The prevalence of sexually transmitted infections among female sex workers from different categories of sex work venues in China

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Abstract

Objective: The aim of this study was to determine prevalence of sexually transmitted infections among female sex workers (FSWs) from different categories of sex work venues in China.

Methods: A cross-sectional study was performed among FSWs recruited from different types of venues in 8 cities in China. An interview with questionnaire was conducted, followed by collection of a blood and cervical swab specimens for tests of HIV, syphilis, N. gonorrhoeae (NG) and C. trachomatis (CT) infections.

Results: A total of 3,099 FSWs were included in the study. The overall prevalence rates of HIV, syphilis, NG and CT were 0.26%, 6.45%, 5.91% and 17.30%, respectively. FSWs in Guangxi had higher risk of HIV infection (AOR=12.99) than those in other areas. Being a FSW from low-tier venue (AOR=2.64) and being age of ≥21 years (AOR=2.27 for 21-25 years; AOR=3.40 for 26-30 years; AOR=3.59 for 31 years or above) had higher, and having secondary school or above education (AOR=0.60 for secondary school education; AOR=0.33 for high school or above education) had lower risk for syphilis infection. Being a FSW from low-tier venue (AOR=1.39) had higher risk and being age of ≥ 21 years (AOR=0.60 for 21-25 years; AOR=0.29 for 26-30 years; AOR=0.35 for 31 years or above) had lower risk for CT infection.

Conclusions: The high STI prevalence rates found among FSWs, especially among FSWs in low-tier sex work venues, suggest that the comprehensive prevention and control programs including not only behavioral interventions but also screening and medical care are needed to meet the needs of this population.
Introduction
Since 2008, the major mode of HIV/AIDS transmission in China has become heterosexual activities, indicating that 46.5% of the estimated 740,000 people living with HIV and AIDS (PLWA) in 2011 were due transmission through heterosexual contacts [1]. Female sex workers (FSWs) are one of the key populations to facilitate increase of the HIV epidemic and likely to determine how fast the HIV epidemic will spread from high risk groups to the general population. In the national HIV/AIDS surveillance system in China, periodic prevalence surveys of syphilis infection among FSWs have been integrated but current CT or NG surveillance activities concentrate mainly on passive case reporting. Similarly, there have been many studies on prevalence of HIV and syphilis infections in this population [2–4] but few on other sexually transmitted infections (STIs) including gonorrhoea and chlamydia [5–6]. In the study described in this article, we sought to determine the frequency of not only syphilis, but also Neisseria gonorrhoeae (NG) and Chlamydia trachomatis (CT) infections in a sample of FSWs recruited from 4 provinces in China, and to identify and compare significant predictors associated with these infections.

Methods
Study population
The study was conducted in eight cities in the eastern and southern parts of China. The details of study sites were reported previously [7]. Between June and September 2009, venues where FSWs solicited clients were mapped. The venues were classified into three subgroups, i.e. high-, middle- and low-class venues (HV, MV and LV). High-class venues included karaoke bars, or hotels; middle-class venues included hair salons or barber shops, massage parlors, foot bathing shops, roadside shops, guesthouses, or roadside restaurants; and low-class venues included street or other public outdoor places. FSWs who solicited clients in HV, MV and LV were named HV-, MV- and LV-based FSWs, respectively. A convenience sampling method was used to recruit FSWs by outreach workers from each of the selected venues. Participant eligibility requirements included age > 16 years (to encompass FSWs representative of those at risk for STIs); ability to give consent; and having provided commercial sex in sex-work venues or rented apartments for money or goods within the previous three months.

Data and specimen collection
All eligible FSWs were requested to participate in the study after receiving a brief description of the purpose and procedure of the study. Site staff secured verbal consent from subjects to have blood and
cervical swab collected for free syphilis, HIV, NG and CT testing, and to be confidentially interviewed with an anonymous and structured questionnaire by the trained outreach workers. All participants who provided specimens were informed of their test results by an outreach team member when the results were available. Participants with positive tests received counseling messages and were referred to designated clinics for further evaluation and possible treatment according to the national guidelines. A small gift priced at 30 yuan (less than 5 US dollars) as an incentive was given to those women who agreed to participate in the survey. The study protocols were reviewed and approved by the Medical Ethics Committee of the Chinese Academy of Medical Sciences Institute of Dermatology and National Center for STD Control in Nanjing.

