



NIH PUBLIC ACCESS

## Author Manuscript

*Sex Transm Dis.* Author manuscript; available in PMC 2013 March 1.

Published in final edited form as:

*Sex Transm Dis.* 2012 March ; 39(3): 195–200. doi:10.1097/OLQ.0b013e31823d2e2a.

## Systematic Differences in Risk Behaviours and Syphilis Prevalence across Types of Female Sex Workers: a Preliminary Study in Liuzhou, China

Jing Li, Ph. D<sup>1</sup>, Xiang-Sheng Chen, M.D., Ph. D<sup>1</sup>, M. Giovanna Merli, Ph. D<sup>2</sup>, Sharon S. Weir, Ph. D<sup>3</sup>, and Gail E. Henderson, Ph. D<sup>4</sup>

<sup>1</sup>National Center for STD Control, Chinese Academy of Medical Science (CAMS) & Peking Union Medical College (PUMC) Institute of Dermatology, Nanjing, China

<sup>2</sup>Sanford School of Public Policy, Duke Population Research Institute and Duke Global Health Institute, Duke University, Durham, North Carolina

<sup>3</sup>The Department of Epidemiology in the Gillings School of Public Health and the Carolina Population Center, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

<sup>4</sup>Department of Social Medicine in the School of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina

### Abstract

**Background**—Female sex workers (FSWs) have become one of the key populations for HIV/STI control in China. Categorization of FSWs can help prioritize HIV/STI intervention efforts. We examined two possible categorizations of FSWs and the relationship with syphilis infection risk in Liuzhou City, China.

**Methods**—From October 2009 to February 2010, a total of 583 FSWs recruited by respondent-driven sampling in a cross-sectional survey were tested for syphilis and interviewed to collect socio-demographic and behavioural information. Respondents were categorized based on transaction price for vaginal sex and type of sex work location. The relationship between the two categorizations and syphilis infection risk was assessed using univariate and multivariate logistic regression analysis.

**Results**—The prevalence rates of lifetime and active syphilis infection were 8.6% and 4.1% respectively. Lifetime and active syphilis prevalence were higher among FSWs in the lowest price category (52.7% and 25.4% respectively) and those working in streets (69.7% and 39.8% respectively) or through telephone (46.3% and 17.0% respectively). Multivariate analysis showed that lifetime syphilis prevalence was significantly higher among street-(Adjusted odds ratio AOR 38.7, 95% CI 10.7-139.9) and telephone-based FSWs (AOR 10.8, 95% CI 3.3-35.1), and that active syphilis prevalence was significantly higher among street-based FSWs (AOR 15.2, 95% CI 3.7-62.1) after adjusting for demographic and behavioural factors.

**Conclusions**—Categorization based on sex work location was more closely related to the risk of syphilis infection than the price classification. Street- and telephone-based FSWs had significantly higher risk of syphilis infection. Focused interventions among these particular high-risk FSWs subgroups are warranted.

## Keywords

female sex workers; syphilis; respondent-driven sampling; China

---

## Introduction

China is experiencing rising HIV and syphilis epidemics and heterosexual transmission has surpassed injection drug use transmission to become the primary mode of infection for HIV.<sup>1</sup> Female sex workers (FSWs) are believed to play a critical role in the heterosexual transmission of HIV/STI in China. Studies have found high prevalence of syphilis infection among FSWs.<sup>2-4</sup> Considering the role of sex work in driving and sustaining the HIV/STI epidemic particularly in countries with concentrated epidemics, it is increasingly important to understand the context and organization of female sex work to better inform HIV/STI intervention programs.<sup>5</sup>

Sex work typology which classifies FSWs into types or categories plays an important role in HIV/STI research and programming in China. The National AIDS Sentinel Surveillance Guideline in China requires that all types of entertainment establishments be systematically mapped, classified into high-, middle- and low-tiers based on high risk behaviours, and sampled proportionately within each tier.<sup>8</sup> Many community-based surveys conducted among FSWs also take into account of sex work typology as part of their sampling strategy.<sup>9-10</sup> From a programmatic perspective, FSWs typology can help prioritize targeted intervention efforts among high-risk FSWs subgroups.

However, the national guideline is not explicit about which indicator of risk behaviour and which criterion should be used for classifying FSWs.<sup>8</sup> Previous studies in China have used different criteria to categorize FSWs including type of sex work location,<sup>2-3, 10-11</sup> price charged per sexual transaction,<sup>12-13</sup> HIV prevalence,<sup>14</sup> and combinations of factors including work organization, relationship with managers, demographic characteristics, and income level.<sup>6</sup> The last two criteria are not directly measurable and thus not easy to operationalize from a programmatic perspective. Some qualitative studies<sup>12-13</sup> applied classifications based on transactional price and observed some differences in demographic characteristics and condom use among FSW subgroups. Sex work location is directly observable and more frequently used by researchers in China and elsewhere for categorization.<sup>5, 15</sup> But there has not been a recommended framework for conducting the classification and evaluating the linkage to actual risk of HIV/STI infection in China.

