Uptake and Correlates of Chlamydia and Gonorrhea Testing among Female Sex Workers in Southern China: A Cross-sectional Study

Peizhen Zhao (✉ 08tjzpz@163.com)
Dermatology Hospital of Southern Medical University

Ya-Jie Wang
Dermatology hospital of southern medical university

Huan-Huan Cheng
The Third Affiliated Hospital, SunYat Sen University

Ye Zhang
University of New South Wales

Wei-Ming Tang
Dermatology Hospital, Southern Medical University

Fan Yang
Dermatology Hospital, Southern Medical University

Wei Zhang
Dermatology Hospital, Southern Medical University

Ji-Yuan Zhou
School of public health, Southern medical university

Cheng Wang
Dermatology Hospital Southern medical university

Research Article

Keywords: Female sex workers, Chlamydia testing, Gonorrhea testing

DOI: https://doi.org/10.21203/rs.3.rs-55555/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License
Abstract

Background: Female sex workers (FSW) are at high risk of chlamydia and gonorrhea infection. However, there is a limited literature examining their testing uptake to date. The aim of this study was to assess the uptake and determinants of chlamydia and gonorrhea testing among FSW in Southern China.

Methods: A cross-sectional study with convenience sampling was conducted in five cities in Southern China. We collected data on socio-demographic characteristics, sex behaviors, chlamydia and gonorrhea testing in the past twelve months and the utilization of health care services from participants through face-to-face interviews. Multivariable logistic regression was performed to identify factors associated with chlamydia and gonorrhea testing, respectively.

Results: Overall, 1207 FSWs were recruited, with the mean age of 30.7±6.8 years old, and an average number of clients per week of 7.0(4.0-10.0). 65.4% participants consistently used condoms with clients in the past month. Only 7.5% and 10.4% had been tested for chlamydia and gonorrhea in the past twelve months, respectively. Multivariable analysis indicated that FSW who worked at low titers (adjusted Odds Ratio (aOR)=2.36, 95%CI:1.23-10.14), had more clients in past month (aOR=1.03, 95%CI:1.01-1.05), used condoms consistently (aOR=1.79, 95%CI:1.12-2.86), had STD symptoms (aOR=4.09,95%CI:2.62-6.40), had HIV testing (aOR=5.16, 95%CI:3.21-8.30) or syphilis testing (aOR=6.90, 95%CI:4.21-11.22) in the past year were more likely to have received chlamydia testing. In addition, FSW who had more clients in the past month (aOR=1.02,95%CI:1.00-1.04), had STD symptoms (aOR=3.33, 95%CI:2.03-5.46), had HIV (aOR=3.94, 95%CI:2.34-6.65) and syphils testing (aOR=3.27, 95%CI:1.96-5.46) in the past year were more likely to have gonorrhea testing.

Conclusions: The chlamydia and gonorrhea testing uptake are low among Chinese FSW. Integrating chlamydia and gonorrhea testing promotion strategies into HIV testing promotion programs may help bridge the gap among FSW.

Background

Chlamydia and gonorrhea are two major causes of reproductive tract morbidity [1], which can increase the risk of both acquiring and transmitting of human immunodeficiency virus (HIV)[2]. Female sex workers (FSW) are highly vulnerable to chlamydia and gonorrhea due to their frequent sexual contact with multiple concurrent sexual partners[3]. In China, the prevalence of chlamydia and gonorrhea among FSW is 13.6% and 6.1%, respectively[4], much higher than that of general 15–49 years old women (chlamydia 3.8%, and gonorrhea 0.9%)[5]. This situation is much worse among FSW from middle and low titer (8.0% and 20.0%, respectively)[6].

Untimely diagnosis and treatment of chlamydia and gonorrhea can lead to onward transmission[7] and severe complications, including pelvic inflammatory disease, infertility, ectopic pregnancy, miscarriage, premature delivery, and low birthweight[8]. Testing is a cost-effective strategy to prevent chlamydia and gonorrhea infection among FSW[9]. However, the current sexually transmitted disease (STD) prevention
services in low and middle-income countries (LMIC) are mainly focused on controlling HIV and syphilis[10], including China, while to date, limited studies are examining the chlamydia and gonorrhea testing uptake among FSW[11, 12]. Previous study in United States and Vietnam indicated that the asymptomatic infection of chlamydia and gonorrhea[13], low levels of knowledge[14], misperceptions of risk, stigma around STD [15], and cost[16] are the main barriers for improving testing uptake of chlamydia and gonorrhea among sexually active women. However, the uptake of chlamydia and gonorrhea testing and barriers among FSW in China are unclear now.

This study aims to examine self-reported chlamydia/gonorrhea testing rate and to determine associated factors among Chinese FSW.