Laboratory tests

Sera from the participants were evaluated at the STD laboratories of local CDCs or institutes of dermatology and venereology using serologic tests for determining syphilis infection according to the national algorithms. For syphilis testing, specimens were first screened for IgG treponemal antibody using an enzyme-linked immunosorbent assay (ELISA, Wansheng Biotech Inc, Beijing, China). Specimens with positive ELISA underwent a qualitative non-treponemal toluidine red unheated serum test (TRUST) testing (Rongsheng Biotech Inc, Shanghai, China). All specimens were firstly screened using an ELISA (Wansheng Biotech Inc, Beijing, China) for antibodies to HIV-1 and the specimens with positive ELISA were confirmed using Western blot (HIV Blot 2.2, Genelabs Diagnostics, Singapore). Cervical specimens were evaluated for NG and CT using polymerase chain reaction (PCR) based on Roche Amplicor assay (Roche Diagnostic Systems, Indianapolis, IN), as recommended by the manufacturer’s instructions. For calculating the prevalence, syphilis infection was defined as having a positive ELISA and a positive TRUST, HIV infection as having a positive ELISA and a positive Western blot, CT and NG infection as having a positive PCR.

Statistical analysis

A total of 3099 FSWs who provided both blood and cervical swabs are included in the data analysis. Data were analyzed using SPSS (version 18.0 for Windows; SPSS Inc., Chicago, IL) and MedCalc (version 7.4 for Windows; Frank Schoonjans, Belgium). Outcome variables include prevalence rates and their 95% confidence intervals (CI). Univariate analysis was used to determine association between characteristics and infection, and odds ratio was calculated. Factors with significance level of p<0.10 were included in multivariate logistic regression model to explore the association of indicators with
acquisition of each of the STIs. Values of p<0.05 were considered statistically significant.

Results

Socio-demographic and behavioral characteristics

Each of the four study’s provinces accounted for about a quarter of the study sample size (759, 747, 795 and 798 from Jiangsu, Guangdong, Hainan and Guangxi, respectively). More FSWs in Hainan (22.4%) and Guangxi (18.9%) were of non-Han ethnicity than other two provinces (less than 8%). Among the 3,099 FSW participants, the mean age was 26.1 years (standard deviation [SD], 6.5; range, 15-53 years). About twenty percent of the participants were local registered residents, 21.4% were from other parts of the study province, and 58.3% were from outside of the province. Eighty percent had education level of secondary school or below, and 36.0% were currently married. Less than one-fifth (19.7%, 609/3099) of the FSWs currently worked in low-tier sex venues, and 41.9% (1298/3099) and 38.5% (1192/3099) were MV- and HV-based FSWs, respectively. The mean age of LV-based FSWs (28.3, SD 8.3 years) was significantly higher than that in MV- (26.5, SD 6.3, P<0.001) or HV-based FSWs (24.5 SD 5.2 years, P<0.001). Half (1611/3099) of the participants reported consistent use of a condom during the previous month and 74% reported use of a condom in the most recent commercial sex. Less than 5% of the FSWs reported having used an illicit drug.

Prevalence of infection

A total of 8 FSWs, in which 7 were from Guangxi and 1 from Hainan, were infected with HIV, giving a prevalence of 0.26 (95%CI, 0.13-0.51%). Six of the 8 (75.0%) HIV-infected FSWs came from low-class sex venues. The overall prevalence rates of syphilis, NG and CT in the study participants were 6.45% (95%CI, 5.64-7.37%), 5.91% (5.13-6.80%) and 17.30 (95%CI, 16.01-18.67%), respectively. More than one-quarter (26.8%) of the FSWs were infected with at least one of the STIs, and 21.5% were tested positive for either NG or CT. LV-based FSWs had a higher prevalence of any STI than those in HV- or MV-based FSWs. As shown in Table 1, the prevalence of syphilis was lowest among FSWs aged 15-20 years and it increased with increasing age, but the prevalence of NG or CT declined with increasing age. The participants who had a low education level or a married or divorced status had higher prevalence of syphilis infection, but a higher prevalence of CT was found in FSWs who never married. Infection of NG was found to be associated with CT infection.