This study aimed to examine whether classification of FSWs based on price charged per sexual transaction and type of sex work location are appropriate criteria for distinguishing FSWs into subgroups at different risk of syphilis infection.

## Methods

### Participant recruitment

From October 2009 to January 2010, we conducted a cross-sectional study that concurrently sampled FSWs using a venue-based sampling method called "PLACE"<sup>16</sup> and respondent-driven sampling (RDS) to compare these two methods (unpublished data) in Liuzhou City, Guangxi Zhuang Autonomous Region in southwest China. Liuzhou has a population of 3.6 million, among which 56% are non-Han ethnic minorities and Zhuang is the largest. This paper utilizes data collected through the RDS arm of that study. A participant was eligible if she (1) was at least 15 years old, (2) self-identified as female, (3) reported having exchanged

sex for money in the past four weeks, (4) and was currently working and living in Liuzhou. Sex was defined to include penetrative vaginal and/or anal sex as well as oral sex.

Most RDS studies utilize a diversified initial group of participants (“seeds”) and a number of waves of recruitment to facilitate cross recruitment among subgroups and attain a sufficient sample.<sup>17</sup> A total of 7 seeds stratified by location where clients were solicited (massage parlours, hair salons, KTVs, saunas, and parks) were recruited with help from experienced local outreach workers in our study. Each respondent was given two coded coupons and instructed to recruit peers from their social networks. Of all the coupons distributed, 54% (607/1126) were returned resulting in 583 eligible participants. The sample size was calculated using an expected 15% positive rate of rapid syphilis test (based on expert consultation) and a design effect of 3 as recommended for RDS.<sup>18</sup> The questionnaire used to measure socio-demographic and behavioural characteristics was validated in an RDS study among FSWs in Shanghai (unpublished data) and a small pilot survey among 10 FSWs in Liuzhou. A dual incentive was offered for all participants: 100 RMB (about US\$16) for completing the interview and 50 RMB (about US\$8) for each successful referral. All interviews were anonymously conducted by interviewers after obtaining verbal consent in a private room. Ethical approval was obtained from Institutional Review Boards at the University of North Carolina at Chapel Hill, Duke University and the National Center for STD Control in Nanjing, China.

### Syphilis testing

Presence of treponemal-specific antibodies was assessed using finger-prick rapid point-of-care (POC) syphilis test (Wantai anti-TP Antibody Rapid Test, Wantai Biological Pharmaceutical Co., Ltd, Beijing, China). Those who were positive were further tested by a toluidine red unheated serum test (TRUST, Rongsheng Biotechnical Company, Shanghai, China) to determine positivity and titres of non-treponemal-specific antibodies. Lifetime syphilis infection was defined as having a positive POC test result since treponemal-specific antibodies usually persist for life despite treatment.<sup>19-20</sup> Active syphilis was defined as POC test positive and TRUST titre  $\geq 1:8$ .<sup>21-23</sup> Forty-seven participants chose not to take the rapid POC test, mainly because they had taken the test before (36/47) or had prior syphilis infection (11/47). These participants were not significantly different from other respondents in terms of age, marital status, education level, ethnicity, and type of sex work location. All the tests were performed by trained doctors and laboratory technicians at Erkong Hospital, Liuzhou. Free treatment for syphilis infection was provided according to the national guidelines.

### Data analysis

We considered two possible categorizations of FSWs. The first categorized FSWs into low-, middle- and high-paid categories based on three pricing ranges charged per vaginal sex (“price typology”): 50 RMB (about US\$8) and less, 50 to 200 RMB (about US\$8-32), and 200 RMB (about US\$32) and above. These groupings incorporated ranges used by prior researchers and the distribution of price for vaginal intercourse found in our sample. The other classification distinguished between five categories based on the type of the most recent physical sex work location in the past six months (“location typology”): (1) KTV-based refers to those FSWs working at Karaoke bars, night clubs and bars; (2) sauna-based refers to those FSWs working at saunas and bathhouses; (3) massage-based refers to those FSWs working at massage parlours and hair salons; (4) street-based, namely those who solicited clients in public outdoor places like parks, streets, etc; (5) telephone-based was defined as a sex work location if clients were only solicited via telephone or referral through telephone in the past six months. The first three locations were referred to as entertainment establishments in previous studies on FSWs in China.<sup>9</sup>

Six of the seven seeds successfully generated 9 to 20 waves of recruitment. The six referral chains were diverse in terms of price and sex work location, except for one chain that primarily consisted of highly-paid KTV-based FSWs (see figure 1). Equilibrium was reached between 2 and 6 waves of referral with regard to age, educational attainment, marital status, ethnicity, life-time syphilis and active syphilis infection. Adjusted population proportions and 95% confidence intervals (CIs) were produced using Respondent-Driven Sampling Analysis Tool (RDSAT)<sup>24</sup> to account for homophily, differential network size and recruitment patterns.<sup>25-26</sup> Overlaps in confidence intervals around each population proportion estimate were compared to examine significant differences among subgroups of FSWs and to determine where significant differences lie. Individual weights for dependent variables were determined based on the RDSAT user manual and exported from RDSAT for multivariate analysis.<sup>26-27</sup> The factors associated with syphilis infection were assessed using univariate logistic regression models and significant factors in univariate analysis were included for further assessment using multivariate logistic regression models. All data were analyzed in STATA.<sup>28</sup>