**Methods**

**Study sites**

We conducted a venue-based cross-sectional study in Guangdong Province in Southern China. Guangdong Province was chosen for this study because of a high burden of chlamydia and gonorrhea. In 2018, the average burden of chlamydia and gonorrhea in China was 50.3 and 9.6 cases per 100,000 population with Guangdong Province reporting 70.1 and 27.9 cases per 100,000 population, respectively [17]. Guangdong has consistently ranked first by the number of newly reported chlamydia and gonorrhea cases in China during the last decade[18].

**Study participants**

Five cities (Jiangmen, Zhuhai, Yunfu, Jieyang and Yangjiang) in Guangdong Province were selected to implement this research between August 2018 and December 2018 based on local capacity of FSW outreach programs, and to encompass areas where STD were highly prevalent.

Each of the five cities has a FSW outreach team composed of medical professionals (nurses and/or physicians), and public health staff. These outreach teams have extensive FSW outreach services experience, which were able to provide reproductive health and STD counseling in addition to public health interventions. FSW outreach programs included regular visits to FSW settings to conduct condom promotion, sexual health education, and risk reduction counseling [19]. Participants were eligible for participation if they met the following inclusion criteria: 1) 18 years or older; 2) exchanged sex at least once for money/goods in the past twelve months; 3) willing to participate and complete the survey by providing written informed consent.

**Sample size**

The primary outcome of this study was the testing rates of chlamydia and gonorrhea in the past twelve months. A previous study reported a detection rate of 65.4% for chlamydia and 77.1% for gonorrhea among FSW[11]. We applied Two-sided Confidence Intervals for One Proportion method to estimate a sample size of 957 for this study to produce a two-sided 95% confidence interval with a width equal to
According to the number of FSW at each city, the total number of study participants at each city ranged from 200 to 300.

**Data collection**

Paper questionnaires were used for data collection in research. The questionnaire items were created based on discussions with HIV and STD experts, local outreach service staff, and policy makers. We also piloted the survey with 20 volunteer female sex workers to test questionnaire items and examine local outreach service capacity. This pilot data was not included in the final analysis.

Prior to this study, a mapping of the sex work venues was performed by local outreach team in each study site according to geographic area and type of venue. A convenience sampling method was used to recruit female sex workers from selected middle and low-level venues. Middle-level venues referred to hair salons or barber shops, massage parlors, roadside shops, foot-bathing shops, guesthouses and roadside restaurants while low-level venues consisted of streets and other public outdoor places. Each paper questionnaire was completed by eligible participants with the help of FSW outreach workers. All survey data were anonymous and confidential, and written consent was obtained before the commencement of the survey. Each participant was given 30 Yuan (about 4.3 USD) for incentive of participation.

**Measures**

**Social-demographic and behavioral variables**

Socio-demographic information included: age, ethnicity, marital status, household registration, length of time working in the current location, highest education obtained and annual income. Sexual behavioral variables included average number of clients in the past months, whether condoms were used inconsistently when engaged in commercial sex in the past month, whether or not providing anal sex for clients, whether or not having a regular partner (boyfriend or husband), whether or not having STD symptoms in the past twelve months (abnormal vaginal discharge, vaginal bleeding after sexual contact, urethral discharge, dysuria, and vaginal pruritus). Inconsistent condom use in the past month was defined as not always using condoms during commercial sex.

**STD testing variables**

We obtained information on testing for HIV, syphilis, chlamydia, or gonorrhea (all in binary) over the past twelve months. The primary outcome measure was whether or not having chlamydia or gonorrhea testing (0 = non-testing, 1 = testing) over the past twelve months.

**Statistical analysis**

Data were double-entered using the software Epidata 3.0 (Epidata Association from Denmark). Descriptive analysis was used to describe demographic factors, sexual behaviors and STD testing. Categorical data were presented as the number and percentage of FSW. Continuous data were expressed
as \( \bar{x} \pm SD \) if data were normally distributed, and as median \( (P_{25}-P_{75}) \) if the data were not normally distributed. The Chi-square test was used to compare categorical variables between groups.

Univariate and multivariable logistic regressions were used to evaluate variables associated with chlamydia and gonorrhea testing. We reported all outcome measures adjusted for demographic characteristics, including age, ethnicity, marital status, education level, monthly income, household registration and length of time working in the current location. We reported odds ratios (OR), 95% confidence intervals (CI) and \( P \) values. Throughout all the analyses in this study, results are reported to be statistically significant when \( P \leq 0.05 \). All analyses were conducted on SAS (version 9.4, SAS int. Cary, NC, USA).