Risk factors of infection

In the multivariate analyses, the following factors were found to be significantly associated with
specific infection at significance level of P<0.05 (Table 2): study location in Guangxi had higher risk of HIV infection (AOR 12.99, 95%CI 1.59-105.80) than other areas; working in low-class sex venues (AOR 2.64, 95%CI 1.75-3.97) and being 21 years or above (AOR 2.27, 95%CI 1.28-4.02 for being 21-25 years; AOR 3.40, 95%CI 1.89-6.11 for being 26-30 years; AOR 3.59, 95%CI 2.04-6.32 for being 31 years or above) had higher risk, and having secondary school or above education (AOR 0.60, 95%CI 0.42-0.85 for having secondary school education; AOR 0.33, 95%CI 0.18-0.60 for high school or above education) had lower risk for syphilis infection; and working in low-class sex venues (AOR 1.39, 95%CI 1.07-1.81) and testing NG-positive (AOR 1.91, 95%CI 1.35-2.70) had higher risk, and being 21 years or above (AOR 0.60, 95%CI 0.48-0.76 for being 21-25 years; AOR 0.29, 95%CI 0.21-0.40 for being 26-30 years; AOR 0.35, 95%CI 0.26-0.47 for being 31 years or above) had lower risk for CT infection.

**Discussion**

To our knowledge, this study was a cross-sectional survey with biggest sample size of FSWs recruited from different categories of sex venues in multiple provinces in China. Two kinds of specimens (blood and cervical swabs) were simultaneously collected to test for HIV, syphilis, gonococcal and chlamydial infections. Our study finding that there were higher prevalence rates of syphilis and chlamydial infections in LV-based FSWs is in accord with previous studies [6]. In China, FSWs who solicit on streets or other outdoor places (freelance FSWs) and conduct commercial sex in rental houses are a special segment of the FSW population with more vulnerable nature in terms of socio-demographic characteristics, organization of sex work, employment and economic status, and relationship with clients [8-9]. Previous studies have shown that the FSWs working in low-class sex venues tended to be older in age, have high turnovers of sexual clients due to a low pay, but infrequently used condoms due to extra pay for unsafe sex [10]. The freelance FSWs either independently solicit clients on streets or find clients through nearby construction sites and factories [9]. They usually earn far less than what FSWs in higher-class sex venues earn but engage in riskier behaviors when having sex with both commercial and regular non-paying partners [9-11] and are highly stigmatized and marginalized by society. In addition, these FSWs may have poorer access to health information and health care services.

Regarding sexual behaviors, self-reported condom use at last commercial sex was reported by 74.0% and consistent use of a condom during the previous month was reported by 52.0%. Unexpected was that the rates of condom use were not associated with syphilis, NG or CT infections. This may be
due, in part, to an upward bias in self-reported condom use rates [12]. Older age, which was found as a risk factor in our study, has also been identified as a syphilis risk factor in previous studies among FSWs in China and other countries [13-14]. Because older FSWs were usually those women who had worked in commercial sex for a longer time, their higher syphilis prevalence was more likely to be the result of a longer duration of exposure to risk of the infection. As shown in the current study, older FSWs tend to work in low-class sex venues and hence have a greater number of sexual clients, which might lead to greater risk exposure to the infection. However, through multivariate analysis, young age was found to be statistically significant predictors of CT infection. In contract, younger age is a significant risk factor for CT infection. A possible explanation is that young FSWs have more sexual activity, and less knowledge and experience with STI prevention. As well, younger women may have increased susceptibility to some STIs due to cervical ectopy following sexual initiation [15-16] or because of less likelihood of acquired protective immunity from previous STI exposure [17]. Previous study reported that the probability of incident chlamydial infection was inversely related to duration of prostitution [18]. Although the prevalence of either syphilis or CT among FSWs in low-class sex venues with higher risk behaviors was higher than that in middle- or high-class ones, the difference in the prevalence rates among LV-, MV- and HV-based FSWs was much bigger for syphilis than CT in our study. Previous study reported no difference in CT prevalence establishment- and street-based FSWs [19]. Therefore, the likelihood of CT infection among FSWs may be not only related to the current risk behaviors but also the previous exposure to the infection which may be relevant to stimulation of protective immunity. In light of these findings and hypothesis further studies is warranted. Lower education was also identified as a syphilis risk factor in the multivariate regression model. FSWs with poor education may have less access to information about STIs, low awareness of STI prevention methods, and poor health care-seeking behaviors.

As FSWs are an important source of infection and probably the bridge population for the heterosexual transmission of STIs, the findings of this study have a number of important implications. First, this study shows a substantial prevalence of not only syphilis but also NG and CT infections among FSWs and much higher prevalence of the infections among FSWs at low-class sex venues. The patterns of infection suggest the importance of including NG and CT prevalence surveys in the current surveillance program and prioritizing the FSWs at low-tier venues in the current program for intervention. Second, this study indicates the association of young age with CT infection, which further
supports the concept of protective immunity to the recurrent infections although more studies are needed. Based on these findings, it is important to consider the potential protective immunity related to age and duration of prostitution when we use CT and NC prevalence as a proxy to indicate risk behaviours among high-risk groups.