## Results

Among those who took the POC test (n=536), 40 were positive and among these 20 were TRUST reactive with titres all  $\geq 1:8$ . The prevalence rates of lifetime and active syphilis infection were estimated to be 8.6% (95% CI 5.3-12.8) and 4.1% (95% CI 2.2-6.4) respectively. Table 1 presents data on socio-demographic and behavioural characteristics and syphilis prevalence for the “price typology” of FSWs. The high-, middle- and low-paid FSWs categories accounted for 40.2%, 43.6% and 16.2% of FSWs population respectively. Compared with middle- and high-paid FSWs, low-paid FSWs had significantly higher lifetime and active syphilis prevalence and reported significantly less consistent condom use with clients in the past week (100% condom use for all sex acts). Significantly different socio-demographic profiles were found across the three price categories. High-paid FSWs were younger, better educated and mostly single. Middle-paid FSWs were relatively older, less educated, and less often single. Low-paid FSWs were even older, least educated and more often divorced or widowed. Compared with middle- and low-paid FSWs, high-paid FSWs reported significantly fewer clients in the past week. No significant difference in ethnicity, injecting drug use, and experience of HIV prevention activities at sex work locations was found.

Table 2 shows socio-demographic and behavioural characteristics and syphilis prevalence for the “location typology” of FSWs. The majority of FSWs were based in massage, KTV and sauna locations (38.6%, 29.6%, and 15.2% respectively), while a small proportion of FSWs were based on street (8.9%) or telephone locations (7.6%). Compared with FSWs in other categories, street- and telephone-based FSWs had significantly higher prevalence of lifetime and active syphilis infection, and reported much less frequent condom use. Socio-demographic characteristics also differed significantly among the five location categories. KTV-based FSWs were the youngest, best educated and mostly single, while street-based FSWs were the oldest, least educated, and mostly divorced or widowed. Socio-demographic characteristics for the other three categories fell in between. Telephone-based FSWs were relatively older and more often divorced or widowed compared with sauna- and massage-based FSWs. Significantly fewer street- and telephone-based FSWs reported experience of HIV prevention activities at sex work location than FSWs in other location categories. No significant difference in ethnicity and injecting drug use was found.

Results of multivariate logistic regression predicting lifetime and active syphilis prevalence are shown in Table 3. Lifetime syphilis prevalence was employed as a measure of lifetime risk and active syphilis infection as a marker of recent risk behaviours. After controlling for

other factors, lifetime syphilis prevalence was significantly higher among street-based FSWs (Adjusted odds ratio AOR 38.7, 95% CI 10.7-139.9), telephone-based FSWs (AOR 10.8, 95% CI 3.3-35.1), those who had not received HIV testing in the past twelve months (AOR 4.2, 95% CI 1.2-15.3) and those who reported having sex with clients who were unwilling to use condoms (AOR 4.1, 95% CI 1.1-15.0). Street-based FSWs were also at higher risk of active syphilis infection (AOR 15.2, 95% CI 3.7-62.1) compared with KTV-based FSWs. Although transaction price was associated with syphilis infection in univariate analysis, it was not significantly related to syphilis infection in multivariate analysis which is probably due to its correlation with type of sex work location (Spearman rank correlation coefficient  $r=0.71$ ,  $p<0.001$ ). In our sample, 55% FSWs were non-Han ethnic minorities, primarily from the Zhuang, Miao and Dong ethnic minority groups. FSWs of non-Han non-Zhuang ethnic minorities were at higher risk of active syphilis infection (AOR 12.2, 95% CI 1.2, 121.9) compared to ethnically Han FSWs.

## Discussion

In this article, we considered two classifications of FSWs based on transaction price for vaginal sex and type of sex work location, and examined whether these classifications distinguished FSW subgroups at different risk of syphilis infection. The results suggested that classification based on type of sex work location had better performance in predicting the risk of syphilis infection than the price classification. In addition, classification based on type of sex work location is more useful from an outreach perspective because it is directly observable, easy to operationalize, and able to aid in mapping and targeting of sex workers within intervention programs.<sup>5</sup>

Our results show that FSWs are operating through various locations with heterogeneous socio-demographic background and risk behaviours. We also identified a category of FSWs that only solicited clients via telephone which has not been reported in previous research on FSWs in China. Telephone-based FSWs as well as streetwalkers tended to hold highly disadvantaged socioeconomic profiles, report longer duration of sex work and a lower rate of consistent condom use. These women were also more likely to be at significantly higher risk of syphilis infection compared with FSWs working in entertainment establishments.

