PREVALENCE OF HIV INFECTION AND PREDICTORS FOR SYPHILIS INFECTION AMONG FEMALE SEX WORKERS IN SOUTHERN CHINA

Fan Lu[1], Yujiang Jia[2,3], Xinhua Sun[4], Lan Wang[1], Wei Liu[5], Yan Xiao[1], Gang Zeng[1], Chunmei Li[6], Jianbo Liu[6], Holly Cassell[2], Huey T Chen[7] and Sten H Vermund[2,3]

[1]National Center for AIDS/STD Control and Prevention, China Center for Disease Control and Prevention, Beijing, PR China; [2]Institute for Global Health, [3]Department of Pediatrics, School of Medicine, Vanderbilt University, Nashville, USA; [4]Division of AIDS, Disease Control Bureau, China Ministry of Health, Beijing, PR China; [5]Guangxi Zhuang Autonomous Region Center for Disease Control and Prevention, Nanning, Guangxi, PR China; [6]Department of Epidemiology and Biostatistics, School of Public Health, Hebei Medical University, Shijiazhuang, Hebei Province, PR China; [7]Department of Health Behavior, School of Public Health, University of Alabama at Birmingham, Birmingham, USA

Abstract. The purpose of this study was to assess the prevalence and risk factors for syphilis infection among female sex workers (FSWs) in Liuzhou City, Guangxi Zhuang Autonomous Region, southern China. A cross-sectional study recruited FSWs using a venue-based method and subsequent snowball sampling with mapping strategies. Questionnaire-based interviews were conducted to collect demographic and behavioral information. Blood was tested for syphilis (RPR with TPPA confirmation) and HIV (EIA with Western blot confirmation) infections. Of the 362 eligible participants, 81.7% were non-local residents (60.5% from other parts of Guangxi and 21.2% were non-Guangxi residents); 58.0% belonged to non-Han minority ethnic groups; 37.5% reported inconsistent condom use with their clients and 71.2% reported inconsistent condom use with their regular sex partners during the past month. Nearly 10% reported having had sex with drug users. The prevalence rates for HIV and syphilis infections were 2.3% and 11.0%, respectively. Almost half (46.6%) of participants reported having had STD symptoms. Inconsistent condom use with clients in the past month (AOR=5.0; 95%CI=1.8-13.8), less education (OR=2.6; 95% CI=1.1-7.4), and HIV infection (AOR=8.1; 95%CI=1.1-68.5) were independently associated with syphilis infection.

Correspondence: Lu Fan, Division of Policy Research and Information, National Center for AIDS/STD Control and Prevention, China Center for Disease Control and Prevention, No. 27 Nanwei Road, Beijing 100050, PR China.
Tel/Fax: +86-10-63039092
E-mail: fanlv@vip.sina.com

Yujiang Jia, Institute for Global Health, Vanderbilt University School of Medicine, 2525 West End Avenue, Suite 750, Nashville TN 37203-1783, USA.
Tel: 615-322-4429†; Fax: 615-343-7797
E-mail: yujiang.jia@vanderbilt.edu

INTRODUCTION

Since the "open door policy" and economic reforms initiated in 1978, the social structure of China has been changing dramatically. Commercial sex activities have flourished across the country and sexually transmitted diseases (STDs) have reemerged as a major public health problem 30 years after their near-elimination in China (Shao *et al*, 1996; Cohen *et al*, 1996, 2000; Gong *et al*, 1998, 2001; Chen *et al*, 2000, 2005, 2007).

