Community engagement on-site rapid test for chlamydia and gonorrhea among men who have sex with men: a pioneering study in Guangzhou, China

Xiao-Xin Lin1†, Si-Yan Meng2†, Wu-Jian Ke1, Xiao-Hui Zhang1, Liu-Yuan Wang1, Yu-Ying Liao1, Han Liu1, Pei-Zhen Zhao1, Chun-Mei Liang1, Hui-Ru Chen1, Hai-Ying Long1, Bin Yang1* and Li-Gang Yang1*

Abstract

Background: Chlamydia trachomatis (CT) and Neisseria gonorrhoeae (NG) infections are prevalent among men who have sex with men (MSM) in China. However, compared to syphilis and HIV, the testing rate for chlamydia and gonorrhea remains low. The purpose of this pilot study was to evaluate the feasibility for conducting rapid nucleic acid test for chlamydia and gonorrhea in MSM community-based organizations (CBO).

Method: We recruited our participants through an MSM CBO where free HV and syphilis testing were routinely provided. We collected data including social-demographic background, sexual history, chlamydia and gonorrhea testing history, and reasons for accepting this on-site rapid testing. Urine and/or anorectal swab samples were collected and tested for chlamydia and gonorrhea on-site and the testing results were delivered in about 1.5 h. Positive cases received on-site free treatment.

Results: From August 2020 to October 2020, 634 MSM visited the CBO for syphilis and HIV testing and 158 (158/634, 24.9%) accepted the on-site chlamydia and gonorrhea rapid test, 135 were finally enrolled. The positive rate for chlamydia was 16.3% (22/135) and 3.0% (4/135) for gonorrhea, respectively. Only 19.3% participants had previously undergone chlamydia and gonorrhea testing and 68.9% (93/135) participants reported that they had heard of gonorrhea, 47.4% (64/135) had heard of chlamydia. The main reason for testing was “free for charge” (66.2%), followed by “convenient, shorter waiting time” (45.2%) and “had high-risk sexual behavior recently” (16.3%).

Conclusions: This pilot study showed that the chlamydia and gonorrhea infection rate remains high among MSM, while the testing rate was low. On-site rapid testing is feasible and potentially preferred by MSM.

Keywords: Men who have sex with men (MSM), Chlamydia, Gonorrhea, Rapid nucleic acid testing, Community Engagement, Community-based Organization (CBO)

Background

Chlamydia and gonorrhea (CT/NG) are prevalent among men who have sex with men (MSM) with the rectum most likely to be infected, and asymptomatic infections are common [1–3]. A number of studies reported that the prevalence of chlamydia infection was 13.9–22.5% and gonorrhea...
infection was 5.3–11.0% among Chinese MSM [4, 5]. In order to prevent and control the spread of chlamydia and gonorrhoea in MSM population, WHO recommended periodic screening in MSM population, and this screening strategy was also recommended by the US CDC and other countries [6, 7].

Despite the high prevalence of chlamydia and gonorrhoea infection, chlamydia and gonorrhoea testing among MSM is not routinely performed in China. In China, testing for sexually transmitted infections including chlamydia and gonorrhoea is dominated by laboratory tests in sexual health clinics, while there are some common problems with getting tested at a sexual health clinic: low awareness to actively conduct chlamydia and gonorrhoea testing from either MSM or healthcare providers [8], stigma of visiting STI clinics [9], discomfort with taking or providing a detailed sexual risk assessment and sample collecting, and excessive waiting times and lack of walk-in services [10, 11]. These problems are particularly prominent in MSM population for those who experience barriers to receive care at clinic-based facilities [9, 12, 13]. In addition, there is no national guideline to guide the chlamydia and gonorrhoea screening among MSM population.

Studies suggested that NG/CT point-of-care test is welcomed and community engagement might be useful for promoting HIV and syphilis testing [14, 15]. For Chinese MSM, there are MSM-focused community-based sites serve as an out-of-clinic source of testing, while most of these testing sites only draw blood to test for HIV and syphilis, and do not test for chlamydia and gonorrhoea as for lacking of the ability to collect rectal samples. Advances in testing techniques have made self-sampling feasible, reliable and more popular among MSM people [11, 16]. In this study, we worked with a local MSM community-based organization (CBO) to deliver on-site testing.