These features raise particular concern for several reasons. First, disease surveillance systems and most intervention studies in China have primarily targeted establishment-based FSWs.<sup>29-30</sup> Street and telephone-based FSWs have been largely missed by intervention efforts thus far. These women are not as easily accessible as establishment-based FSWs who can be contacted through their managers who undergo regular inspections from health departments. Additionally, over 30% of the FSWs in our sample who worked in a physical location (as compared to exclusively via phone) reported that they had solicited clients through cell phones at least once in the past six months to avoid submitting commissions to managers or pimps. The increasing use of cell phones for the purpose of sex work may result in an expanding and even harder-to-reach segment of FSWs. Intervention resources should be reallocated toward these subgroups to make greater impact on containing the growing syphilis epidemic.

Secondly, like most other migrant workers in China, FSWs often do not have health insurance.<sup>31</sup> High health care costs may place greater restriction on the affordability of testing and treatment services among street- and telephone-based FSWs who usually charge their clients much less than establishment-based FSW.<sup>32-33</sup> Left untested and untreated, these women may be at risk to further spread syphilis, and experience devastating health consequences such as transmission to newborns causing congenital syphilis, and increased risk of HIV acquisition.<sup>34</sup> This situation is further complicated by the fact that symptoms of



early syphilis frequently go unnoticed, especially among women.<sup>35</sup> Furthermore, syphilis infection can be persistent without adequate treatment.<sup>36</sup>

Lastly, street-based FSWs serve a large client volume in order to earn sufficient income at their lower asking price.<sup>32-33</sup> Simultaneously, a large population of male migrant workers have created an increasing surplus male population in urban and semi-urban areas and substantial demand for low-price FSWs.<sup>37-38</sup> Such a combination suggests the potential for an expanding syphilis epidemic in and beyond these high risk groups.

We also found that FSWs of non-Han non-Zhuang ethnic minorities were at significantly higher risk of active syphilis infection relative to FSWs of Han ethnicity. Though exploratory analysis did not find significant difference in condom use with clients among ethnic groups, FSWs of other ethnic minorities were less educated, less likely to have tested for HIV in the past year and more likely to have ever been arrested. Further studies should include sufficient number of FSWs of ethnic minorities to understand the differential impact of these factors on syphilis infection across ethnic groups. Multivariate analysis also revealed that known HIV status and refusal to have sex with clients unwilling to use condoms were both protective factors of syphilis infection in the study population. Researchers have found that high-risk populations reduce risk behaviours after having an HIV test,<sup>39</sup> which could help explain the lower syphilis prevalence among FSWs with known HIV status. Our results indicate that a group of FSWs could exercise certain power on condom use negotiation with clients and protect themselves from syphilis infection. Experience from such groups of FSWs might be informative for other FSWs and intervention programs.

Our study is subject to limitations. Although RDS has certain advantages over other sampling methods used to sample hidden populations, empirical research has found inconsistent evidence of its ability to produce samples that faithfully represent hidden populations when compared with more conventional sampling method (unpublished findings from our main study).<sup>40</sup> Therefore, results presented here are of uncertain generalizability to the broader population of FSWs in Liuzhou. In addition, results should be interpreted with caution as all the information collected was based on self-report. Lastly, we used the POC test as a screening test for syphilis. Studies have found that the POC test is less sensitive when performed on whole-blood specimens in the field,<sup>41-42</sup> which may be the reason why syphilis prevalence was relatively lower than expected and lower than that found in other studies conducted among FSWs in southwest China.<sup>2-3</sup>

In conclusion, categorization of FSWs based on type of sex work location had better performance in predicting the risk of syphilis infection than the price classification. It also had important implications for designing surveillance and intervention activities in this population from a programmatic perspective. Street and telephone-based FSWs were identified as at particularly high risk of syphilis infection. Focused interventions are warranted to specifically target these subgroups of FSWs.

## Acknowledgments

The authors thank all the physicians and the outreach workers in the study area for their hard work and all the respondents for their participation in the study.

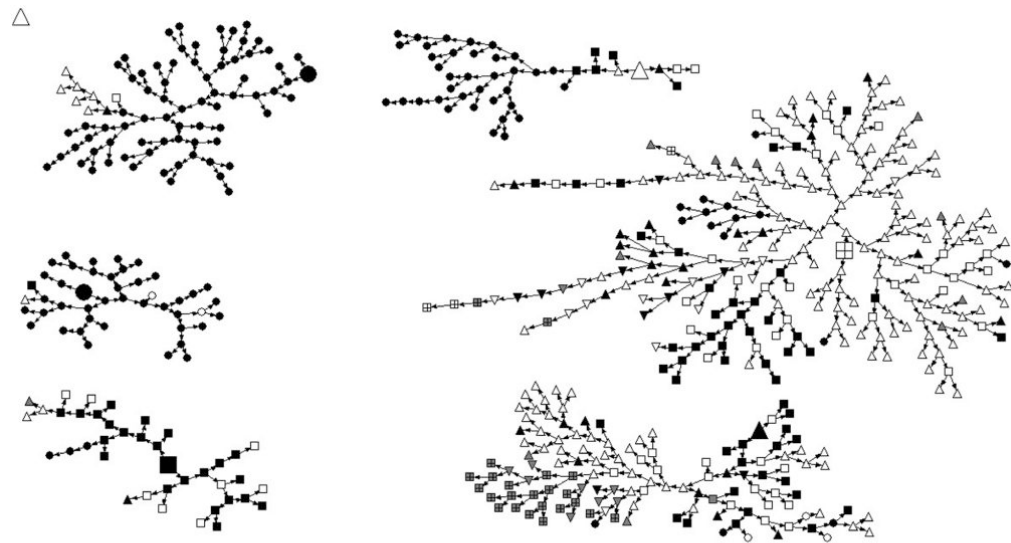
Sources of Support: Support for this research was provided by the WHO Rapid Syphilis Test Project (UNICEF/UNDP/World Bank/WHO A70577), the UNC Social Science Research on HIV/AIDS in China (NIH NICHD R24 HD056670-01), RDS and PLACE comparison study (GHS-I-00-07-00002-00)