Several limitations of this study should be considered in the interpretation of the results. First, study participants were not randomly recruited, so they may not be an accurate representation of the target study population. Second, as prostitution is illegal in China, some FSWs (ranging from 10% to 40% and varying between different types of venues) refused participating in the study, resulting in potential selection bias. Third, our results may also be affected by a self-reporting bias, particularly those related to sexual behaviours.

Conclusion
The high STI prevalence rates found among FSWs in China, especially among LV-based FSWs, suggest that it is essential that comprehensive prevention and control programs including not only behavioral interventions but also screening and medical care are needed to meet the needs of this high-risk population. However, such programs should be adjusted to the STI prevalence and its risk behaviors among FSWs.

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

Authors’ contributions
XSC, YPY, QQW, GJL, NJ and BW conceived the study and participated in study design. QL, XPH, BY, YIZ, DLP, GFF and LGY participated in implementation of the study in sites and data collection. MQS coordinated the laboratory testing of syphilis infection and helped to interpret the data. NJ and
XSC performed the statistical analysis. XSC prepared the manuscript with assistance of YPY, QQW, NJ and BW. All authors read and approved the final manuscript.

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### Table 1. Prevalence and Odds of Sexually Transmitted Infection (STI) by Socio-demographic and Behavioral Characteristics and Other STIs

<table>
<thead>
<tr>
<th>Factor</th>
<th>Sample size</th>
<th>Syphilis</th>
<th>Gonorrhea</th>
<th>Chlamydia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% OR (95%CI) P value</td>
<td>% OR (95%CI) P value</td>
<td>% OR (95%CI) P value</td>
</tr>
<tr>
<td><strong>FSW category</strong></td>
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<td></td>
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<tr>
<td>High-tier</td>
<td>1192</td>
<td>3.94 Reference</td>
<td>5.54 Reference</td>
<td>16.36 Reference</td>
</tr>
<tr>
<td>Middle-tier</td>
<td>1298</td>
<td>5.47 1.41 (0.97-2.06) 0.07</td>
<td>5.24 0.94 (0.67-1.34) 0.74</td>
<td>16.87 1.04 (0.84-1.28) 0.73</td>
</tr>
<tr>
<td>Low-tier</td>
<td>609</td>
<td>13.46 3.79 (2.61-5.50) &lt;0.001</td>
<td>8.04 1.49 (1.02-2.19) 0.04</td>
<td>20.03 1.28 (1.00-1.65) 0.05</td>
</tr>
<tr>
<td><strong>Age group (years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-20</td>
<td>617</td>
<td>2.59 Reference</td>
<td>8.10 Reference</td>
<td>27.88 Reference</td>
</tr>
<tr>
<td>21-25</td>
<td>1149</td>
<td>4.96 1.96 (1.12-3.44) 0.02</td>
<td>5.05 0.60 (0.41-0.89) 0.01</td>
<td>18.53 0.59 (0.47-0.74) &lt;0.001</td>
</tr>
<tr>
<td>26-30</td>
<td>648</td>
<td>7.72 3.14 (1.77-5.58) &lt;0.001</td>
<td>4.94 0.59 (0.37-0.93) 0.02</td>
<td>10.03 0.29 (0.21-0.39) &lt;0.001</td>
</tr>
<tr>
<td>&gt;30</td>
<td>685</td>
<td>11.24 4.76 (2.74-8.25) &lt;0.001</td>
<td>6.28 0.76 (0.50-1.16) 0.20</td>
<td>12.55 0.37 (0.28-0.49) &lt;0.001</td>
</tr>
<tr>
<td><strong>Geographic area</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other provinces</td>
<td>2301</td>
<td>5.95 Reference</td>
<td>5.43 Reference</td>
<td>16.30 Reference</td>
</tr>
<tr>
<td>Guangxi</td>
<td>798</td>
<td>7.89 1.35 (0.99-1.85) 0.06</td>
<td>7.27 1.36 (0.99-1.88) 0.06</td>
<td>20.18 1.30 (1.06-1.59) 0.01</td>
</tr>
<tr>
<td><strong>Education level</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school or below</td>
<td>460</td>
<td>13.91 Reference</td>
<td>7.17 Reference</td>
<td>14.56 Reference</td>
</tr>
<tr>
<td>Secondary school</td>
<td>2074</td>
<td>5.78 0.38 (0.28-0.52) &lt;0.001</td>
<td>5.59 0.77 (0.51-1.14) 0.19</td>
<td>17.84 1.27 (0.96-1.69) 0.09</td>
</tr>
<tr>
<td>High school or above</td>
<td>562</td>
<td>2.85 0.18 (0.10-0.32) &lt;0.001</td>
<td>6.05 0.83 (0.51-1.37) 0.47</td>
<td>17.61 1.25 (0.89-1.76) 0.19</td>
</tr>
<tr>
<td><strong>Marital status</strong></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Never married</td>
<td>1890</td>
<td>4.22 Reference</td>
<td>5.38 Reference</td>
<td>19.79 Reference</td>
</tr>
<tr>
<td>Married</td>
<td>1113</td>
<td>9.97 2.51 (1.87-3.38) &lt;0.001</td>
<td>6.65 1.25 (0.92-1.70) 0.15</td>
<td>13.57 0.64 (0.52-0.78) &lt;0.001</td>
</tr>
<tr>
<td>Divorced</td>
<td>87</td>
<td>10.34 2.62 (1.27-5.41) 0.01</td>
<td>5.75 1.07 (0.42-2.70) 0.88</td>
<td>11.49 0.53 (0.27-1.03) 0.06</td>
</tr>
<tr>
<td><strong>Consistent condom use in past month</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1611</td>
<td>6.02 Reference</td>
<td>6.33 Reference</td>
<td>16.57 Reference</td>
</tr>
<tr>
<td>No</td>
<td>1488</td>
<td>6.92 1.16 (0.87-1.55) 0.31</td>
<td>5.44 0.85 (0.63-1.15) 0.29</td>
<td>17.08 1.11 (0.92-1.34) 0.27</td>
</tr>
<tr>
<td><strong>Other STIs</strong></td>
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<td></td>
<td></td>
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<tr>
<td>Syphilis</td>
<td>200</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Gonorrhoea</td>
<td>183</td>
<td>9.84 1.64 (0.99-2.73) 0.06</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Chlamydia</td>
<td>536</td>
<td>5.22 0.77 (0.51-1.15) 0.20</td>
<td>9.70 1.99 (1.43-2.79) &lt;0.001</td>
<td>—</td>
</tr>
</tbody>
</table>