Sample collection and testing
Prior to the start of the project, a GeneXpert automatic medical Polymerase Chain Reaction (PCR) analysis system (GeneXpert IV, Cepheid, Sunnyvale, California, USA) was installed in the MSM CBO. Nucleic acid amplification testing (NAAT) is the preferred method to detect *Chlamydia trachomatis* and *Neisseria gonorrhoeae* [17]. In 2012, the Cepheid Xpert chlamydia and gonorrhoea assay, a real-time PCR assay, was approved by FDA to test chlamydia and gonorrhoea from female endocervical swabs, vaginal swabs and female and male urine samples [18]. In 2019, the Xpert CT/NG (Cepheid) was further approved by FDA for extragenital diagnostic testing for these infections via throat and rectum samples. Training was provided to the medical personnel and research assistants who involved in the project. After the study began, the engineer from the company regularly carried out quality control and maintenance on the testing instruments.

After completing the survey, the participants were then instructed by a trained staff to collect urine sample or/and rectal swabs by themselves determined by their sexual history. We did not collect pharyngeal samples for corresponding testing because our previous study showed that the positive rate of chlamydia and gonorrhoea pharyngeal samples was much lower than that of rectal samples and limitations on the supply of testing reagents [3]. The staff put the samples into a GeneXpert collection kit and turned over 3–4 times to ensure that samples and reagents were well mixed, and then put into machine for testing. Testing results were told by CBO staff or as a message sent to participants in about 90 minutes. Any participants with a positive result would be provided following the Chinese STI clinical criteria included: male in gender; over 18 years old; self-reported history of anal sex (receptive or penetrative) with another man; no antibiotics use in the past 30 days.

At the MSM CBO site, after receiving their written consent, the eligible MSM were asked to finish an electronic questionnaire survey which included socio-demographic information (age, education, incomes and sexual orientation); sexual behavior information (the number of steady/casual sexual partners in past 6 months, receptive or penetrative and the frequency of condom use); testing history of HIV, syphilis and chlamydia and gonorrhoea. We also collected data about reasons for taking the test, the questions we asked including have you ever heard of chlamydia and gonorrhoea and the reasons for joining this on-site testing.

**Method**

**Setting and population**
The study was undertaken in a local MSM CBO in Guangzhou, China, named “Lingnan Partner Community Support Center”. This site was chosen because it was developed with strong input from MSM and provided free HIV/syphilis testing to local MSM. The CBO advertised the free chlamydia and gonorrhoea testing news to their target MSM who came to the CBO for free HIV/syphilis testing. Eligible MSM made testing appointment through the CBO Internet platform. The eligibility
management guidelines. All those who provided samples were informed of the results within two hours, and those who returned on the same day received treatment drugs on the same day. All positive patients were treated in the CBO.

Data analysis
To establish a database, one investigator entered the questionnaire data and laboratory results into Microsoft Office Excel forms. The IBM SPSS Statistics for Windows Version 23.0 (IBM Corp., Armonk, NY) was used to statistically analyze the dataset. Descriptive statistics were used to present questionnaire survey results and chlamydia and gonorrhea testing results.

Ethics
This research is part of a clinical trial. Ethical approval for this trial was obtained from the institutional review board at the Southern Medical University Dermatology Hospital (GDDHLS-20190503). All participants signed paper-based consent form before joining the study.

Results
From August 2020 to October 2020, 158 among 634 MSM who came to the CBO for HIV/syphilis testing accepted the testing invitations. We further excluded 23 MSM on site who did not fully meet the inclusion criteria. Finally 135 were enrolled in the study. Of the 135 participants, the median age was 30 years old (30.43 ± 6.53), and most of them lived in Guangzhou (120/135, 88.9%) with bachelor and above degree (95/135, 70.4%) (Table 1).

Of the 135 participants, determined by sexual history, 38 participants only provided rectal samples, 54 only provided urine samples, and 43 provided both rectal and urine samples. Three urine samples were excluded due to incorrect or invalid results from GeneXpert system. Therefore 81 rectal samples and 97 urine samples were finally analyzed.