## References

1. Ministry of Health of the People's Republic of China. China 2010 UNGASS Country Progress Report. April.2010
2. Ruan Y, Cao XY, Qian HZ, Zhang L, et al. Syphilis among female sex workers in southwestern China: potential for HIV transmission. *Sex Transm Dis.* 2006; 33(12):719–723. [PubMed: 16708055]
3. Lu F, Jia YJ, Sun XH, et al. Prevalence of HIV infection and predictors for syphilis infection among female sex workers in southern China. *Southeast Asian J Trop Med Public Health.* 2009; 40(2):263–272. [PubMed: 19323011]
4. Lin CC, Gao X, Chen XS, et al. China's syphilis epidemic: a systematic review of seroprevalence studies. *Sex Trans Dis.* 2006; 33(7):726–736.
5. Buzdugan R, Halli SS, Cowan FM. The female sex work typology in India in the context of HIV/AIDS. *Trop Med Int Health.* 2009; 14(6):673–687. [PubMed: 19392742]
6. Huang YY, Henderson GE, Pan SW, et al. HIV/STIS risk among brothel-based female sex workers in China: assessing the terms, content, and knowledge of sex work. *Sex Trans Dis.* 2004; 31(11):695–700.
7. Hong Y, Li XM. Behavioral studies of female sex workers in China: A literature review and recommendation for future research. *AIDS Behav.* 2008; 12(4):623–636. [PubMed: 17694431]
8. National Center for AIDS/STIS Control, Chinese Centers for Diseases Control and Prevention. National AIDS Sentinel Surveillance Guidelines. March.2009
9. Wu Z, Sullivan SG, Wang Y, et al. Evolution of China's response to HIV/AIDS. *Lancet.* 2007; 369:679–690. [PubMed: 17321313]
10. Ding YP, Detels R, Zhao ZW, et al. HIV infection and sexually transmitted diseases in female commercial sex workers in China. *J Acquir Immune Defic Syndr.* 2005; 38(3):314–319. [PubMed: 15735451]
11. Yi H, Mantell JE, Wu RR, et al. A profile of HIV risk factors in the context of sex work environments among migrant female sex workers in Beijing, China. *Psychol Health Med.* 2010; 15(2):172–187. [PubMed: 20391235]
12. Xia GM, Yang XS. Risky sexual behaviour among female entertainment workers in China: implications for HIV/STD prevention intervention. *AIDS Educ Prev.* 2005; 17(2):143–156. [PubMed: 15899752]
13. Choi SY, Holroyd E. The influence of power, poverty and agency in the negotiation of condom use for female sex workers in mainland China. *Cul Health Sex.* 2007; 9(5):489–503.
14. Wang HB, Chen RY, Ding GW, et al. Prevalence and predictors of HIV infection among female sex workers in Kaiyuan City, Yunnan Province, China. *Int J Infect Dis.* 2009; 13(2):162–169. [PubMed: 18718801]
15. Harcourt C, Donovan B. The many faces of sex work. *Sex Trans Infect.* 2005; 81(3):201–206.
16. Weir SS, Pailman C, Mahlalela X, et al. From people to places: focusing AIDS prevention efforts where it matters most. *AIDS.* 2003; 17(6):895–903. [PubMed: 12660537]
17. Johnston LG, Malekinejad M, Kendall C, et al. Implementation challenges to using respondent-driven sampling methodology for HIV biological and behavioural surveillance: field experiences in international settings. *AIDS Behav.* 2008; 12(Suppl 4):131–141.
18. Salganik MJ. Variance estimation, design effects, and sample size calculations for respondent-driven sampling. *J Urban Health.* 2006; 83(Suppl 7):98–112.
19. Centers for Disease Control and Prevention. Syphilis testing algorithms using treponemal test for initial screening—four laboratories, New York City, 2005–2006. *MMWR Morb Mortal Wkly Rep.* 2008; 57(32):872–875. [PubMed: 18701877]
20. Mishra S, Moses S, Prakash K, et al. Sex work, syphilis and seeking treatment: an opportunity for intervention in HIV prevention programming in Karnataka, South India. *Sex Transm Infect.* 2009; 36(3):157–164.
21. Gupte S, Daly C, Agarwal V, et al. Introduction of Rapid Tests for Large-Scale Syphilis Screening Among Female, Male, and Transgender Sex Workers in Mumbai, India. *Sex Transm Dis.* 2011 January. Epub ahead of print.

