Sexually Transmitted Infections Among Female Sex Workers in Yunnan, China

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ABSTRACT

A cross-sectional prevalence survey of sexually transmitted infections (STIs) was conducted among female sex workers (FSWs) in Kunming, Yunnan Province, China. A total of 505 FSWs participated in the survey. All eligible participants gave informed consent. Demographic, behavioral, and clinical information of the participants was gathered by direct structured interviews. Tampon swabs were collected to test for *Chlamydia trachomatis*, *Nesseria gonorrhoeae*, and *Trichomonas vaginalis* and serum specimens were collected to test for HIV antibody by enzyme-linked immunosorbent assay (ELISA) screening and Western blot confirmation, syphilis with rapid plasma reagin (RPR) and *T. pallidum* hemagglutination (TPHA) confirmation, and for HSV-2 antibodies with the HerpeSelect 2 ELISA. The most prevalent bacterial STI was *Chlamydia trachomatis* (58.6%), followed by *Trichomonas vaginalis* (43.2%) and *Nesseria gonorrhoeae* (37.8%). Three hundred twenty-seven (65.1%) sex workers had serologic evidence of exposure to HSV-2 infection. Ten percent were positive for HIV infection, all injecting drug users (IDUs); and 9.5% had infection with syphilis. Comprehensive prevention and effective STI services for sex workers and their clients will be the key strategies to the control of STIs, including HIV. Policies and prevention strategies for STI/HIV need to focus on high-risk subpopulations, such as sex workers (particularly sex workers who inject drugs) and their clients.

INTRODUCTION

Sexually transmitted diseases (STDs) are a major public health concern in the developing world. It has been estimated that more than 35 million new STD cases occurred in the Western Pacific Region in the 1990s. STDs have consistently ranked among the five most important causes of adults seeking health care and of healthy productive lives lost1 and have become the third most common infectious disease in China. In recent years, epidemiologic studies have shown that persons with ulcerative and nonulcerative STDs are more susceptible to HIV. People with HIV and nonulcerative STDs have increased shedding of HIV-infected cells and greater efficiency in transmitting the virus.2 The association be-

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between STDs and HIV is strongest for those infections that cause genital ulceration,\textsuperscript{3−5} but has also been demonstrated for infections such as gonorrhea, chlamydia, and trichomoniasis.\textsuperscript{6} Prevention and treatment of STDs as parts of HIV prevention packages are helpful in containing the HIV epidemic. In order to formulate sexually transmitted infection (STI) and HIV control strategies and programs, it is useful to understand the epidemiology of STDs and to estimate the prevalence of the various etiological agents responsible for STDs in the local community, particularly among high-risk populations.

However, epidemiology of STDs in China is not well defined, with only a few prevalence surveys,\textsuperscript{7,8} in which small-size samples were investigated with nonstandardized protocols having been conducted. Based on the National STD Surveillance System, close to 1 million new STD cases have been reported annually in recent years and there was an average annual increase of 39\% from 1985 to 2004.\textsuperscript{9} The most commonly reported STD is gonorrhea but a significant increase of cases with syphilis and nongonococcal urethritis (NGU) has been observed. Current STD surveillance activities in China mainly concentrate on passive case reporting and sentinel site surveillance in which case reporting has been enhanced and a limited prevalence surveys are carried out. It is acknowledged that reported STI and HIV infections make up only a small portion of the real number and that there is a need to strengthen STD and HIV surveillance and information systems. One strategy to improve surveillance is to conduct periodic baseline prevalence studies of selected STDs. This study details the findings of the STI prevalence survey conducted during 1999–2000 among female sex workers (FSWs).

**MATERIALS AND METHODS**

**Study population**

The study was conducted among 505 FSWs from November 1999 to May 2000 in Kunming City of Yunnan Province which is located in southwest part of China and is one of HIV-epidemic areas in the country. Majority of study subjects are those sex workers arrested by local police because of the illegal commercial sex activities. A convenience sampling method was used to recruit sex workers from local reeducation center or STD clinics where sex workers received a medical check-up. Protocol of the study was reviewed and approved by each institution’s local review board (ethics committee), namely the National Center for STD Control in Nanjing, and the Kunming Institute of Dermatology in Kunming.

