Title: Low chlamydia and gonorrhea testing rates among men who have sex with men in Guangdong and Shandong Provinces, China

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CONFLICTS OF INTEREST AND SOURCE OF FUNDING

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Background

Although periodic chlamydia and gonorrhea testing is recommended for men who have sex with men (MSM), little is known about testing rates in China. This study examines chlamydia and gonorrhea testing rates and testing correlates among Chinese MSM.

Methods

An online survey of MSM was conducted in August 2017. Men aged 16 years or above who had ever had sex with a man were enrolled through a gay social networking mobile application. We asked men about their sexual behaviors, community engagement in sexual health, and previous testing for chlamydia, gonorrhea and HIV. Multivariable logistic regressions were used to examine the association of testing with community engagement and recent HIV testing.

Results

Of 1031 men, 819 (79.5%) were under 30 years of age, and 263 (25.5%) reported condomless sex in past three months. In total, 294 (28.5%) men tested for chlamydia, 315 (30.6%) men tested for gonorrhea, and 817(79.2%) men tested for HIV. One hundred and twenty-five (42.5%) men who received chlamydia testing and 134 (42.5%) men who received gonorrhea testing had substantial community engagement. Compared to men with no/minimal community engagement, men with substantial community engagement had greater odds of chlamydia testing (adjusted odds ratio [AOR] =2.8, 95%CI: 1.9-4.3) and gonorrhea testing (AOR=2.9, 95%CI: 2.0-4.4). Men with recent HIV testing were more likely

to have received chlamydia testing (AOR=1.5, 95%CI: 1.1-2.0) and gonorrhea testing (AOR=1.6, 95%CI: 1.2-2.1).

Conclusions

Chlamydia and gonorrhea testing levels are low among Chinese MSM. Integrating chlamydia and gonorrhea test promotion strategies into HIV prevention programs that engage MSM communities may help bridge the gap.

Summary

We found low chlamydia and gonorrhea lifetime testing rates among MSM in China and integrated STI/HIV testing programs that engage MSM may improve lifetime chlamydia and gonorrhea test uptake.

Keywords: chlamydia test; gonorrhea test; men who have sex with men; China

INTRODUCTION

Chlamydia and gonorrhea are the most common bacterial sexually transmitted diseases (STDs) worldwide.[1] Men who have sex with men (MSM) are at particularly high risk for infection. In China, prevalence estimates among MSM range from 8.0-24.0% for chlamydia, and 1.5-2.7% for gonorrhea.[2] Chlamydia and gonorrhea infection increase the risk of both transmitting and acquiring HIV,[3-5] and the rate of coinfection with HIV is high.[6] In addition to the risk of transmitting chlamydia and gonorrhea to male sex partners, MSM may also be a bridge for transmitting the two infections to their female sex partners. A previous study showed that up to 26.3% of Chinese MSM had recent sexual intercourse with women and only 25.6% consistently used condoms with female sex partners in the last six months.[7] Further, antimicrobial resistance (AMR) is becoming a global concern, and treatment options for drug-resistant gonorrhea strains are increasingly limited.[8] Early diagnosis and prevention of further transmission are crucial for controlling the spread and impact of drug-resistant gonorrhea.[9]

WHO guidelines suggest that if the prevalence of asymptomatic urethral and rectal chlamydia and gonorrhea infections is over 1-2%, the benefits of periodic testing for these two infections among MSM outweigh the harms and costs.[10] However, current STI control efforts are focused on controlling HIV and syphilis in most resourced limited low- and middle-income countries, including China. China has no guidelines for chlamydia and gonorrhea testing among MSM, and chlamydia is not a reportable STI. The expense of nucleic acid amplification tests for gonorrhea and chlamydia may also discourage testing.[10]

Given that China's universal healthcare system has many competing priorities with limited health resources, optimal gonorrhea and chlamydia testing frequency for Chinese MSM remains unknown. Periodic chlamydia and gonorrhea testing recommended by the WHO may be a challenging strategy for the country. However, it is also unwise to neglect the two infections among Chinese MSM due to the high prevalence in this group. Other less complicated and costly alternative screening strategies in MSM may be worth consideration, such as testing chlamydia and gonorrhea at least once in sexually active young MSM.