**Results**

**Sociodemographic characteristics**

A total of 1,207 participants were recruited in this survey and included in the analysis. The mean age was 30.7 ± 6.8 years. The majority of the participants were between 25 and 30 years old (30.6%, 369/1207), married (63.1%, 762/1207), had a monthly income between $500-$1000 (56.8%, 686/1207) and worked in the current location over one year (61.2%, 738/1207). Almost three-fourths (77.6%, 936/1207) of participants' household registrations were in other provinces. (Table 1)
Table 1
Social demographic and sexual behavioral characteristics of participants among FSW in Southern China, 2018 (N=1207)

| Characteristics               | Gonorrhea testing in the past twelve months n (%) | Chlamydia testing in the past twelve months n (%) | Total |
|-------------------------------|--------------------------------------------------|--------------------------------------------------|-------|
|                               | No (n = 1117) Yes (n = 90) P                      | No (n = 1082) Yes (n = 125) P                     |       |
| Age(years)                    | < 0.001                                          | < 0.001                                          |       |
| 18–25                         | 182(16.3) 19(21.1)                               | 177(16.4) 24(19.2)                               | 201(16.7) |
| 26–29                         | 356(31.9) 13(14.4)                               | 345(31.9) 24(19.2)                               | 369(30.6) |
| 30–34                         | 299(26.8) 15(16.7)                               | 292(27) 22(17.6)                                 | 314(26.0) |
| ≥ 35                          | 280(25.1) 43(47.8)                               | 268(24.8) 55(44.0)                               | 323(26.7) |
| Workplace                     | 0.040                                            | 0.003                                            |       |
| Middle tier                   | 128(11.5) 4(4.4)                                 | 128(11.8) 4(3.2)                                 | 132(10.9) |
| Low tier                      | 989(88.5) 86(95.6)                               | 954(88.2) 121(96.8)                              | 1075(89.1) |
| Ethnicity                     | 0.002                                            | 0.004                                            |       |
| Han                           | 1011(90.5) 72(80.0)                              | 980(90.6) 103(82.4)                              | 1083(89.7) |
| Non-Han                       | 106(9.5) 18(20.0)                                | 102(9.4) 22(17.6)                                | 124(10.3) |
| Marital status                | < 0.001                                          | 0.004                                            |       |
| Not married                   | 315(28.2) 26(28.9)                               | 303(28) 38(30.4)                                 | 341(28.3) |
| Married                       | 717(64.2) 45(50.0)                               | 700(64.7) 62(49.6)                               | 762(63.2) |
| Divorced or widowed           | 84(7.5) 19(21.1)                                 | 78(7.2) 25(20.0)                                 | 103(8.5) |
| Household registration        | 0.071                                            | < 0.001                                          |       |
| Local city                    | 75(6.7) 11(12.2)                                 | 67(6.2) 19(15.2)                                 | 86(7.1) |
| Other cities in this province | 168(15.0) 17(18.9)                               | 153(14.1) 32(25.6)                               | 185(15.3) |
| Other provinces               | 874(78.2) 62(68.9)                               | 862(79.7) 74(59.2)                               | 936(77.6) |
| Monthly income (USD)          | 0.017                                            | 0.001                                            |       |
| Characteristics                          | Gonorrhea testing in the past twelve months $n$ (%) | Chlamydia testing in the past twelve months $n$ (%) | Total |
|------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-------|
|                                          | No ($n = 1117$) | Yes ($n = 90$) | P   | No ($n = 1082$) | Yes ($n = 125$) | P   |
|                                          |               |               |     |               |               |     |
| <$500                                   | 260(23.3)     | 33(36.7)      |     | 246(22.7)     | 47(37.6)      |     |
|                                          |               |               |     |               |               |     |
| $500-$1000                              | 644(57.7)     | 42(46.7)      |     | 627(57.9)     | 59(47.2)      |     |
|                                          |               |               |     |               |               |     |
| >$1000                                  | 213(19.1)     | 15(16.7)      |     | 209(19.3)     | 19(15.2)      |     |
|                                          |               |               |     |               |               |     |
| **Education level**                     | 0.669         | 0.272         |     |               |               |     |
| Illiterate or elementary school         | 287(25.7)     | 27(30.0)      |     | 284(26.2)     | 30(24.0)      |     |
|                                          |               |               |     |               |               |     |
| Junior high school                      | 737(66)       | 56(62.2)      |     | 713(65.9)     | 80(64.0)      |     |
|                                          |               |               |     |               |               |     |
| High school and above                   | 93(8.3)       | 7(7.8)        |     | 85(7.9)       | 15(12.0)      |     |
|                                          |               |               |     |               |               |     |
| **Length of time working in current location** | < 0.001       | < 0.001       |     |               |               |     |
| One year and above                      | 665(59.5)     | 73(81.1)      |     | 634(58.6)     | 104(83.2)     |     |
|                                          |               |               |     |               |               |     |
| 6–12 months                             | 267(23.9)     | 15(16.7)      |     | 264(24.4)     | 18(14.4)      |     |
|                                          |               |               |     |               |               |     |
| < 6 months                              | 184(16.5)     | 2(2.2)        |     | 183(16.9)     | 3(2.4)        |     |
|                                          |               |               |     |               |               |     |
| **Average number of clients in the past month** | < 0.001       | < 0.001       |     |               |               |     |
| <=30                                    | 626(56.0)     | 32(35.5)      |     | 612(56.5)     | 46(36.8)      |     |
|                                          |               |               |     |               |               |     |
| 31–60                                   | 352(31.5)     | 51(56.7)      |     | 333(30.8)     | 70(56.0)      |     |
|                                          |               |               |     |               |               |     |
| >60                                     | 139(12.4)     | 7(7.8)        |     | 137(12.7)     | 9(7.2)        |     |
|                                          |               |               |     |               |               |     |
| **Consistent condom uses with clients in the past month** | 0.969         | 0.099         |     |               |               |     |
| No                                      | 387(34.6)     | 31(34.4)      |     | 383(35.4)     | 35(28.0)      |     |
|                                          |               |               |     |               |               |     |
| Yes                                     | 730(65.4)     | 59(65.6)      |     | 699(64.6)     | 90(72.0)      |     |
|                                          |               |               |     |               |               |     |
| **Providing anal sex for clients**      | < 0.001       | < 0.001       |     |               |               |     |
| No                                      | 903(80.8)     | 57(63.3)      |     | 889(82.2)     | 71(56.8)      |     |
|                                          |               |               |     |               |               |     |
| Yes                                     | 374(19.2)     | 33(36.7)      |     | 313(17.8)     | 53(43.2)      |     |
|                                          |               |               |     |               |               |     |