In total, 22 participants tested positive for chlamydia and 4 participants tested positive for gonorrhea with at least one sample, the overall positive rate was 16.3% (22/135) for chlamydia and 3.0% (4/135) for gonorrhea, respectively (Table 2). For rectal samples, the chlamydia positive rate was 22.2% (18/81), and was 4.9% (4/81) for gonorrhea. For urine samples, the chlamydia positive rate was 6.2% (6/97) and was 1.0% (1/97) for gonorrhea. Of the 43 who provided both rectal and urine samples, 1 tested positive for chlamydia in urine sample only, 9 tested positive for chlamydia in rectal samples, only 2 tested positive for chlamydia in both rectal and urine samples, only 1 sample tested positive for gonorrhea in both rectal and urine samples (Table 2).

Table 1  Demographic characteristics and sexual history of 135 study participants attending the community based CT/NG testing in Guangzhou

| Characteristic | Number | %   |
|---------------|--------|-----|
| **Demographic characteristics** |        |     |
| Age (years)   |        |     |
| 18–30         | 78     | 57.8%|
| > 30          | 57     | 42.2%|
| Local living time |    |   |
| Less than 6 months | 12 | 8.9%|
| More than 6 months | 123 | 91.1%|
| Education     |        |     |
| Middle school or less | 3 | 2.2%|
| Senior school  | 6      | 4.4%|
| Secondary school or junior collage | 31 | 23.0%|
| Bachelor or above | 95 | 70.4%|
| **Sexual partners in past 6 months** |        |     |
| Number of regular sexual partners |        |     |
| 0 ~ 3         | 122    | 90.4%|
| > 3           | 13     | 9.6%|
| Number of casual sexual partners |        |     |
| 0 ~ 3         | 101    | 74.8%|
| > 3           | 34     | 25.2%|
| **The most recent sex** |        |     |
| < 30 days     | 98     | 72.6%|
| 30 ~ 60 days  | 25     | 18.5%|
| 60 ~ 180 days | 12     | 8.9%|
| Sexual partner |        |     |
| regular partner | 88   | 65.2%|
| casual partner | 47     | 34.8%|
| Anal sex or not |      |   |
| No            | 15     | 11.1%|
| Yes           | 120    | 88.9%|
| Active inserter | 52    | 43.3%|
| Passive receiver | 36    | 30% |
| Active and passive | 32  | 26.7%|
| Condom use    |        |     |
| Always        | 88     | 73.3%|
| Not all the time | 32  | 26.7%|

Table 2  The positive rate of chlamydia and gonorrhea among 135 participants by sample type

| Sample type | Number of samples | CT + ve (%) | NG + ve (%) | CT + NG + ve (%) |
|-------------|-------------------|-------------|-------------|------------------|
| Rectal      | 81                | 22.2% (18/81)| 4.9% (4/81)| 3.70% (3/81)     |
| Urine       | 97                | 6.2% (6/97)  | 1.0% (1/97) | 1.0% (1/97)      |

CT chlamydia, NG gonorrhea
For the chlamydia and gonorrhea knowledge and testing history, 68.9% (93/135) participants reported that they had heard of gonorrhea, 47.4% (64/135) had heard of chlamydia. Only 19.3% participants had previously undergone chlamydia and gonorrhea testing. Regarding on-site testing, in the multiple-choice questions “why are you willing to take this test”, the main reason for accepting the testing invitation was “free for charge” (66.2%), following by “convenient, shorter waiting time,” (45.2%) and “had high-risk sexual behavior recently” (16.3%) (Table 3).

**Discussion**

As far as we know, this study was the first on-site rapid testing for chlamydia and gonorrhea at MSM community in China. The whole process for sample collection, tests, and treatment were all conducted at MSM CBO. Compared with our previous study, 16.3% chlamydia positive rate was in accordance with our previous results, while the 3.0% gonorrhea positive rate was lower than the previous one. This is mainly because the previous study recruited participants from both STI clinic and MSM community [3]. The results further proved that chlamydia and gonorrhea were prevalent among MSM in Guangzhou. This study also found that despite the high prevalence of chlamydia and gonorrhea infection, more than half of participants had never heard of chlamydia, and only about 1/4 of them had been tested. We also investigated the reasons for taking the tests, beside the free of charge, almost half of participants thought CBO-based on-site testing was convenient and acceptable. This result informs us that on-site CBO-based testing is feasible.