22. Majid N, Bollen L, Morineau G, et al. Syphilis among female sex workers in Indonesia: need and opportunity for intervention. *Sex Transm Infect.* 2010; 86(5):377–383. [PubMed: 20522623]
23. Loza O, Patterson TL, Rusch M, et al. Drug-related behaviors independently associated with syphilis infection among female sex workers in two Mexico-US border cities. *Addiction.* 2010; 105(8):1448–1456. [PubMed: 20456292]
24. RDSAT 5.6 [computer program]. Ithaca, NY: RDS Inc.; 2006.
25. Salganik MJ, Heckathorn DD. Sampling and estimation in hidden populations using Respondent-driven sampling. *Sociol Methodol.* 2004; 34(1):193–240.
26. [Accessed at June 20, 2010] Respondent-driven Sampling Analysis Tool 5.6 User Manual. Available at [www.respondentdrivensampling.org](http://www.respondentdrivensampling.org)
27. Zhong F, Lin P, Xu HF, et al. Possible increase in HIV and syphilis prevalence among men who have sex with men in Guangzhou, China: results from a respondent-driven sampling survey. *AIDS Behav.* 2009 OCT 14. Epub ahead of print.
28. Stata Statistical Software: Release 11.0 [computer program]. College Station, TX: StataCorp LP; 2010.
29. Hong Y, Poon AN, Zhang C. HIV/STI prevention interventions targeting FSWs in China: a systematic literature review. 2011; 23(suppl 1):54–65.
30. Poon AN, Li ZJ, Wang N, et al. Review of HIV and other sexually transmitted infections among female sex workers in China.
31. Hong Y, Li X, Stanton B, et al. Too costly to be ill: Healthcare access and health-seeking behaviours among rural-to-urban migrants in China. *World Health & Population.* 2006; 8(2):22–34. [PubMed: 18277099]
32. Wang Q, Yang P, Gong XD, et al. Syphilis prevalence and high risk behaviors among female sex workers in different settings. *Chin J AIDS STDs.* 2009; 15:398–400.
33. Yang X, Xia G. Gender, work, and HIV risk: determinants of risky sexual behavior among female entertainment workers in China. *AIDS Educ Prev.* 2006; 18:333–47. [PubMed: 16961450]
34. Galvin SR, Cohen MS. The role of sexually transmitted diseases in HIV transmission. *Nat Rev Microbiol.* 2004; 2:33–42. [PubMed: 15035007]
35. Golden MR, Marra CM, Holmes KK. Update on syphilis: resurgence of an old problem. *JAMA.* 2003; 290(11):1510–14. [PubMed: 13129993]
36. Wang HB, Smith K, Brown KS, et al. Prevalence, incidence and persistence of syphilis infection in female sex workers in a Chinese province. *Epidemiol Infect.* 2010 Nov 15.:1–9. Epub ahead of print.
37. He N. Sociodemographic characteristics, sexual behaviour, and HIV risks of rural-to-urban migrants in China. *Biosci Trends.* 2007; 1(2):72–80. [PubMed: 20103872]
38. Tucker JD, Henderson GE, Wang TF, et al. Surplus men, sex work, and the spread of HIV in China. *AIDS.* 2005; 19(6):539–547. [PubMed: 15802971]
39. Jin X, Smith K, Sun Y, et al. Association between testing for human immunodeficiency virus and changes in risk behaviours among injecting drug users in southern China. *Sex Transm Dis.* 2009; 36(8):473–477. [PubMed: 19455077]
40. Kendall C, Kerr LR, Gondim RC, et al. An empirical comparison of respondent-driven sampling, time location sampling, and snowball sampling for behavioral surveillance in men who have sex with men, Fortaleza, Brazil. *AIDS Behav.* 2008; 12(4 Suppl):97–104.
41. Campos PE, Buffardi AL, Chiappe M, Buendia C, Garcia PJ, Carcamo CP, et al. Utility of the Determine Syphilis TP rapid test in commercial sex venues in Peru. *Sex Transm Infect.* 2006; 82(Suppl 5):v22–5. [PubMed: 17116642]
42. Mishra S, Naik B, Venugopal B, et al. Syphilis screening among female sex workers in Bangalore, India: comparison of point-of-care testing and traditional serological approaches. *Sex Transm Infect.* 2010; 86(3):193–198. [PubMed: 19965800]





○ KTV-based   □ sauna-based   △ massage-based   ▣ street-based   ▽ telephone-based  
 Black-high-paid   white-middle-paid   grey-low-paid

**Figure 1. Liuzhou FSWs recruitment Chains based on 6 FSWs seeds**

TABLE 1

Socio-demographic, Risk Behaviour Characteristics and Syphilis Prevalence by Different Ranges of Price Charged per Sexual Transaction among Female Sex Workers in Liuzhou City.