### Characteristics

| Characteristics                                      | Gonorrhea testing in the past twelve months n (%) | Chlamydia testing in the past twelve months n (%) | Total |
|-----------------------------------------------------|---------------------------------------------------|---------------------------------------------------|-------|
|                                                     | No (n = 1117)                                      | Yes (n = 90)                                      |       |
| Yes                                                 | 214(19.2)                                          | 33(36.7)                                          |       |
|                                                     |                                                   |                                                   | 247(20.5) |
| Regular partner (boyfriend or husband)              | 0.153                                              | 0.015                                             |       |
| No                                                  | 273(24.4)                                          | 16(17.8)                                          | 289(24.0) |
| Yes                                                 | 843(75.5)                                          | 74(82.2)                                          | 917(76.0) |
| HIV testing in the past twelve months               | < 0.001                                            | < 0.001                                           |       |
| No                                                  | 782(70.0)                                          | 31(34.4)                                          | 813(67.4) |
| Yes                                                 | 335(30.0)                                          | 59(65.6)                                          | 394(32.6) |
| Syphilis testing in the past twelve months           | < 0.001                                            | < 0.001                                           |       |
| No                                                  | 778(69.7)                                          | 33(36.7)                                          | 811(67.2) |
| Yes                                                 | 339(30.3)                                          | 57(63.3)                                          | 396(32.8) |
| STD symptoms in the past twelve months               | < 0.001                                            | < 0.001                                           |       |
| No                                                  | 665(59.5)                                          | 11(12.2)                                          | 676(56.0) |
| Yes                                                 | 452(40.5)                                          | 79(87.8)                                          | 531(44.0) |

### Sexual behaviors

The median number of clients in the past month was 28.0 (16.0–40.0). Most participants always used condoms when having sex with clients in the past month (65.4%, 789/1207) and had a regular partner (76.0%, 917/1207). One-fifth (20.5%, 247/1207) of the participants had ever provided anal sex for clients. Approximately half (44.0%, 531/1207) of the participants had STD-related symptoms over the past twelve months. (Table 1)

### Chlamydia and gonorrhea testing

The testing rate of gonorrhea and chlamydia in the past twelve months were 7.5% (90/1207) and 10.4% (125/1297). Seventy-five (6.2%, 75/1207) participants were tested for both gonorrhea and chlamydia
within the past twelve months. Additionally, the testing rate of HIV and syphilis were 32.6% (394/1207) and 32.8% (396/1207) in the past year. (Fig. 1)

**Factors correlated with chlamydia testing**

In the multivariable analysis, chlamydia testing is positively correlated with low titer (adjusted Odds Ratio ($a OR = 3.53, 95\%CI:1.23–10.14$), number of clients in the past month ($a OR = 1.03, 95\%CI:1.01–1.05$), consistent condom use with clients in the past month ($a OR = 1.79 95\%CI:1.12–2.86$), providing anal sex for clients ($a OR = 2.36, 95\%CI:1.54–3.60$), having regular partners ($a OR = 3.12, 95\%CI:1.72–5.68$), having STD symptoms in the past twelve months ($a OR = 4.09, 95\%CI:2.62–6.40$), having HIV testing in the past twelve months ($a OR = 5.16, 95\%CI:3.21–8.30$), and having syphilis testing in the past twelve months ($a OR = 6.90, 95\%CI:4.21–11.22$) after adjusting for age, ethnicity, marital status, education level, marital status, monthly income, household registration, and length of time working in the current location. (Table 2)
Table 2
Factors associated with chlamydia testing among FSW in Southern China, 2018 (N= 1207)