**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. An informed consent should be obtained from the eligible participants prior to data and sample collection. The participants were confidentially interviewed with a structured questionnaire by a trained medical worker to obtain information about socio-demographic information, risk behaviors including sexual partners, lifetime drug and condom use, and history of STDs. A physician interviewed the FSWs for symptoms of STDs (abnormal vaginal discharge, and lower abdominal pain) and performed a routine genital examination for STD signs and symptoms. The subjects were given a tampon and verbal instructions as to how to use the tampon to collect the vaginal specimen (i.e., to insert the tampon into the vagina and immediately withdrawn and placed it in 15 mL of transport medium).

**Laboratory tests**

At the study clinic site, a wet mount of vaginal fluid was prepared and examined microscopically for the presence of motile *Trichomonas vaginalis*. At the Reference Laboratory of the National Center for STD Control, cells were dislodged from tampons by manual ringing and squeezing, and were pelleted by centrifugation. DNA was extracted from 20-\textmu L aliquots of tampon cell pellet using a QIAamp DNA Purification Kit (Qiagen Inc., Valencia, CA) per the manufacturer’s instructions. Overall, three amplification reactions were per-
formed on DNA extracted from each tampon specimen. Roche Diagnostics was used for detection of *C. trachomatis* and *N. gonorrhoeae*. Polymerase chain reaction (PCR) detection of *T. vaginalis* and β-globin gene sequences were performed using PCR-enzyme-linked immunosorbent assay (ELISA) DNA detection assay (Roche Biochemicals). Amplification was performed in capillaries with a volume of 50 μL, consisting of a 20-μL aliquot of extracted DNA and 30 μL of mastermix reactions (obtaining from Royal Women’s Hospital, Melbourne). All serum samples were screened for antibodies to *T. pallidum* by rapid plasma reagin (RPR) test (Shanghai, China), and retested by *T. pallidum* hemagglutination (TPHA) test (Fuji Corporation, Japan) if the RPR was positive. A treponemal seropositivity was considered if both RPR and TPHA test results were found to be positive. HIV tests were done on an unlinked aliquot of serum using the ELISA technique (Vironostika® HIV Uni-Form II Plus O; Organon Teknika). Positive serum samples were then confirmed by a reference laboratory using Western blot (Genelabs Diagnostics®, HIV Blot 2.2, Singapore). Anti-HSV-2-specific immunoglobulin G (IgG) antibodies were detected with ELISA HSV-2 kit (HerpeSelect®, Focus Technologies, Cypress, USA) based on the use of the recombinant gG-2 antigen. Procedure and interpretation of the assay were as recommended by the manufacturer’s instruction manual. During the survey, participants received counseling on STD and HIV prevention. STD syndromic management was provided at the time of examination according to the national syndromic approach protocols.

**RESULTS**

**Characteristics of the study population**

Of the 505 eligible FSWs, more than half (54.3%) were aged under 25 years; their mean age was 24.7 years (standard deviation [SD] ± 5.0; range, 15–39). The majority (81.2%, 410/505) had an educational level of secondary school or lower; 75.0% (379/505) were unmarried or divorced and living or not living with a sexual partner. One third (30.1%) came from outside the local area, but from within the study province and one third (37.8%) came from other provinces.