Injection drug users (IDUs) and commercial blood/plasma collection have been the main sources for HIV infection in China (China CDC, 2000; China Ministry of Health and UN theme Group on HIV/AIDS in China, 2004; Wu *et al*, 2004; China Ministry of Health, UNAIDS and WHO, 2006; Jia *et al*, 2007, 2008; Xiao *et al*, 2007). However, the risk for HIV/AIDS in China is increasingly attributable to unprotected sex, accounting for nearly half of new infections in 2005 (Lu *et al*, 2006). Heterosexual transmission of HIV through contact with female sex workers (FSWs) is of particular concern (Zhang *et al*, 2000; Qian *et al*, 2005; Tucker *et al*, 2005; Yang *et al*, 2005; Lu *et al*, 2006; Xiao *et al*, 2007). It is estimated that there are 4-6 million FSWs in China (Hong and Li, 2008). High rates of risk behavior among FSWs and a high prevalence of sexually transmitted diseases (STDs) have been reported, with overlapping risk exposure. For example, 45.5% of IDUs share needles and syringes and 11% of IDUs engage in high risk sexual activities, thereby providing a potential bridge between FSWs and the general population (Ming *et al*, 2002; Qu *et al*, 2002; Liu *et al*, 2005; Ruan *et al*, 2006).

Between 1989 and 1998, the number of newly infected STD cases nationwide increased by 20% per year (Chen *et al*, 2000). The majority of STD cases were infected through unprotected sexual contact with their heterosexual partners, though men having sex with men (MSM) represented a growing concern (Shao *et al*, 1996; Gong *et al*, 1998; Chen *et al*, 2000; Qin *et al*, 2003). Syphilis is a common STD in China, accounting for ≈ 10% of the reported STD cases nationwide (9.9% in 2000 and 10.9% in 2004) (Gong *et al*, 2001; China CDC, 2005a). FSWs, IDUs, and mobile populations (usually men far from spouses at home) are fueling the expasion of HIV and STDs in the general population of Chinese society. Since syphilis is known to facilitate the transmission of HIV, the prevalence of syphilis among FSWs is an especially important public health problem at present.

Epidemiological studies report a wide range of STD prevalence among FSWs in China, from 0% to 10.3% (Wei *et al*, 2004; Chen *et al*, 2005; Ding *et al*, 2005; Wang *et al*, 2005). The disparity may result from varying sampling strategies, but is more likely from local conditions in different geographic venues. We conducted a cross-sectional survey among FSWs in a northern city of Guangxi in 2005 to assess the prevalence and the association of behaviors and risk factors with syphilis and HIV infections.

MATERIALS AND METHODS

Study setting

Guangxi is located in southern China and has a population of 40 million persons. It is one of the regions hardest hit by HIV in China, bordering Vietnam on the southwest and along a major drug transportation route linking Yunnan with Guangzhong. Guangxi has witnessed an alarming HIV epidemic among local IDUs. HIV infection rates among IDUs vary from 20% to 70% in different parts of Guangxi. This region ranks third in the number of reported HIV/AIDS cases among provinces in China (Guangxi CDC, 2006). The HIV epidemic in Guangxi is following the national trend of spreading into the general population. Liuzhou City with 3.6 million people located in northern Guangxi, has since the 1980s become a passage for narcotics trafficking from the notorious Golden Triangle. Data suggest that about 21% of drug users test positive for HIV. The proportion of reported HIV cases attributed to sexual contact has grown from 0.5% in 2000 to 10% in 2005 (Guangxi CDC, 2006).

Participants and procedure

The size of the FSW population was estimated in each community and geographic

mapping was conducted in the study's targeted communities in Liuzhou City. The participants were primarily enrolled by the trained staff using venue-based recruitment, community outreach and peer referral "snowball" techniques. The peer referrals were limited to a maximum of five participants in order to enroll a relatively representative sample in the FSW community. Trained staff distributed information to FSWs. Written informed consent was obtained from all study participants before being interviewed. Eligibility criteria required that participants be female, willing to participate, and self reporting of having engaged in commercial sex in the past month. The interviews were all performed in a participant friendly environment at either local clinics or at the location where sexual activities were taking place. Blood samples were collected for the HIV and syphilis tests. The trained staff provided the pre-test and post-test counseling for both HIV and syphilis testing. The syphilis infected cases were referred to local hospitals or clinics for standard treatment and care. HIV positive cases were referred to HIV intervention, treatment and care programs. Both HIV and syphilis infected cases were reported to the local center for disease control and prevention. The study was approved by the Institutional Review Board (IRB) of the National Center for AIDS/STD Control and Prevention of the China CDC and by the IRB of Vanderbilt University. Participants received voluntary HIV counseling and testing (VCT) and had blood drawn to test for HIV and syphilis infections. Participants were given HIV post-testing counseling when they returned for their test results.