We conducted a cross-sectional survey among MSM recruited online from Guangdong and Shandong Provinces in China. The purpose of this study is to examine self-reported chlamydia/gonorrhea testing rates and factors associated with testing among a Chinese MSM population.

MATERIALS AND METHODS

Sampling

We conducted an online survey of 1,031 MSM in August 2017. We recruited men through a gay social networking dating app, Blued, by sending a survey invitation to registered users in eight Chinese cities (Guangzhou, Shenzhen, Zhuhai, and Jiangmen in Guangdong Province; Jinan, Qingdao, Yantai and Jining in Shandong Province). In both provinces, HIV and syphilis testing services are promoted in MSM but chlamydia and gonorrhea testing are only recommended among symptomatic men. Eligibility criteria for our study included the

following: 1) biologically male at birth, 2) 16 years old or above, 3) reported ever having anal sex with men, and 4) HIV negative or unknown HIV status. All survey data were anonymous and confidential, and online consent was obtained before the commencement of the survey. An incentive of 7.5 USD (50 Chinese Yuan) mobile phone top-up was provided to all participants.

Measures

We collected information about participants' sociodemographic characteristics including age, residence, marital status, highest education obtained, and annual income. We also collected sexual history, including sexual orientation (gay, bisexual/unsure), sexual orientation disclosure to healthcare providers (yes/no), and whether they had condomless sex with either men or women in past three months (yes/no). We obtained information about ever testing for HIV, syphilis, chlamydia or gonorrhea (yes/no), and their HIV testing in the past three months (yes/no). Community engagement was measured using a six-item construct validated in Chinese MSM. [11] These questions assessed whether men had (1) discussed HIV/STI testing or sexual health online, (2) awareness of ongoing sexual health community events, (3) encouraged someone to get tested for HIV/STDs, (4) accompanied someone to get tested for HIV/STDs, (5) volunteered to help provide sexual health services, or (6) helped organize a sexual health campaign. Participants who answered "yes" to items (1) and/or (2) were considered to have "minimal engagement"; (3) and/or (4) to have "moderate engagement", and (5) and/or (6) to have "substantial engagement".[11] Participants who answered yes to multiple items were categorized into the level of engagement corresponding with the highest item number. Participants did not answer "yes" to any items were considered to have no

151 engagement.

152 We also measured anticipated HIV stigma[12] and HIV testing self-efficacy.[13] The 7-item
153 anticipated HIV stigma scale asked participants about their own feelings about themselves if
154 they had HIV as well as perceived discriminating attitudes from other people. For example,
155 men were asked to rate level of agreement with "If I had HIV, I'd worry about people
156 discriminating against me". HIV testing self-efficacy was measured using a six-item scale,
157 measuring men's confidence about HIV testing. For example, we asked them about the level
158 of agreement with "You have confidence that you will undergo HIV testing regularly". We
159 used a four-point Likert format: strongly disagree (1), disagree (2), agree (3), strongly agree
160 (4) for responses to above scales. Scores for anticipated HIV stigma and self-efficacy ranged
161 from 1 to 4. A higher score indicated a higher level of anticipated stigma or better self-
162 efficacy.

163 **Statistical analysis**

164 Descriptive analysis was used to describe sample characteristics, including sociodemographic
165 backgrounds, sexual behaviors, HIV, syphilis, chlamydia and gonorrhea testing, anticipated
166 HIV-related stigma, HIV testing self-efficacy, and community engagement. Chi-squared tests
167 or independent samples t-tests were conducted to examine differences in characteristics
168 between testers and never testers for chlamydia and gonorrhea.

169 We carried out multivariable logistic regression analyses to examine factors associated with
170 chlamydia and gonorrhea testing behaviors, controlling for age, marital status, education,
171 annual income and province. No engagement and minimal engagement were grouped as one
172 category for regression analysis due to small cell numbers. We reported odds ratios, 95%

confidence intervals (CIs) and p values. A p-value of <0.05 was considered statistically significant. Data were analyzed using SPSS, version 25.

Ethical statement

Ethical approval was obtained from the institutional review committees at the Dermatology Hospital of Southern Medical University (14-1865) and the University of North Carolina at Chapel Hill (1R01AI114310) prior to the launch of the survey.