WHO recommends asymptomatic MSM need to be tested for urethral and anorectal chlamydia and gonorrhea [6]. Our previous study along with this one support that regular screening of chlamydia and gonorrhea is necessary for the asymptomatic MSM in Guangzhou. Unfortunately, only minority of MSM had ever been tested in Guangzhou. Lack of awareness among MSM and healthcare providers, limited testing resources and facility capacity are all barriers to expand the tests. In addition, MSM may also be reluctant to go to medical facilities for testing because of possible discrimination [19]. In this pilot study, all the testing process were conducted at CBO, with the minimal training operator, occupied very small space, and provided results in a much shorter time (90 mins) than traditional test [18]. In addition, we provided treatment for positive participants on site, which is important to prevent the further transmission. Nearly half of the participants admitted that they came for the test as it was convenient and had shorter waiting time, proving that such a model of testing was attractive to the MSM.

This pilot study proved that on-site testing was feasible, but since there was no control group, it could not be concluded whether on-site testing was more popular with MSM although our questionnaire results showed that half of the participants consider on-site testing acceptable. One of the other limitations of this study is that we did not calculate the sample size in advance. Although the positive rate obtained was similar to that of our previous studies, the potential bias could not be ruled out.

**Conclusion**

Our preliminary findings demonstrated that chlamydia and gonorrhea tests at MSM CBO is feasible, while as we did not conduct a cost–benefit analysis, the sustainability of such testing is unclear. Multi-site studies, including cost–benefit evaluations, are needed before such model of testing could be implemented widely in Guangzhou or even throughout China.

**Table 3** Chlamydia and gonorrhea knowledge, testing history and reasons for attending the community-based chlamydia and gonorrhea testing (n = 135)

| Characteristic          | Number | %    |
|-------------------------|--------|------|
| Knowledge of CT and NG  |        |      |
| Previously heard of NG  | 93     | 68.9 |
| Previously heard of CT  | 64     | 47.4 |
| Testing history         |        |      |
| Previously tested of NG/CT | 34     | 25.2 |
| Reasons for attending this testing |    |      |
| Free of charge          | 84     | 62.2 |
| Convenient and short waiting time | 61 | 45.2 |
| Recent risk sex         | 22     | 16.3 |
| Medical staff recommendation | 14 | 10.4 |
| Friends recommendation  | 10     | 7.4  |

**Abbreviations**

CT: Chlamydia Trachomatis; NG: Neisseria Gonorrhoeae; MSM: Men who have Sex with Men; CBO: Community-based organization; HIV: Human Immunodeficiency Virus; PCR: Polymerase Chain Reaction; STD: Sexually Transmitted Diseases; WHO: World Health Organization.

**Acknowledgements**

The authors gratefully acknowledge the support of the Lingnan Partner Community Support Center (Guangzhou, China) and thank the many study participants who made this work possible.

**Authors’ contributions**

XXL and YLG designed the study. LXX, MSY and YLG wrote the initial manuscript. KWJ, ZXH, WLY, LYY, LH, ZPZ, LCM, CHH, and LHY did the data collection and analysis. LXX, MSY, YLG and YB edited the manuscript and completed the final revisions. All authors read and approved the final manuscripts.

**Funding**

This work was supported by the Bureau of Science and Information Technology of Guangzhou Municipality [201704020219]. The funder had no role in
study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Availability of data and materials
The datasets generated during and analyzed during the current study are not publicly available as following the hospital procedure but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical approval for this was obtained from the institutional review board at the Southern Medical University Dermatology Hospital (GDDHLS-20190503). Informed consent was obtained from all study participants. All methods were performed in accordance with the relevant guidelines and regulations.

Consent for publication
No applicable.

Competing interests
The authors declare that they have no competing interests.

Author details
1 Department of Sexually Transmitted Diseases, Dermatology Hospital, Southern Medical University, Guangzhou 510091, China. 2 UNC Project China, University of North Carolina at Chapel Hill, Guangzhou, China.