Characteristics	Transaction Price category <sup>a</sup>		
	High (N=287) APP% (95%CI)	Middle(N=251) APP% (95%CI)	Low (N=45) APP% (95%CI)
Total	40.2(32.7-48.1)	43.6(37.0-50.8)	16.2(9.4-23.2)
Age group			
15-19	24.1(16.5-29.8)	5.2(2.3-8.2)	0.2(0-0)
20-29	66(60.5-74.4)	49.7(41.1-57.6)	3.3(0.4-9.3)
30-39	9.8(5.3-14.4)	43.4(35.4-52.8)	26.4(15.4-39.8)
40-	0.7(0-1.3)	1.7(0-3.6)	70.1(55.2-81.9)
Education			
Primary or less	10.1(4.8-16.4)	27.3(21.2-34.7)	77.7(59.9-82.5)
Junior high	58.2(51-66.6)	62.3(56.5-70.6)	20.2(15.8-37.1)
Senior high & above	31.7(24-38.6)	10.4(4.6-12.9)	2.1(0-4.9)
Ethnicity			
Han	52.8(45.9-60.8)	41.4(34.3-48.6)	24.2(15.7-37.9)
Zhuang	37.1(29.8-44.7)	50.2(42.9-57.9)	72.9(58.7-81.2)
Other	10.1(5.7-14.6)	8.4(4.2-12.3)	2.9(0-7.1)
Marital status			
Never married	87.7(82.8-91.8)	51.8(43.7-60)	4.2(1.3-8.7)
Currently married	2.5(1.2-4.2)	18.8(12.8-25.4)	22.6(6.8-33.0)
divorced/widowed	9.9(5.9-14.5)	29.4(22.3-36.7)	73.2(62.1-89.3)
Duration of sex work			
<=2 years	53.9(45.1-61.9)	44.5(36.8-51.7)	37.2(17.7-43.7)
3~4 years	31.9(24.5-39.4)	29.7(23.8-35.8)	31.6(28.0-45.1)
>=5 years	14.1(10.1-19.4)	25.8(19.7-32.8)	31.3(20.1-47.6)
Number of clients in the past week			
<= 5 clients	77.8(70.3-83.6)	60.4(53.0-67.2)	55.2(38.8-68.4)
>5 clients	22.2(16.4-29.8)	39.6(32.8-47.0)	44.8(31.6-61.2)
Consistent condom use with client in the past week	67.3(59.4-74.3)	73.2(65.8-80.9)	9.4(1.2-27.8)
Ever injected drugs	2.4(0.1-5.5)	2.2(0.3-4.5)	2.9(0-8.9)
HIV prevention activities at sex work location	42.5(35.5-49.4)	54.7(45.7-61.4)	28.2(12-43.2)
Known HIV status in past 12 months	9.1(5.7-13.9)	22.8(16.6-28.8)	11.8(3.5-25.6)
Lifetime syphilis infection	4.9(1.3-10.6)	3.3(1.4-5.5)	52.7(34.0-70.1)
Active syphilis infection	3.5(0.2-7.4)	1.4(0.2-2.5)	25.4(15.3-35.3)

Note:

<sup>a</sup> transaction price categories included high as 200 RMB (about US\$32) and above, middle as 50 to 200 RMB (about US\$8-32), and low as 50 RMB (about US\$8) and less for vaginal sex.

APP, RDS Adjusted population proportions produced; CI, confidence intervals.

**TABLE 2**  
**Socio-demographic, Risk Behaviour Characteristics and Syphilis Prevalence by Sex Work Locations among Female Sex Workers in Liuzhou City**