**Prevalence of sexually transmitted infections**

The data on prevalence of STIs among the FSWs are shown in Table 1. The prevalence rate for *C. trachomatis* was 58.6%, for *T. vaginalis* 43.2%, and for *N. gonorrhoeae* 37.8%. One quarter had coinfection with both *N. gonorrhoeae* and *C. trachomatis*. The prevalence of HIV infection was 10.3% and all HIV-positive cases were injecting drug users (IDUs). Seropositivity to *T. pallidum* was approximately 10%. Of the 505 FSWs, 426 (84.4%) had at least one infection (*N. gonorrhoeae, C. Trachomatis, T. vaginalis*, and syphilis), 244 (48.3%) had two concurrent infections, 77 (15.2%) had three concurrent infections, and 6 (1.2%) had four infections. Three hundred twenty-seven (65.1%) sex workers had serologic positivity of HSV-2 infection. Five (1.0%) FSWs had coinfection of HIV and syphilis and 41 (8.1%) had infection of both HIV and HSV-2. Subjects with positive HSV-2 antibodies had a significantly higher prevalence of HIV infection (12.5%) than those with HSV-2 negativity (6.3%, χ² = 4.80, p = 0.028, odds ratio [OR] = 2.14, 95% CI: 1.07, 4.27). Prevalence of *N. gonorrhoeae* and *C. trachomatis* among the FSWs with and without symptoms of abnormal vaginal discharge was analyzed; 75.4% (144/191) of the FSWs with gonococcal infection and 77.0 (228/296) with chlamydial infection and 70.8% (34/48) with trichomonas...
infection were asymptomatic. Among the 393 FSWs without abnormal vaginal discharge, 228 (58.0%) had chlamydia, 144 (36.6%) had gonorrhea, and 34 (8.7%) had trichomoniasis detected by PCR technique. There were not any differences in terms of prevalence of N. gonorrhoeae, C. trachomatis, T. vaginalis between FSWs with and without abnormal vaginal discharge (Table 2).

Risk behaviors and factors of infections

A high frequency of risky behaviors was noted among the FSWs in the study. Among FSWs who was respondent to question of condom use, 54.8% (n = 187) reported no condom use for 50% or more of sexual acts. Approximately 44% (219/496 responses) reported having irregular sex partners, including sexual clients and casual boyfriends, and 58.1% (292/503 responses) reported using drugs. Proportion of drug use among local FSWs (73.2%, 229/313) was significantly higher than that (33.1%, 63/190) among those from other provinces (OR = 5.50, 95% CI: 3.71–8.13; χ² = 77.7, p < 0.001). Certain potential risk factors of the infection were examined. As shown in Table 3, the youngest subjects (aged below 20 years) had the highest prevalence of 55.7% for N. gonorrhoeae and 67.1% for C. trachomatis and a decreasing trend in the prevalence of gonorrhea and chlamydia in relation to age was observed (χ² test for trend, p = 0.03 and < 0.01 for gonorrhea and chlamydia, respectively). Infection with N. gonorrhoeae was statistically related to lower education level but a significantly higher prevalence of T. vaginalis and syphilis was observed among those with a higher education background (p < 0.01). Sex workers from the study areas or the areas within the study province had a significantly higher HIV prevalence than those from other provinces.

### Table 1. Prevalence of STIs among Five Hundred Five FSWs in Kunming

<table>
<thead>
<tr>
<th>Etiologic diagnosis</th>
<th>No. (%) of positive samples</th>
<th>95% confidence intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. gonorrhoeae</td>
<td>191 (37.8)</td>
<td>33.6–42.0</td>
</tr>
<tr>
<td>C. trachomatis</td>
<td>296 (58.6)</td>
<td>54.3–62.9</td>
</tr>
<tr>
<td>T. vaginalis</td>
<td>218 (43.2)</td>
<td>38.9–47.5</td>
</tr>
<tr>
<td>Syphilis⁰</td>
<td>48 (9.5)</td>
<td>6.9–12.1</td>
</tr>
<tr>
<td>Two infections⁰</td>
<td>244 (48.3)</td>
<td>44.0–52.7</td>
</tr>
<tr>
<td>Three infections⁰</td>
<td>77 (15.2)</td>
<td>12.4–18.6</td>
</tr>
<tr>
<td>Four infections⁰</td>
<td>6 (1.2)</td>
<td>0.5–2.6</td>
</tr>
<tr>
<td>Any STI⁰</td>
<td>426 (84.4)</td>
<td>80.9–87.3</td>
</tr>
<tr>
<td>HIV</td>
<td>52 (10.3)</td>
<td>7.6–13.0</td>
</tr>
<tr>
<td>HSV-2</td>
<td>327 (65.1)</td>
<td>60.9–69.2</td>
</tr>
<tr>
<td>HIV and syphilis</td>
<td>5 (1.0)</td>
<td>0.4–2.3</td>
</tr>
<tr>
<td>HIV and HSV-2</td>
<td>41 (8.1)</td>
<td>6.0–10.8</td>
</tr>
</tbody>
</table>