| Characteristics                                         | Crude Model |               | Adjusted Model |               |
|---------------------------------------------------------|-------------|---------------|----------------|---------------|
|                                                         | OR (95%CI)  | P             | OR (95%CI)     | P             |
| Workplace                                               |             |               |                |               |
| Middle tier                                             | Ref         | -             | Ref            | -             |
| Low tier                                                | 4.06(1.47 ~ 11.18) | 0.007         | 3.53(1.23 ~ 10.14) | 0.019         |
| Average number of clients in the past month (continue variable) | 1.04(1.01 ~ 1.07) | 0.041         | 1.03(1.01 ~ 1.05) | 0.043         |
| Consistent condom uses with clients in the past month   |             |               |                |               |
| No                                                      | Ref         | -             | Ref            | -             |
| Yes                                                     | 1.41(0.93 ~ 2.13) | 0.101         | 1.79(1.12 ~ 2.86) | 0.016         |
| Providing anal sex for clients                          |             |               |                |               |
| No                                                      | Ref         | -             | Ref            | -             |
| Yes                                                     | 3.50(2.38 ~ 5.16) | < 0.001       | 2.36(1.54 ~ 3.60) | < 0.001       |
| Regular partner (boyfriend or husband)                  |             |               |                |               |
| No                                                      | Ref         | -             | Ref            | -             |
| Yes                                                     | 1.86(1.12 ~ 3.09) | 0.017         | 3.12(1.72 ~ 5.68) | 0.002         |
| STD symptoms in the past twelve months                  |             |               |                |               |
| No                                                      | Ref         | -             | Ref            | -             |
| Yes                                                     | 5.44(3.66 ~ 8.09) | < 0.001       | 4.09(2.62 ~ 6.40) | < 0.001       |
| HIV testing in the past twelve months                   |             |               |                |               |
| No                                                      | Ref         | -             | Ref            | -             |
| Yes                                                     | 5.32(3.57 ~ 7.92) | < 0.001       | 5.16(3.21 ~ 8.30) | < 0.001       |
| Syphilis testing in the past twelve months              |             |               |                |               |
| No                                                      | Ref         | -             | Ref            | -             |
| Yes                                                     | 6.82(4.5 ~ 10.33) | < 0.001       | 6.90(4.21 ~ 11.22) | < 0.001       |

Note: # Model adjusted for age, ethnicity, marital status, education level, marital status, monthly income, household registration and length of time working in current location
Factors correlated with gonorrhea testing

In the multivariable analysis, gonorrhea testing was positively correlated with number of clients in the past month ($OR = 1.02$, 95% CI: 1.00–1.04), providing anal sex for clients ($OR = 1.82$; 95% CI: 1.11–2.96), having regular partners ($OR = 2.59$, 95% CI: 1.35–4.99), having STD symptoms over the past twelve months ($OR = 3.33$, 95% CI: 2.03–5.46), HIV testing in the past twelve months ($OR = 3.94$, 95% CI: 2.34–6.65) and syphilis testing in the past twelve months ($OR = 3.27$, 95% CI: 1.96–5.46) after adjusting for age, ethnicity, marital status, education level, marital status, monthly income, household registration, and length of time working in the current location. (Table 3)
Table 3
Factors associated with gonorrhea testing among FSW in Southern China, 2018 (N=1207)

| Characteristics                                      | Crude Model | Adjusted Model# |
|------------------------------------------------------|-------------|-----------------|
|                                                      | OR (95%CI)  | P               | OR (95%CI)  | P       |
| Workplace                                            |             |                 |             |         |
| Middle-level venue                                   | *Ref*       |                 | *Ref*       |         |
| Low-level venue                                      | 2.78(1.01 ~ 7.70) | 0.049         | 1.95(0.68 ~ 5.59) | 0.216   |
| Average number of clients in the past month (continue variable) | 1.02(1.00 ~ 1.04) | 0.043         | 1.02(1.00 ~ 1.04) | **0.045** |
| Consistent condom uses with clients in the past month|             |                 |             |         |
| No                                                   | *Ref*       |                 | *Ref*       | -       |
| Yes                                                  | 1.01(0.64 ~ 1.59) | 0.969         | 1.15(0.69 ~ 1.92) | 0.583   |
| Providing anal sex for clients                        |             |                 |             |         |
| No                                                   | *Ref*       |                 | *Ref*       | -       |
| Yes                                                  | 2.44(1.55 ~ 3.85) | 0.001         | 1.82(1.11 ~ 2.96) | **0.017** |
| Regular partner (boyfriend or husband)               |             |                 |             |         |
| No                                                   | *Ref*       |                 | *Ref*       | -       |
| Yes                                                  | 1.50(0.86 ~ 2.62) | 0.155         | 2.59(1.35 ~ 4.99) | **0.004** |
| STD symptoms in the past twelve months               |             |                 |             |         |
| No                                                   | *Ref*       |                 | *Ref*       | -       |
| Yes                                                  | 4.03(2.58 ~ 6.29) | < 0.001       | 3.33(2.03 ~ 5.46) | < **0.001** |
| HIV testing in the past twelve months                 |             |                 |             |         |
| No                                                   | *Ref*       |                 | *Ref*       | -       |
| Yes                                                  | 5.32(3.57 ~ 7.92) | < 0.001       | 3.94(2.34 ~ 6.65) | < **0.001** |
| Syphilis testing in the past twelve months            |             |                 |             |         |
| No                                                   | *Ref*       |                 | *Ref*       | -       |
| Yes                                                  | 6.82(4.5 ~ 10.33) | < 0.001       | 3.27(1.96 ~ 5.46) | < **0.001** |