Questionnaire and data collection

Structured questionnaire-based interviews were administered confidentially by trained staff. The questionnaire included age, marital status, current residency, ethnicity, years of education, monthly income, place of sex work, awareness of the three HIV transmission routines (sex, blood, and mother to child), age at sexual debut, age at first commercial sex, duration of commercial sex, frequency of commercial sex in the past month, number of clients in the past week, clients' residencies, condom use with past commercial sex, condom use with clients in the past month, condom use with regular sex partners in the past month, ever having sex with drug users in the past six months, ever using drugs in the past six months, and ever having had STD symptoms in the past year (the trained staff collected this information through asking the participants whether they ever had any symptoms of STDs, such as abnormal discharge from the vagina, lower abdominal pain not during the monthly period, pain or burning sensation when urinating, and skin lesions, *eg*, bumps, sore, rash). Place of sex work was categorized as "high end" for "star" hotels, VIP clubs, big karaoke and dancing bars, and saunas; or "low end" if in hair salons, massage parlors, small hotels, and on the street.

Laboratory tests

Blood samples were collected and stored at 4ºC prior to testing for both HIV and syphilis antibodies. An algorithm for a screening test using an enzyme immunoassay (EIA, Beijing Jinhao Biologic Production, China) and a confirmatory test using an HIV-1/2 Western blot immune assay (HIV Blot 2.2 WB; Genelabs Diagnostics, Singapore) were applied for HIV. Syphilis seropositivity was determined through screening by a positive rapid-plasma reagin (RPR) test (Macro-Vue RPR™ Card Test, Becton-Dickinson, USA) and confirmed by a Passive Particle Agglutination Test for Detection of Antibodies to *Treponema pallidum* (TPPA, Beijing Jinhao Biologic Production).

Statistical analysis

Questionnaire data were entered into EpiData (The EpiData Association, Odense M, Denmark). After validation through double entry, the results were exported to Statistical Package Social Sciences (SPSS15.01™, SPSS Institute, Cary NC, USA) for statistical analysis. Associations between sociodemographic factors and risk factors for syphilis infection status were analyzed. Variables significant at a level of 0.1 on bivariate logistic regression analyses were fitted into multivariate models. Multivariate logistic regression models were constructed through backwards elimination to select independent risk factors for syphilis infection, while controlling for potential confounding factors. Both adjusted odds ration (AOR) and confidence intervals were obtained for each explanatory variable in the final models.

RESULTS

Sociodemographic characteristics (Table 1)

A total of 362 participants were assessed and met the eligibility criteria, 8 refused to participate (2.2% refusal rate) due to the sensitivity of the sexual questions. All 362 women (100%) returned for their test results; 90.3% (196/217) of participants were from low-end establishments. The average age was 21.5 years (SD±3.9 years); Only 18.3% of women were from Liuzhou City, 60.5% were from other parts of Guangxi, and 21.2% were from other provinces of China; 58.0% belonged to non-Han minority ethnic groups (Yi, Dai, and other groups); Nearly three quarters of participants had > 6 years of education (71.7%, 265/375), and 28.3% has ≤ 6 years of education; Sixty-eight percent (240/353) were single or separated and 32.0% were married or cohabited; Most participants (77%, 236/295) reported having > USD120 (about CNY 1,000) monthly income.

HIV knowledge and sexual behavior (Table 1)

Seventy percent of the participants (250/357) knew the three major routes of transmission for HIV (blood, sex and mother to infant), 91.2% (323/354) were willing to use condoms to prevent HIV and STDs, and 37.5% (135/360) had received VCT. The median age for initiating sex work was 16.5 years (range 15 to 19 years). The median duration of sex work was 2 years. The median number of all clients in the past week was 2.8 men; the majority of participants (95.4%, 208/218) reported more than ten episodes of trading sex for money in the past month; 62.5% of the participants (202/323) reported consistent condom use with their clients in the past month; however, only 28.8% (57/198) of the participants reported consistent use with their regular sex partners in the past month; Nearly 10% (16/161) reported they ever had sex with drug users, and 42.2% (162/348) reported STI symptoms. Illicit drug use was not common with 1.4% (5/357) reporting ever having used illicit drugs (Ecstasy and Ketamine).