OR: odds ratio; CI: confidence interval.
### Table 2. Factors Associated With Sexually Transmitted Infection (STI): Results From Multivariate Logistic Regression Analysis

<table>
<thead>
<tr>
<th>Independent factor</th>
<th>Syphilis</th>
<th>Chlamydia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working in low-tier venues(^a)</td>
<td>2.64 (1.75-3.97)**</td>
<td>1.39 (1.07-1.81)*</td>
</tr>
<tr>
<td>Being 21-25 years old(^b)</td>
<td>2.27 (1.28-4.02)**</td>
<td>0.60 (0.48-0.76)**</td>
</tr>
<tr>
<td>Being 26-30 years old(^b)</td>
<td>3.40 (1.89-6.11)**</td>
<td>0.29 (0.21-0.40)**</td>
</tr>
<tr>
<td>Being 31 years or older(^b)</td>
<td>3.59 (2.04-6.32)**</td>
<td>0.35 (0.26-0.47)**</td>
</tr>
<tr>
<td>Locating in Guangxi Province(^c)</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>Having secondary school education(^d)</td>
<td>0.60 (0.42-0.85)*</td>
<td>NS</td>
</tr>
<tr>
<td>Having high school or above education(^d)</td>
<td>0.33 (0.18-0.60)**</td>
<td>NS</td>
</tr>
<tr>
<td>Having gonorrhoea(^e)</td>
<td>NS</td>
<td>1.91 (1.35-2.70)**</td>
</tr>
</tbody>
</table>

\(^a\) Reference group was FSWs working in high-tier venues.  
\(^b\) Reference group was FSWs aged 25 years or younger.  
\(^c\) Reference group was other provinces.  
\(^d\) Reference group was primary school or below education.  
\(^e\) Reference group was FSWs having not gonorrhoea. 

* P<0.05; ** P<0.01.

NS: It is not the factor to include in multivariate regression analysis or to be not significantly associated with the infection.