Received: 15 August 2021   Accepted: 18 May 2022

Published online: 24 May 2022

References
1. Chow EPF, Gruilch AE, Fairley CK. Epidemiology and prevention of sexually transmitted infections in men who have sex with men at risk of HIV. Lancet HIV. 2019;6:e396–405.
2. Kent CK, Chaw JK, Wong W, et al. Prevalence of rectal, urethral, and pharyngeal chlamydia and gonorrhea detected in 2 clinical settings among men who have sex with men: San Francisco, California, 2003. Clin Infect Dis. 2005;41:67–74.
3. Yang LG, Zhang XH, Zhao PZ, et al. Gonorrhea and chlamydia prevalence in different anatomical sites among men who have sex with men: a cross-sectional study in Guangzhou. China BMC Infect Dis. 2018;18:675.
4. Zhou Y, Cai YM, Li SL, et al. Anatomical site prevalence and genotypes of Chlamydia trachomatis infections among men who have sex with men: a multi-site study in China. BMC Infect Dis. 2019;19:1041.
5. Zhang X, Jia M, Chen M, et al. Prevalence and the associated risk factors of HIV, STIs and HBV among men who have sex with men in Kunming, China. Int J STD AIDS. 2017;28:1115–23.
6. WHO. Prevention and treatment of HIV and other sexually transmitted infections among men who have sex with men and transgender people. Recommendations for a public health approach, 2011. WHO; 2011. https://www.who.int/publications/i/item/9789241501750.
7. Workowski KA, Bachmann LH, Chan PA, et al. Sexually Transmitted Infections Treatment Guidelines, 2021. MMWR Recomm Rep. 2021;70:1–187.
8. Wong WCW, Cheng JY, Huang XY, Choi KWY, Yang LG. Decentralising Sexually Transmitted Infection testing for MSM population in China’s primary care. Travel Med Infect Dis. 2020;37:101714.
9. Refugio ON, Roberts C, West R, Klausner JD. Sexually transmissible infection control programs for men who have sex with men - what will they look like in 2020? Sex Health. 2017;14:126–32.
10. Lutz AR. Screening for Asymptomatic Extragenital Gonorrhea and Chlamydia in Men Who Have Sex with Men: Significance, Recommendations, and Options for Overcoming Barriers to Testing. LGBT Health. 2015;2:27–34.
11. Haddad MS, Bifulco L, McIntosh J, Garcia MMC. Rectal specimen self-collection for chlamydia and gonorrhea screening: a cross-sectional feasibility study at a community health center. Pilot Feasibility Stud. 2021;7:208.
12. Meulbroek M, Ditzel E, Szaj J, et al. BCN Checkpoint, a community-based centre for men who have sex with men in Barcelona, Catalonia, Spain, shows high efficiency in HIV detection and linkage to care. HIV Med. 2013;14(Suppl 3):25–8.
13. Mayer KH, Ducharme R, Zaller ND, et al. Unprotected sex, underestimated risk, undiagnosed HIV and sexually transmitted diseases among men who have sex with men accessing testing services in a New England bathhouse. J Acquir Immune Defic Syndr. 2012;59:194–8.
14. Ferreyra C, Redard-Jacot M, Wi T, Dally J, Kelly-Cirino C. Barriers to Access to New Gonorrhea Point-of-Care Diagnostic Tests in Low- and Middle-Income Countries and Potential Solutions: A Qualitative Interview-Based Study. Sex Transm Dis. 2020;47:698–704.
15. Zhang TP, Liu C, Han L, et al. Community engagement in sexual health and uptake of HIV testing and syphilis testing among MSM in China: a cross-sectional online survey. J Int AIDS Soc. 2017;20:21372.
16. Yared N, Horvath K, Fashanu O, Zhao R, Baker J, Kulasingam S. Optimizing Screening for Sexually Transmitted Infections in Men Using Self-Collected Swabs: A Systematic Review. Sex Transm Dis. 2018;45:294–300.
17. Cosentino LA, Campbell T, Jett A, et al. Use of nucleic acid amplification testing for diagnosis of anorectal sexually transmitted infections. J Clin Microbiol. 2012;50:2005–8.
18. Gaydos CA. Review of use of a new rapid real-time PCR, the Cepheid GeneXpert(R) (Xpert) CT/NG assay, for Chlamydia trachomatis and Neisseria gonorrhoeae: results for patients while in a clinical setting. Expert Rev Mol Diagn. 2014;14:135–7.
19. Wang R, Cui N, Long M, Mu L, Zeng H. Barriers to uptake of hepatitis C virus (HCV) health intervention among men who have sex with men in Southwest China: A qualitative study. Health Soc Care Community. 2021;29:445–52.

Publisher’s Note
Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.