Note: # Model adjusted for age, ethnicity, marital status, education level, marital status, monthly income, household registration, length of time working in the current location
Discussion

Although testing is an effective strategy to prevent the transmission of chlamydia and gonorrhea, our findings suggest that chlamydia and gonorrhea testing rates remain low among FSW in China. Only one in ten FSW in our study reported that they had tested for chlamydia and gonorrhea in the past year. This study extends the literature by recruiting large number of FSW on middle and low-level venues, and examining chlamydia and gonorrhea testing uptake and associated factors. Findings from this study provide an evidence for the future interventions on promoting chlamydia and gonorrhea testing uptake among FSW.

We found notably low levels of testing uptake of chlamydia and gonorrhea testing among Chinese FSW. In our study, chlamydia and gonorrhea testing rates are much lower than those reported in Germany (77.1% and 65.4%)[20] and previously reported among men who have sex with men (MSM) in China (28.5% and 30.6%)[2]. Additionally, FSW in this study reported high levels of inconsistent condom use (34.6%), and this rate was similar to that in a systematic review among FSW in China[21], exposing them to the risk of contracting or transmitting HIV and frequent STD[22]. The low rates of testing uptake alongside highly risky sexual behaviors among FSW highlight the importance of promoting frequent testing among FSW in China. Chlamydia and gonorrhea screening guidelines have been released for sexually active women to promote the testing uptake in many countries which do not include China, such as United states[23], Australia[24] and England[25]. It has been proven that screening is an effective strategy for chlamydia and gonorrhea control[26]. There is an urgent need for the establishment of national guideline for chlamydia and gonorrhea screening in China.

We found that HIV and syphilis testing were positively correlated with chlamydia and gonorrhea testing in this study. This finding was consistent with studies conducted among men who have sex with men [2, 27]. This may be partly attributable to the extensive HIV and syphilis testing system in China, which may serve as a gateway for FSW to improve awareness of other STD, such as chlamydia and gonorrhea[14]. Meanwhile, the FSW who had HIV testing tended to have higher awareness of STD testing[28]. Although there are many possible ways for promoting chlamydia and gonorrhea testing, such as home-based testing or self-collection[15], outreach services [29]and pay-it-forward[30], the effect is still not ideal. There are many proven effective strategies around the world in response to the low HIV and syphilis testing, including voluntary counseling and testing (VCT)[31], provider-initiated HIV/syphilis testing and counseling (PITC)[32]. Given that there was already a relationship between chlamydia/gonorrhea testing and HIV/syphilis testing, integrating chlamydia and gonorrhea testing into existing HIV or syphilis testing programs has the potential to increase test uptake among FSW.

Our results showed that FSW who have higher risk of STD infection were more likely to have chlamydia and gonorrhea testing in this study, such as low-tier FSW[6] and FSW who had a greater number of clients. This finding was similar with results reported in previous studies about HIV testing among FSW and chlamydia/gonorrhea testing among MSM [33, 34]. This may be partly attributable to higher risk perception of chlamydia and gonorrhea infection among those FSW. Although those FSW were more
likely to have chlamydia and gonorrhea testing, the testing rates among them were still low (only 8%, 86/1075).

There were several limitations of our study. First, participants in this study were not randomly recruited, so they might not accurately represent Chinese FSW. Second, the vulnerability of the self-reported information to social desirability bias may lead to misclassification in this study, particularly those related to sexual behaviors. Third, this study was conducted among FSW in cities with rich experience in STD prevention. The results of this study may not be generalizable to FSW in cities that are not experienced in STD prevention.

Conclusions

The testing uptake of chlamydia and gonorrhea in Chinese FSW is low, alongside with a high level of engagement in risky sexual behaviors, which indicates a high risk of chlamydia and gonorrhea infection. Chlamydia and gonorrhea testing could be integrated into HIV and syphilis testing promotion programs to achieve further public health impact. Intervention to improve the availability of chlamydia and gonorrhea testing services is paramount.

Abbreviations

HIV
Human immunodeficiency virus
FSW
Female sex workers
STD
Sexually transmitted disease
LMIC
Low and middle-income countries
OR
Odds ratios
CI
Confidence intervals
aOR
Adjusted odds ratio
MSM
Men who have sex with men
VCT
Voluntary counseling and testing
PITC
Provider-initiated HIV/syphilis testing and counseling
Declarations

Acknowledgments

We are very grateful to all the participants who participated in this study. The authors wish to acknowledge Jiangmen Center for Disease Control and Prevention, Yunfu City Chronic Disease Control Center, Yangjiang City Public Health Hospital, Zhuhai City Chronic Disease Control Center, Puning City Chronic Disease Control Center, Rongcheng District Chronic Disease Prevention Hospital for having helped for participants recruitment.