Syphilis and HIV infections and ever having had any symptoms of STDs (Table 1)

Of the 354 participants, 11.0% (38) were infected with syphilis, 2.3% were infected with HIV, and 46.6% reported ever having had symptoms of STDs.

Risk factors for syphilis infection (Table 2)

On univariate analysis, the factors significantly associated with syphilis infection were lower level education (OR=2.1, 95% CI=1.0-4.1), lower monthly income (OR=2.4, 95%CI=1.1-5.6), low frequency of commercial sex in the past month (OR=5.9, 95%CI=1.5-22.7), inconsistent or no use of condoms with clients in the past month (OR=5.3, 95%CI=2.4-11.3), ever having had sex with drug users (OR=9.5, 95%CI=3.0-30.3), ever having had STI symptoms (OR=3.2, 95% CI=1.5-6.9), past drug use (OR=6.2, 95%CI=1.0-38.6), and HIV

Table 1
Demographic and behavioral factors associated with syphilis infection among female sex workers in the Guangxi Zhuang Autonomous Region of southern China.

Factors	*n* (%)[a]	Syphilis+ (%)[b]	OR (95% CI)	*p*
Age (years)				
<23	189 (52.4)	16 (8.5)	1.0	0.2
≥23	172 (47.6)	22 (12.8)	1.6 (0.8-3.1)	
Marital status				
Single or separated	244 (68.3)	22 (9.0)	1.0	0.2
Married or cohabiting	113 (31.7)	16 (14.2)	1.6 (0.8-3.3)	
Local residency				
Luzhou	66 (18.0)	7 (10.0)	1.0	
Non-Liuzhou, Guangxi	217 (60.5)	24 (11.0)	1.0 (0.4-2.6)	0.9
Non-Guangxi	76 (21.2)	7 (9.2)	0.9 (0.3-2.6)	0.5
Ethnicity				
Han	144 (41.5)	11 (7.6)	1.0	0.1
Non-Han ethnicity	203 (58.5)	26 (12.8)	1.8 (0.8-3.7)	
Years of education				
>6	265 (74.2)	23 (8.7)	1.0	0.04
≤ 6	92 (25.8)	15 (16.3)	2.1 (1.0-4.1)	
Monthly income (USD)				
>120	58 (19.7)	10 (17.2)	1.0	0.04
≤120	236 (80.3)	18 (7.6)	2.4 (1.1-5.6)	
Place of sex work[c]				
Low end	196 (90.3)	8 (4.1)	1.0	0.6
High end	21 (9.7)	0	-	
Awareness of three major transmission routes for HIV (blood, sex and mother to infant)				
Yes	250 (70.0)	26 (10.4)	1.0	0.8
No	107 (30.0)	12 (11.2)	1.1 (0.5-2.2)	
Age at sex debut (years of age)				
≥18	142 (43.0)	16 (11.3)	1.0	0.9
<18	188 (57.0)	22 (11.7)	1.0 (0.5-2.1)	
Age at first commercial sex (years of age)				
≥23	106 (32.4)	17 (16.0)	1.0	0.07
<23	221 (67.6)	20 (9.0)	0.5 (0.3-1.0)	
Duration of commercial sex (years)				
<2	122 (51.9)	9 (7.4)	1.0	0.2
≥2	113 (48.1)	16 (14.2)	2.1 (0.9-4.9)	0.1
Frequency of sex trade in the past month				
≥10 times	208 (95.4)	20 (9.6)	1.0	0.02
<10 times	10 (4.6)	4 (40.0)	5.9 (1.5-22.7)	
Number of clients in the past week				
<3	152 (56.5)	20 (13.2)	1.0	0.6
≥3	117 (43.5)	13 (11.1)	0.8 (0.4-1.7)	
Clients' residency				
Local residents	188 (74.3)	22 (11.7)	1.0	0.2
Non-local residents	65 (25.7)	12 (18.5)	1.7 (0.8-3.7)	

Table 1 (Continued).