RESULTS

A total of 1031 men completed the survey. Figure 1 shows self -reported lifetime testing history of HIV, syphilis, gonorrhea and chlamydia. In total, 294 (28.5%) men ever tested for chlamydia, 315 (30.6%) men ever tested for gonorrhea, 473 (45.9%) men tested for syphilis, and 817 (79.2%) men tested for HIV. The socio-demographic and behavioral characteristics of the total sample, respondents who ever tested for chlamydia and gonorrhea, are shown in Table 1. The majority were aged under 30 years (819, 79.4%), never married (907, 88.0%), had an annual personal income of 8500 USD or below (779, 75.6%), and obtained up to a college education (649, 62.9%). About a quarter reported condomless sex with either men or women in past three months.

Over half of chlamydia (175, 59.5%) and gonorrhea (185, 58.7%) testers were living in Guangdong Province. The majority of chlamydia and gonorrhea testers were not students, had no children, self-identified as gay, and did not report condomless sex in past three months. Among chlamydia testers, 138 (46.9%) had any HIV testing, 92(31.3%) had facility-based HIV testing, and 97(33.0%) had HIV self-testing in the past three months. Among

gonorrhea testers, 152(48.3%) had any HIV testing, 101(32.1%) had facility-based HIV testing, and 106(33.7%) had HIV self-testing in past three months. Up to 125 (42.5%) of chlamydia testers and 134 (42.5%) of gonorrhea testers had substantial community engagement.

Compared to those who had never tested for gonorrhea or chlamydia, mean scores of HIV testing self-efficacy were significantly higher among those who had tested for chlamydia (3.26 vs 3.10, $p<0.001$) and gonorrhea (3.24 vs 3.10, $p<0.001$); anticipated HIV stigma mean scores were significantly lower among chlamydia (2.80 vs 2.91, $p=0.02$) and gonorrhea testers (2.81 vs 2.91, $p=0.04$) (Table 2). Multivariable logistic regression analyses showed that men living in Guangdong had higher odds of testing for chlamydia (adjusted odds ratio [AOR]= 1.6, 95%CI: 1.2-2.2) and gonorrhea (AOR=1.5, 95%CI: 1.1-2.0) compared to those who lived in Shandong (Table 3). The odds of testing for gonorrhea in men with high school/below education were 60% higher (AOR=1.6, 95%CI: 1.1-2.3) than those with university education or above.

After controlling for demographic variables, those who had substantial community engagement were significantly more likely to report ever testing for chlamydia (AOR =2.8, 95%CI: 1.9-4.3) and gonorrhea (AOR=2.9, 95%CI: 2.0-4.4), compared to men with no or minimal community engagement. Men with recent HIV testing were more likely to have received chlamydia testing (AOR=1.5, 95%CI: 1.1-2.0) and gonorrhea testing (AOR=1.6, 95%CI: 1.2-2.1). Further, each point increase in the HIV testing self-efficacy mean score was associated with higher odds of chlamydia (AOR=1.9, 95%CI: 1.4-2.6) and gonorrhea testing (AOR=1.8, 95%CI: 1.3-2.4) respectively (Table 3).

DISCUSSION

Chlamydia and gonorrhea are common STDs in China, but test uptake rates are low. We surveyed 1031 MSM in Guangdong and Shandong Provinces to analyze their chlamydia/gonorrhea testing history. This study extends the literature by examining chlamydia and gonorrhea testing uptake in a middle-income country. We found that less than one-third of men reported ever receiving a chlamydia or gonorrhea testing. Chlamydia/gonorrhea testing was associated with recent HIV testing and higher levels of community engagement.

We found low levels of lifetime testing for chlamydia and gonorrhea in MSM in China. We examined chlamydia and gonorrhea testing at a single time point in two provinces only. The study findings may not be generalizable to the entire MSM population in the country. Additionally, a self-administered online survey may be subject to social desirability bias and men might not be familiar with chlamydia and gonorrhea. But our study provides a snapshot of testing behaviors for these often neglected STDs in an important Chinese subpopulation. Our test uptake rates were similar to previous reports from China,[14] and lower than test uptake rates from high-income country MSM.[15 16] Many more men received HIV and syphilis testing, compared to the number of men who received chlamydia/gonorrhea testing. This may be due to China's focused efforts on HIV/syphilis prevention, without integration of chlamydia and gonorrhea testing services.[17] However, previous studies have shown that a substantial proportion of new HIV infections can be attributed to coinfection with chlamydia

or gonorrhea,[18 19] and screening for chlamydia/gonorrhea may be beneficial to the subset of MSM who are at higher risk of HIV acquisition.[20] To comprehensively address the HIV epidemic among MSM, there is a need for more attention to chlamydia/gonorrhea testing promotion in China.