Authors’ contributions

PZ, JZ and CW participated in all stages and wrote the manuscript, YW and FY helped collect the data; HC, YZ, FY, WT and WZ helped design the study and reviewed the manuscript.

Funding

This publication is supported by Medical Scientific Research Foundation of Guangdong Province, China (A2018508).

Availability of data and materials

The dataset used in the study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

This study was approved by the Ethical Committee of Dermatology Hospital of Southern Medical University (GDDHLS-20181207). All participants provided informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.
References

1. World Health Organization. Report on global sexually transmitted infection surveillance, 2018.
2. Wu D, Li KT, Tang W, Ong JJ, Huang W, Fu H, Lee A, Wei C, Tucker JD. Low Chlamydia and Gonorrhea Testing Rates Among Men Who Have Sex With Men in Guangdong and Shandong Provinces, China. SEX TRANSM DIS. 2019;46(4):260–5.
3. Wong HTH, Lee KCK, Chan DPC. Community-Based Sexually Transmitted Infection Screening and Increased Detection of Pharyngeal and Urogenital Chlamydia trachomatis and Neisseria gonorrhoeae Infections in Female Sex Workers in Hong Kong. SEX TRANSM DIS. 2015;42(4):185–91.
4. Su S, Chow EPF, Muessig KE, Yuan L, Tucker JD, Zhang X, Ren J, Fairley CK, Jing J, Zhang L. Sustained high prevalence of viral hepatitis and sexually transmissible infections among female sex workers in China: a systematic review and meta-analysis. BMC INFECT DIS 2015, 16(1).
5. Rowley J, Vander Hoorn S, Korenromp E, Low N, Unemo M, Abu-Raddad LJ, Chico RM, Smolak A, Newman L, Gottlieb S, et al. Chlamydia, gonorrhoea, trichomoniasis and syphilis: global prevalence and incidence estimates, 2016. B WORLD HEALTH ORGAN. 2019;97(8):548–62.
6. Chen X, Yin Y, Liang G, Wang Q, Jiang N, Liu Q, Fu G, Yang B, Zhou Y, Shi M, et al. The prevalences of Neisseria gonorrhoeae and Chlamydia trachomatis infections among female sex workers in China. BMC PUBLIC HEALTH. 2013;13(1):121.
7. Guy RJ, Ward J, Causer LM, Natoli L, Badman SG, Tangey A, Hengel B, Wand H, Whiley D, Tabrizi SN, et al. Molecular point-of-care testing for chlamydia and gonorrhoea in Indigenous Australians attending remote primary health services (TTANGO): a cluster-randomised, controlled, crossover trial. LANCET INFECT DIS. 2018;18(10):1117–26.
8. Tsevat DG, Wiesenfeld HC, Parks C, Peipert JF. Sexually transmitted diseases and infertility. AM J OBSTET GYNECOL. 2017;216(1):1–9.
9. Wiesenfeld HC. Screening for Chlamydia trachomatis Infections in Women. N Engl J Med. 2017;376(22):2198.
10. World Health Organization. Sexually transmitted infections 2016–2021. 2016.
11. Bremer V, Haark G, Gassowski M, Hamouda O, Nielsen S. STI tests and proportion of positive tests in female sex workers attending local public health departments in Germany in 2010/11. BMC PUBLIC HEALTH 2016, 16(1).
12. Tang W, Pan J, Jiang N, Hu H, Mahapatra T, Yin Y, Mahapatra S, Wang X, Chen X, Lin N, et al. Correlates of chlamydia and gonorrhea infection among female sex workers: the untold story of Jiangsu, China. PLOS ONE. 2014;9(1):e85985.
13. Chacko MR, Wiemann CM, Smith PB. Chlamydia and gonorrhea screening in asymptomatic young women. J PEDIATR ADOL GYNEC. 2004;17(3):169–78.
14. Nguyen S, Dang A, Vu G, Nguyen C, Le T, Truong N, Hoang C, Tran T, Tran T, Pham H, et al. Lack of Knowledge about Sexually Transmitted Diseases (STDs): Implications for STDs Prevention and Care
15. McRee A, Esber A, Reiter PL. Acceptability of Home-Based Chlamydia and Gonorrhea Testing Among a National Sample of Sexual Minority Young Adults. PERSPECT SEX REPRO H. 2015;47(1):3–10.

16. Rukh S, Khurana R, Mickey T, Anderson L, Velasquez C, Taylor M. Chlamydia and Gonorrhea Diagnosis, Treatment, Personnel Cost Savings, and Service Delivery Improvements After the Implementation of Express Sexually Transmitted Disease Testing in Maricopa County, Arizona. SEX TRANSM DIS. 2014;41(1):74–8.