Factors	*n* (%)[a]	Syphilis+ (%)[b]	OR (95% CI)	*p*
Condom use with past commercial sex				
Yes	240 (75.2)	26 (10.8)	1.0	0.3
No	79 (24.8)	12 (15.2)	1.5 (0.7-3.1)	
Condom use with clients in the past month				
Consistent use	202 (62.5)	10 (5.0)	1.0	<0.001
Inconsistent or never use	121 (37.5)	26 (21.5)	5.3 (2.4-11.3)	
Consistent condom use with regular sex partner in the past month				
Yes	57 (28.8)	4 (7.0)	1.0	0.1
No	141 (71.2)	21 (14.9)	2.3 (0.8-7.1)	
Ever having sex with drug users in the past six months				
No	145 (90.1)	11 (7.6)	1.0	<0.001
Yes	16 (9.9)	7 (43.8)	9.5 (3.0-30.3)	
Drug use in the past six months				
No	352 (98.6)	34 (9.7)	1.0	0.05
Yes	5 (1.4)	2 (40.0)	6.2 (1.0-38.6)	
Ever had any symptoms of STDs in the past year				
No	186 (53.4)	10 (5.4)	1.0	0.003
Yes	162 (46.6)	25 (15.4)	3.2 (1.5-6.9)	
HIV infection				
Negative	346 (97.7)	35 (10.1)	1.0	0.03
Positive	8 (2.3)	3 (37.5)	5.3 (1.2-23.3)	

[a]N, The number of participants being interviewed and tested for syphilis or HIV infections. The totals less than 354 indicate missing data; %, constitution ratio; [b]Syphilis +, syphilis-positive, which was determined through screening by a positive rapid-plasma reagin (RPR) test and confirmation by a Passive Particle Agglutination Test for Detection of Antibodies to *Treponema pallidum*; %, the prevalence rate for syphilis infection.

[c]"Place of sex work" was categorized as "high end" if they worked in star hotels, VIP clubs, big karaoke and dancing bars, and saunas; or "low end" if they worked in hair salons, massage parlors, small hotels, or on the streets.

OR, unadjusted odds ratio and CI, confidence interval.

Table 2

Risk factors for syphilis infection among female sex workers in the Guangxi Zhuang Autonomous Region of southern China: a summary of results on multivariate logistic regression analysis.

Risk factors	AOR (95%CI)[a]	*p*
Condom use with clients in the past month (inconsistent or never use *vs* consistent use)	5.0 (1.8-13.8)	0.002
Lower level of education (≤6 years of education *vs* >6 years)	2.6 (1.1- 7.4)	0.04
HIV infection (HIV-positive *vs* HIV-negative)	8.3 (1.1-68.5)	0.03

[a]AOR, adjusted odds ratio and CI, confidence interval.

infection (OR=5.3, 95%CI=1.2-23.3) (Table 1). Multivariate logistic regression analysis demonstrated that participants who reported inconsistent condom use with clients in the past month (AOR=5.0, 95% CI=1.8-13.8), lower education level (AOR=2.6; 95% CI=1.0-7.4) and HIV infection (AOR=8.1; 95% CI=1.1-68.5) were more likely to be infected with syphilis (Table 2).

DISCUSSION

This community-based study found a 2.3% prevalence rate of HIV among FSWs in Liuzhou City, Guangxi. The HIV prevalence rate was significantly lower than that among FSWs from a reeducation center in the neighboring province of Yunnan (10.3%) (Chen *et al*, 2005), but much higher than estimates from community-based surveys among FSWs in many other provinces in China (China CDC, 2005b). For example, in 2004, no cases of HIV infection were diagnosed in fourteen community-based surveys of 5,128 FSWs in different Chinese cities, including four cities in neighboring provinces (China CDC, 2005b). Lower rates (0.2% to 0.8%) were reported in five community-based surveys of 1,894 FSWs, including in two neighboring provinces (China CDC, 2005b; Ruan *et al*, 2006).