We also found that chlamydia/gonorrhea testing was significantly associated with substantial community engagement in sexual health. It is worth noting, however, that men with more community engagement and who have been tested are more likely to take the survey than their counterparts. Our test uptake rates are likely over-estimates. This trend is consistent with previous literature showing improved HIV and syphilis testing uptake among individuals with higher community engagement.[11] A recent quasi-experimental study in China also found that engaging MSM in STI testing programs significantly improved men's dual chlamydia/gonorrhea test uptake.[21] There is currently a trend toward key population-led HIV prevention campaigns and strategies.[22-24] Integrating chlamydia and gonorrhea test promotion strategies into HIV prevention programs that engage MSM communities may help increase testing rates.

Chlamydia/gonorrhea testing was significantly associated with recent HIV testing, including both facility-based and self-testing. This may be partly attributable to the extensive HIV testing system in China, which may serve as a gateway for MSM to improve awareness of STIs such as chlamydia and gonorrhea. Previous literature has explored the potential for integrated syphilis/HIV testing.[25-27] Given that there is already a relationship between

chlamydia/gonorrhea testing and HIV testing, incorporating chlamydia/gonorrhea testing with existing HIV testing services may be a promising strategy to increase test uptake. Nonetheless, our cross-sectional survey approach evaluated lifetime chlamydia and gonorrhea testing, and the analyses do not imply a causal relationship between HIV testing and chlamydia/gonorrhea testing. Further research is needed to examine potential effects of HIV testing behaviors on chlamydia and gonorrhea test uptake in China.

CONCLUSION

Compared to HIV and syphilis testing levels, chlamydia and gonorrhea testing rates in Chinese MSM are suboptimal. Few STI services are integrated into HIV prevention programs in China. We found that chlamydia and gonorrhea testing behaviors had a significant association with men's community engagement in sexual health and their recent HIV testing. This suggests that integrating chlamydia and gonorrhea test promotion strategies into HIV prevention programs that engage MSM may be useful.

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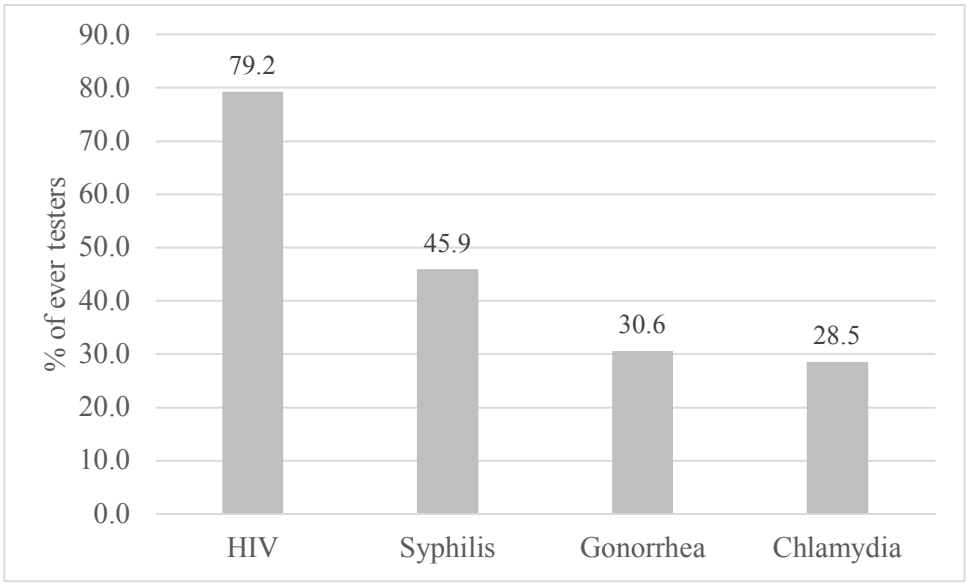

Figure 1: Percentage of MSM who reported to have ever tested for HIV, syphilis, gonorrhea, and chlamydia in 2017 in China (*N*=1031).