17. National Health Commission of the People's Republic of China. http://www.nhc.gov.cn/jkj/s3578/201904/050427ff32704a5db64f4ae1f6d57c6c.shtml. 2019.

18. Wang C, Tang W, Zhao P, Tucker J, Chen L, Smith MK, Wong NS, Dong W, Yang B, Zheng H. Rapid increase of gonorrhoea cases in Guangdong Province, China, 2014–2017: a review of surveillance data. BMJ OPEN. 2019;9(11):e31578.

19. Chen X, Yin Y, Liu G, Wei W, Wang H, Yu Y, Mabey DC, Peeling RW. Outreach syphilis testing services by different health providers to female sex workers in southern China. PLOS ONE. 2013;8(4):e60626.

20. Bremer V, Haar K, Gassowski M, Hamouda O, Nielsen S. STI tests and proportion of positive tests in female sex workers attending local public health departments in Germany in 2010/11. BMC PUBLIC HEALTH 2016, 16(1).

21. Chow EPF, Muessig KE, Yuan L, Wang Y, Zhang X, Zhao R, Sun P, Sun X, Tucker JD, Jing J, et al. Risk Behaviours among Female Sex Workers in China: A Systematic Review and Data Synthesis. PLOS ONE. 2015;10(3):e120595.

22. Han L, Zhou C, Li Z, Poon AN, Rou K, Fuller S, Li Y, Shen L, Kang D, Huang L, et al. Differences in risk behaviours and HIV/STI prevalence between low-fee and medium-fee female sex workers in three provinces in China. SEX TRANSM INFECT. 2016;92(4):309–15.

23. Centers for Disease Control and Prevention
Which STD Tests Should I Get?
Centers for Disease Control and Prevention. Which STD Tests Should I Get? https://www.cdc.gov/std/prevention/screeningreccs.htm. 2018.

24. Australasian Sexual Health Alliance. STI management guidelines. 2018.

25. England Public Health. Guidance for the detection of gonorrhoea in England. 2015.

26. Pillay J, Moore A, Rahman P, Lewin G, Reynolds D, Riva J, Thériault G, Thombs B, Wilson B, Robinson J, et al: Screening for chlamydia and/or gonorrhea in primary health care: protocol for systematic review. Systematic Reviews 2018, 7(1).

27. Hoots BE, Torrone EA, Bernstein KT, Paz-Bailey G. Self-Reported Chlamydia and Gonorrhea Testing and Diagnosis Among Men Who Have Sex With Men—20 US Cities, 2011 and 2014. SEX TRANSM DIS. 2018;45(7):469–75.

28. Nguyen S, Dang A, Vu G, Nguyen C, Le T, Truong N, Hoang C, Tran T, Tran T, Pham H, et al. Lack of Knowledge about Sexually Transmitted Diseases (STDs): Implications for STDs Prevention and Care among Dermatology Patients in an Urban City in Vietnam. INT J ENV RES PUB HE. 2019;16(6):1080.
29. Badarane D, Knox J, Camacho A, Magill MK, Van Hala S, Jones JL. Increasing Chlamydia Testing Rates via Targeted Outreach. **PRiMER** 2019, 3.

30. Zhang TP, Yang F, Tang W, Alexander M, Forastiere L, Kumar N, Li K, Zou F, Yang L, Mi G, et al: Pay-it-forward gonorrhea and chlamydia testing among men who have sex with men in China: a study protocol for a three-arm cluster randomized controlled trial. **INFECT DIS POVERTY** 2019, 8(1).

31. Fonner VA, Denison J, Kennedy CE, O'Reilly K, Sweat M: Voluntary counseling and testing (VCT) for changing HIV-related risk behavior in developing countries. **COCHRANE DB SYST REV** 2012.

32. Kennedy CE, Fonner VA, Sweat MD, Okero FA, Baggaley R, O Reilly KR. Provider-Initiated HIV Testing and Counseling in Low- and Middle-Income Countries: A Systematic Review. **AIDS BEHAV.** 2013;17(5):1571–90.

33. Todd CS, Alibayeva G, Khakimov MM, Sanchez JL, Bautista CT, Earhart KC. Prevalence and Correlates of Condom Use and HIV Testing Among Female Sex Workers in Tashkent, Uzbekistan: Implications for HIV Transmission. **AIDS BEHAV.** 2007;11(3):435–42.

34. Grayman JH, Nhan DT, Huong PT, Jenkins RA, Carey JW, West GR, Minh TT. Factors Associated with HIV Testing, Condom Use, and Sexually Transmitted Infections Among Female Sex Workers in Nha Trang, Vietnam. **AIDS BEHAV.** 2005;9(1):41–51.

**Figures**

![Percentage of FSW who reported to have tested for HIV, syphilis, chlamydia and gonorrhoea in Southern China in the past twelve months, 2018.](image)

**Figure 1**

Percentage of FSW who reported to have tested for HIV, syphilis, chlamydia and gonorrhoea in Southern China in the past twelve months, 2018.