⁰Seropositivity for both RPR and TPHA.
⁰N. gonorrhoeae, C. trachomatis, T. vaginalis, and syphilis.
⁰Confirmation with Western blot.

### Table 2. Prevalence of STIs among FSWs with and without Symptoms of Abnormal Vaginal Discharge

<table>
<thead>
<tr>
<th>Etiologic diagnosis</th>
<th>Prevalence (%)</th>
<th>χ² value (p value)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Symptomatic (n = 112)</td>
<td>Asymptomatic (n = 393)</td>
</tr>
<tr>
<td>N. gonorrhoeae</td>
<td>42.0</td>
<td>36.6</td>
</tr>
<tr>
<td>C. trachomatis</td>
<td>60.7</td>
<td>58.0</td>
</tr>
<tr>
<td>T. vaginalis</td>
<td>12.5</td>
<td>8.7</td>
</tr>
</tbody>
</table>

STIs, sexually transmitted infections; FSWs, female sex workers.
provinces \((p < 0.01)\). Age at first sex and frequency of condom use in the last 6 months was not found to be related to infection with STIs except that a higher HSV-2 infection was observed among those who had their first sex at age of less than 22 years old. Among FSWs who used drugs, a significantly lower prevalence of \(N.\) gonorrhoeae \((p < 0.03)\) and \(C.\) trachomatis \((p < 0.01)\) and higher prevalence of HIV \((p < 0.01)\), HSV-2 \((p < 0.01)\) and \(T.\) vaginalis \((p < 0.01)\) was observed. Multivariate analysis indicated that younger age \((p < 0.01)\) and lower educational level \((p = 0.03)\) were risk factors of gonococcal infection; the sex workers from local areas \((p = 0.01)\) and those who used drugs \((p < 0.01)\) had a significantly higher HIV infection; and the earlier age at first sex \((p = 0.03)\) and drug use \((p < 0.01)\) was significantly related to HSV-2 infections.

**DISCUSSION**

Very high prevalence rates of bacterial STIs were found among FSWs, as expected, condom use was very low with more than half of FSWs using less than 50% sex acts, and no effective intervention strategy has been implemented in this population. The number of FSWs in China is not well known, but the experts’ estimates range from 4 to 6 million FSWs\(^1\) which are a heterogeneous population with different risks of acquiring and transmitting STIs and HIV\(^1\) which will be a big reservoir for expanding STIs and HIV in China.
Although it is difficult to compare STI prevalence in FSW in different areas with different sampling and laboratory techniques, comparisons were made as information to further relevant efforts. Approximately 38% of the FSWs in the present survey were PCR-positive for gonorrhea, which is similar to that found among street-based FSWs in Bangladesh\(^1\)\(^2\)\(^3\) and brothel-based FSWs in Indonesia, where 35.6% and 31% of sex workers were positive for gonorrhea, respectively, but our prevalence is much higher than those observed among FSWs in a southern city in China,\(^1\)\(^4\)\(^5\) and some developed countries and developing countries in Asia.\(^1\)\(^4\)\(^5\) Similar high rates of gonococcal infection were found in sex workers in African countries, with prevalence of 28% to 46% in middle- and lower-social strata prostitutes in Kenya, and of up to 31% in Ivory Coast.\(^1\)\(^6\)\(^1\)\(^7\) Prevalence of trichomoniasis was 43.2%, in our study, with similar prevalence rates reported from street-based FSWs in Bangladesh\(^1\)\(^2\)\(^3\) and those found in Africa.\(^1\)\(^8\) Chlamydia infection was much more prevalent (58.6%) in our subjects than those found in most of other studies,\(^1\)\(^2\)\(^4\)\(^5\)\(^1\)\(^8\)\(^1\)\(^9\)\(^2\)\(^0\) although there were a few studies in which a similar rates were reported.\(^2\)\(^1\)

