13.5	1.42	1.17-1.72	0.0003	1.23	0.99-1.52	0.0507
>44	80	8.3	110	5.8	1.50	1.17-1.92	0.0014	1.42	1.00-1.86	0.0102
Province										
Beijing	536	55.7	995	52.1						
Tianjin	159	16.5	367	19.2	0.86	0.72-1.03	1.1039			
Sichuan	178	18.5	410	21.5	0.86	0.73-1.02	0.0928			
Yunnan	89	9.3	138	7.2	1.12	0.89-1.40	0.3225			
Ethnicity										
Han ethnicity	889	92.4	1770	92.7						
Other ethnicities	73	7.6	140	7.3	0.96	0.77-1.24	0.839			
Monthly income (CNY)										
<3,000	190	19.8	520	27.2						
3,000-7,000	322	33.5	666	34.9	1.23	1.02-1.46	0.0312			
7,000-10,000	192	20.0	333	17.4	1.37	1.12-1.67	0.0023			
>10,000	258	26.7	391	20.5	1.49	1.23-1.79	<0.0001			
Education										
Post-graduate and above	174	18.1	257	13.5	1.14	0.93-1.41	0.215			
College	609	63.3	1326	69.4	0.89	0.75-1.05	0.169			
High school or below	179	18.6	327	17.1						
Employment status										
Employed	769	79.9	1353	70.8						
Student	132	13.7	416	21.8	0.66	0.55-0.80	<0.0001	0.7466	0.60-0.93	0.0078
Unemployed	28	2.9	65	3.4	0.83	0.57-1.21	0.335	0.8854	0.61-1.29	0.5290
Other	33	3.5	76	4.0	0.84	0.59-1.18	0.312	0.8479	0.92-1.87	0.3596
Orientation										
Homosexual or gay	709	73.3	1397	73.1						
Heterosexual or straight	3	0.3	8	0.4	0.81	0.26-2.52	0.716			
Bisexual	247	25.7	494	25.9	0.99	0.86-1.14	0.893			
Other	3	0.3	11	0.6	0.64	0.20-1.98	0.435			
<b>Sexual behaviors</b>										
Frequency of condom use during anal sex in the past 6 months										
Always	551	57.3	1052	55.1	1.60	1.19-2.15	0.0017	1.73	1.29-2.33	0.0003
Most of the time	276	28.7	453	23.7	1.77	1.30-2.40	0.0003	1.84	1.35-2.51	0.0001
Some of the time	87	9.5	229	12.0	1.28	0.90-1.83	0.1633	1.31	0.92-1.87	0.1329
Never	48	5.0	176	9.2						
Anal sex with commercial partner(s) in the past 6 months	67	7.0	106	5.5	1.17	0.91-1.50	0.22			
Partnership status										
In an ongoing sexual relationship with an HIV-positive partner	46	4.8	36	1.9	1.88	1.39-2.53	<0.0001	1.84	1.36-2.48	<0.0001
In a mutually monogamous relationship with a recently tested HIV-negative partner	253	26.3	320	16.8	1.48	1.28-1.71	<0.0001	1.53	1.32-1.77	<0.0001
Others	663	68.9	1554	81.3						

Substance use in the past 6 months	515	53.5	1161	60.8	1.22	1.07-1.38	0.0025	1.22	1.07-1.39	0.0025
Injected drugs that were not prescribed by a clinician in the past 6 months	1	0.1	9	0.3	0.30	0.04-2.12	0.226			

\* Substance use includes any of the following: rush popper, meth, 0 capsule, G-spot liquid, K powder, Ecstasy, and "others".

**Table 3. Association between time since most recent HIV test and STI testing in the last 6 months (n=2,872)**

Time since most recent HIV test*	STI tested			Not tested			Total	
	n	col%	row%	N	col%	row%	n	col%
Tested in last 3 months	615	63.9	61.5	385	20.2	38.5	1000	34.8
Tested 3-6 months ago	197	20.5	46.0	231	12.1	54.0	428	14.9
Tested 6-12 months ago	63	6.5	22.0	223	11.7	78.0	286	10.0
Tested more than 12 months ago	61	6.3	14.3	366	19.1	85.7	427	14.9
Never tested	26	2.8	3.6	705	36.9	96.4	731	25.4
Total	962		33.5	1,910		66.5	2,872	

\*Pearson's chi-square test, p<0.0001

**Table 4. Association between HIV testing and STI testing in the last 6 months (n=2,872)**

Time since most recent HIV test*	STI tested			Not tested			Total	
	N	col%	row%	n	col%	row%	n	col%
Tested in last 6 months ago	812	84.4	56.9	616	32.3	43.1	1,428	49.7
Tested more than 6 months ago	150	15.6	10.4	1,294	67.7	89.6	1,444	50.3
Total	962		33.5	1,910		66.5	2,872	

\*McNemar's test, p<0.0001

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