Characteristics	KTV-based (N=174) APP% (95%CI)	Sauna-based (N=139) APP% (95%CI)	Massage-based (N=212) APP% (95%CI)	Street-based (N=27) APP% (95%CI)	Phone-based (N=31) APP% (95%CI)
Total	29.6(15.3-48.9)	15.2(9.7-21.1)	38.6(26.2-49.1)	8.9(2.9-16.2)	7.6(3.3-12.5)
Age group					
15-19	33.7(23.4-42.4)	6.6(1.8-10.9)	6.8(3.0-10.9)	0.1(0-0)	0.2(0-0)
20-29	65.7(57.0-76.0)	74.1(65.9-84.2)	46.5(38.9-57.0)	4.1(0-22.0)	7.6(0-24.1)
30-39	0.1(0-0)	18.4(9.5-27.0)	43.6(32.4-52.4)	12.5(4.9-21.2)	60.2(48.1-77.6)
40-	0.5(0-1.8)	0.9(0-2.8)	3.1(0-6.8)	83.3(62.7-91.3)	32.0(12.5-42.6)
Education					
Primary or less	1.9(0.6-4.0)	23.8(13.0-34.3)	30.8(24.1-37.0)	85.1(65.2-99.4)	37.9(16.2-55.6)
Junior high	49.2(40.5-58.0)	59.6(49.7-72.0)	61.6(55.2-69.1)	12.3(0.6-28.6)	58.1(40.3-79.7)
Senior high & above	48.9(39.7-57.5)	16.6(7.3-25.7)	7.6(3.9-11.5)	2.5(0-7.2)	4.0(0-9.2)
Ethnicity					
Han	56(47.4-64.6)	46.8(35.4-57.8)	36.4(30.2-45.9)	36.9(12.9-58.0)	52.1(28.8-73.8)
Zhuang	36.4(27.9-45.8)	41.6(31.5-53.4)	54.2(44.5-60.3)	59.0(37.8-83.1)	44.5(22.5-69.0)
Other	7.6(3-13.2)	11.6(5.8-16.9)	9.3(5.2-14.2)	4.2(0-11.4)	3.4(0-10.2)
Marital status					
Never married	98.7(97.3-99.9)	77.6(68.5-86.6)	48.7(39.9-56.6)	3.5(0.8-8.2)	27.9(10.7-51.7)
Currently married	0.1(0-0)	9.1(3.8-14.2)	22.0(14.8-31.1)	5.0(0-11.8)	9.7(0-19.5)
Divorced/widowed	1.1(0.1-2.8)	13.3(6.3-21.5)	29.2(22.3-36.6)	91.5(83.7-96.7)	62.4(40.0-81.5)
Duration of sex work					
<=2 years	71.5(63.0-78.2)	33.3(21.9-44.5)	51.4(42.3-60.8)	23.9(9.3-41.7)	22.8(7.7-43.0)
3~4 years	23.2(16.8-30.4)	50.4(37.8-61.6)	26.0(19.5-32.2)	40.5(21.0-48.6)	25.5(10.3-40.7)
>=5 years	5.2(2.6-9.9)	16.3(10.4-24.7)	22.6(15.8-29.6)	35.6(22.4-61.5)	51.6(33.3-68.2)
Number of clients in past week					
<= 5 clients	88.8(82.3-93.8)	50.3(37.5-61.8)	63.9(54.4-70.9)	24.1(9.9-40.9)	89.8(80.2-97.8)
>5 clients	11.2(6.3-17.7)	49.7(38.2-62.5)	36.1(29.1-45.6)	75.9(59.1-90.1)	10.2(2.2-19.9)
Consistent condom use with clients in past week	59.2(48.5-67.0)	80.5(71.1-87.7)	69.3(60.0-76.9)	17.4(0-56.3)	40.1(21.3-62.3)
Ever injected drugs	0(0-0)	1.3(0-3.6)	2.6(0-6.6)	2.7(0-10.4)	10.2(0-23.1)

Characteristics	KTV-based (N=174) APP% (95%CI)	Sauna-based (N=139) APP% (95%CI)	Message-based (N=212) APP% (95%CI)	Street-based (N=27) APP% (95%CI)	Phone-based (N=31) APP% (95%CI)
HIV prevention activities at sex work location	42.9(34.9-53.2)	52.7(41.3-65.3)	61.3(52.4-69.1)	18.7(6.8-33.0)	8.7(0-20.9)
Known HIV status in past 12 months	10.3(5.1-16.4)	14.2(6.4-22.5)	22.7(16.2-30.4)	7.0(2.7-14.2)	10.4(1.3-23.3)
Lifetime syphilis infection	4.3(0.4-9.7)	1.9(0-4.7)	3.0(1.0-5.3)	69.7(49.7-82.9)	46.3(20.6-67.1)
Active syphilis infection	3.8(0.2-9.8)	1.0(0-3.0)	0.7(0-0.9)	39.8(22.1-53.0)	17.0(2.9-30.5)

NOTE. APP, RDS Adjusted population proportions; CI, confidence intervals.

TABLE 3

Determinants of Syphilis Infection by Multivariate Logistic Regression Analysis among Female Sex Workers in Liuzhou City.

Characteristics <sup>a</sup>	Lifetime syphilis <sup>a</sup> (N=536 <sup>b</sup> ) AOR <sup>c</sup> (95%CI)	Active syphilis <sup>a</sup> (N=532 <sup>b</sup> ) AOR <sup>c</sup> (95%CI)
Type of sex work locations		
KTV-based	1.0 (ref)	1.0 (ref)
Sauna-based	0.8 (0.1-4.7)	0.2 (0.01-2.7)
Massage-based	1.1 (0.2-5.9)	0.3 (0.03-2.4)
Street-based	38.7 (10.7-139.9)	15.2 (3.7-62.1)
Telephone-based	10.8 (3.3-35.1)	4.0 (0.6-25.4)
Known HIV status in the past 12 months		
Yes	1.0(ref)	
No	4.2 (1.2-15.3)	
Refused clients who were unwilling to Use condoms in the past month		
Yes	1.0(ref)	
No	4.1 (1.1-15.0)	
Ethnicity		
Han		1.0 (ref)
Zhuang		2.3 (0.6-8.1)
Other		12.2 (1.2-121.9)

<sup>a</sup>Positive treponemal-specific rapid syphilis test results were defined as lifetime syphilis infection. Non-treponemal-specific test titer  $\geq 1:8$  and rapid test positive were classified as active syphilis.

<sup>b</sup>Participants who refused the rapid syphilis test were not included in the regression analysis.

<sup>c</sup>AOR estimate was adjusted for age group, education attainment, marital status, price charged per sexual transaction, consistent condom use with clients in past week, any HIV prevention activities at place of sex work.