We found an 11.0% prevalence rate of syphilis among FSWs in Liuzhou City, Guangxi. The prevalence rate of syphilis in this study is similar to the 6.0-15.7% rates reported in four community-based surveys of FSWs [Shengzheng, Guangzhou Province (6.6%); Yining, Xinjiang Autonomous Region (6.0%); Qingdao, Shandong Province (7.4%); Dongshan, Fujian Province (13.3%) and Xichang, Sichuan Province (15.7%)] (China CDC, 2005b; Ruan *et al*, 2006). In fourteen other community-based surveys among FSWs conducted during the same period, lower rates (0-3.6%) were reported. As true elsewhere in the world, syphilis rates can vary markedly by city or venue.

Our findings indicate HIV has been introduced into the high risk FSW population in Liuzhou in the context of high prevalence rates of syphilis infection and self-reported STDs (46.6% of participants reported having had symptoms of STDs). Liuzhoug is located along a major drug trafficking-route in southern China and a high HIV prevalence rate is noted among local IDUs (Yu *et al*, 1999, 2002; Ming *et al*, 2002; Wong *et al*, 2007). Drug use contributed to >80% of HIV infections in Liuzhou; 22.1% of IDUs were infected with HIV in 2005 and a 60% of HIV prevalence rate was reported among IDUs in the nearby city of Nanning, the capital city of Guangxi (Guangxi CDC, 2005). Although multivariate analysis did not show an association between syphilis infection and FSWs ever having had sex with drug users, a strong association was found on univariate analysis (OR=9.5; 95%CI=3.0-30.3). This statistical association may be found if the sample size is large enough. This may reflect the theory that HIV starts spreads from IDUs to FSWs and their clients. We found that inconsistent condom use with clients during the past month, lower level of education, and HIV infection were independently associated with higher risk of syphilis infection among FSWs. These are clear avenues for intervention, namely condom advocacy, skill training, and HIV/STD intervention education. High rates of co-infection bode ill for HIV trends among Liuzhou FSWs in the absence of interventions.

The strengths of this study include (1) the multiple recruitment methods, such as venue-based recruitment, community outreach, and peer referral "snowball" techniques with limited five referred peers for each "seed" and (2) the mapping strategies with the size of the FSW population estimation. There were also limitations. Al-

though, multiple recruitment methods were used, it is not a random sampling method, *eg*, snowballing tends to recruit participants with similar characteristics and leads to sample bias. Data regarding sexual behaviors and condom use is subject to self-reporting bias and social response bias due to the sensitivity of these topics. The sample size for this study may not be large enough to shown some potential associations between infections and different factors, *eg* the syphilis infection and ever having had sex with drug users. Finally, our cross-sectional study cannot ascertain a causal association, *eg*, between syphilis and HIV infection, although the relationship has been confirmed elsewhere (Wasserheit, 1992; Royce *et al*, 1997; Fleming and Wasserheit, 1999; Zetola *et al*, 2007).

Drug use is an important risk factor for HIV infection through needle sharing and contributes to riskier behaviors by altering people's judgment and inhibition. Liuzhou FSWs rarely used drugs themselves (1.4%); 9.9% of FSWs reported ever having had sex with drug users. In many Asian countries, HIV has spread initially among drug users, and later, sexually (Yang *et al*, 2005; Ruan *et al*, 2006). The association between syphilis and HIV, between syphilis and unprotected sex, and between drug-trafficking venue and the high HIV prevalence rate among IDUs may suggest a disturbing bridging role of FSWs in HIV transmission from IDUs to the general population in our study area. We must learn more about the sexual and drug use network, their mixing dynamics, and specific effective strategies for risk reduction. Syphilis screening and contact tracing, HIV/STD risk reduction education, VCT and aggressive condom promotion programs are urgently needed. Much can and should be done to stem this co-epidemic in FSWs.

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