Nearly 10% FSWs infected with syphilis in our study is comparable with 8.5% found among hotel-based sex workers in Bangladesh,\(^2\)\(^1\)\(^7\) 7.5% to 13% among brothel-based FSWs in Indonesia,\(^1\)\(^9\)\(^2\)\(^3\) and 7.2% among foreign sex workers in Japan,\(^1\)\(^5\) lower than 32.6% found among street-based FSWs in Bangladesh,\(^1\)\(^2\)\(^3\) and 22.7% found among sex workers in red light areas of India,\(^1\)\(^4\) and but higher than local sex workers in Japan,\(^1\)\(^5\) Peru,\(^2\)\(^0\) Spain,\(^2\)\(^3\) and Greece.\(^2\)\(^4\)

Prevalence of HIV infection (10.3%) is comparable to 6.6%–13.6% reported among FSWs in Vietnam,\(^2\)\(^5\)\(^2\)\(^6\) but much higher than that had been reported in previous studies in some areas in China.\(^2\)\(^7\)\(^2\)\(^8\) Two factors that could explain the high HIV infection rate in the study group are the high STI prevalence rates (which can facilitate HIV infection) and the high proportion (58.1%) of drug users among the participants. HIV prevalence among local FSW was higher than those from other provinces, which may be related to the high prevalence of drug use practice among local FSWs. Because it is unknown about the representativeness of the study pop-

ulation in terms of the overlap between drug use and prostitution behaviors among FSWs, caution should be used in extrapolation of the HIV prevalence to the general sex worker population in China. However, based on the high proportion of drug users among FSWs in study population, a specific intervention focusing on harm reduction such as needle exchange needs to be considered in intervention program in addition to current condom promotion and health education activities.

A high seropositivity of HSV-2 antibodies (65.1%) was observed among our FSWs and was found associated with those who had first sex at younger age, which are in agreement with those found in most studies in both developed and developing countries.\(^2\)\(^9\)\(^3\)\(^0\)

As observed elsewhere,\(^3\)\(^1\)\(^3\)\(^2\) more than half of the women with cervical infections were asymptomatic. The lack of symptoms among sex workers with STIs is a major constraint in using syndromic approaches to screen for gonococcal and/or chlamydial infections. The high rates of STIs among the FSWs in the study would justify that appropriate treatment approach such as presumptive treatment, can rapidly reduce STI rates. Once prevalence rates are brought down, however, other sustainable strategies are required.

Several limitations to this survey should be considered in the interpretation of the results. First, the participants were not recruited randomly from their establishments with mapping undertaken. Some of them are consecutively enrolled from reeducation centers, resulting in a less representative study FSW population. Second, the information biases particularly those related to self-reported sexual behaviors and drug use are also to be considered.

**CONCLUSION**

These findings from the present study reveal a high burden of STIs and HIV among FSWs in Yunnan Province, China. The high mobility of this population, low condom use, low education, young age, having early first sex, etc., may contribute to the expansion of the STI and HIV epidemic into lower risk populations through their clients. Comprehensive and appropriate
prevention through health education, condom promotion and harm reduction activities and effective STI services for sex workers and their clients, particularly for the young, will be the key strategies to the control of STIs, including HIV. Policies and prevention strategies for STI/HIV need to focus on high-risk subpopulations, such as sex workers (particularly sex workers who inject drugs) and their clients.

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REFERENCES


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