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Neisseria gonorrhoeae prevalence, incidence and associated risk factors among female sex workers in a high HIV-prevalence area of China

Li Luo [a], Xin Li [b], Lu-lu Zhang [b,*]

[a] Chinese Center for Disease Control and Prevention, 155 Changbai Rd, Changping District, Beijing 102206, PR China
[b] Engineering Research Center of Microbial Tumor Marker and Drug Sensitive Test, Xinxiang, Henan 453400, China

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SUMMARY

Background: *Neisseria gonorrhoeae (N. gonorrhoeae)* is one of the most prevalent non-ulcerative sexually transmitted infections (STIs) in China, however, the data about *N. gonorrhoeae* infections are limited in this population. The objective of this study is to determine *N. gonorrheae* incidence and associated risk factors among female sex workers (FSWs) in China.

Methods: This serial cross-sectional study was conducted semi-annually among FSWs in a City of Yunnan Province, which constituted an open cohort study. Participants were interviewed and tested for *N. gonorrhoeae* every 6 months.

Results: During 3 years of follow-up, 64 incident cases of *N. gonorrhoeae* infection were diagnosed, yielding an overall incidence of 5.9 per 100 person years (PY) (95% confidence interval (CI), 4.53-7.41). Working in higher risk commercial sex venue (adjusted hazard ratio (AHR)=2.7, 95% CI, 1.56-4.55), inconsistently used condoms with clients in previous week (AHR=1.9, 95% CI, 1.07-3.35) and being infected with *C. trachomatis* (AHR=1.9, 95% CI, 1.06-3.26) were independent risk factors for incident *N. gonorrhoeae* infection.

Conclusions: A relatively high prevalence and incidence of *N. gonorrhoeae* among a prospective cohort of FSWs underscore the urgency for traditional HIV/STIs prevention methods among FSWs, such as condom promotion, screening and treatment of STIs, considering the high prevalence of STIs. Significant attention should focus on FSWs working in higher risk commercial sex venues as they are at higher risk for *N. gonorrhoeae* and transmission than those in lower risk commercial sex venues.

1. Background

Sexual transmission has become the primary mode of human immunodeficiency virus (HIV) transmission in China, and heterosexual transmission through commercial sex is recognized as one of the main modes.[1] Female sex workers (FSWs) are not only at high risk for HIV infection, but also a "core population" who may be responsible for a large proportion of HIV transmission in China. It has been well studied that sexually transmitted infections (STIs) may facilitate the spread of HIV.[2,3]

Neisseria gonorrhoeae (N. gonorrhoeae), which is one of the most prevalent non-ulcerative STIs in China, acts as a facilitating factor in transmission of HIV,[4–6] and if left untreated, can cause long-term debilitating effects, such as chronic pelvic pain, pelvic inflammatory disease, ectopic pregnancy, and tubal infertility.[4,7] Surveillance of syphilis infection among FSWs has been integrated into the national HIV surveillance system in China, but *N. gonorrhoeae* surveillance activities were mainly based on passive case reporting.[8] There have been many studies on HIV and syphilis,[9,10] but the data about *N. gonorrhoeae* infections are limited in this population in China.[8,11–13] These cross-sectional studies conducted between 2005 and 2013 revealed the range of *N. gonorrhoeae* prevalence among FSWs being 1.8–37.8% in different regions across the country (median = 7.8%).[8,11–14]

HIV/STI prevalence is highest among FSWs in Yunnan Province in southern China, near the borders with Vietnam, Thailand, and Myanmar,[15] as many of the FSWs are illegal drug users and may serve commercial sex as a means to financially support their drug habits.[5] Most of the studies related to FSWs are cross-sectional

* Corresponding author. Engineering Research Center of Microbial Tumor Marker and Drug Sensitive Test, Xinxiang, Henan 453400, China.
Tel.: +86 (0371) 6789 0306; fax: +86 (0371) 8662 8586.
E-mail address: llz@yhkodia.com (L.-l. Zhang).

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design in Yunnan Province,[5,11,16–20] therefore there are limited data about *N. gonorrhoeae* incidence and associated risk factors. The aim of this study was to determine the incidence and risk factors for incident *N. gonorrhoeae* infection among FSWs in Yunnan Province, China. This study was conducted in a moderately-sized city of Yunnan Province, with a population of 292,000 and large numbers of sex workers (Figure 1).

2. Methods

2.1. Survey methods

From March 2009 to May 2012, cross-sectional studies were carried out every 6 months and in total 7 surveys were conducted by the Chinese Center for Disease Control and Prevention (China CDC) in Beijing with provincial and local staff in Yunnan. Subjects who completed two or more surveys constituted an open cohort. Local CDC outreach workers explained study purpose, procedures, and the risks and benefits of participation to all commercial sex venues and bosses and invited women working as sex workers to participate. The inclusion criteria were women aged ≥16 years, self-reported to have sold sex for money within the previous 3 months, willing to provide written informed consent and who agreed to testing and counseling for HIV/STIs. Study protocol received approval from the institutional review boards of the National CDC and the Yunnan Provincial CDC.

In order to maximize participant retention, the study schedule was thoroughly explained during informed consent procedures and was re-emphasized at subsequent follow up surveys. Detailed contact information of FSWs and their representatives was collected and was reviewed at each study visit. Additionally, FSWs were compensated 50 RMB (8 USD) upon each survey completion.

2.2. Data Collection

Specialists from China CDC and the Yunnan Provincial CDC trained local staff members from CDC on protection of human subjects, obtaining informed consent, safeguarding confidentiality, and HIV/STIs pre and post-test counseling.

After providing written informed consent, participants were asked a series of questions regarding their demographics, basic medical history, and sexual and drug use behavior. All subjects were contacted through provided contact information and reminded of returning to future surveys and of future testing periods. After survey completion, endocervical swabs were collected and tested for *N. gonorrhoeae* and *Chlamydia trachomatis* by polymerase chain reaction (PCR, AMPLICOR, Roche, USA); the sensitivity and specificity of PCR were 93% and 100% for *Chlamydia trachomatis* and 95% and 99% for *N. gonorrhoeae* respectively. Blood was collected and tested for HSV-2 antibody (HSV-2, HerpeSelect-2 ELISA IgG, Focus, USA), HIV-1 antibodies (enzyme-linked immunosorbent assay (ELISA), Vironostika HIV Uni-Form plus O, bioMerieux, Holland), and syphilis (rapid plasma reagin (RPR) test, Diagnosis kit, Xinjiang Xindi company, China). Positive HIV-1 ELISAs were confirmed by Western blot (Diagnostics HIV Blot 2.2, Genelabs, USA) and positive RPR tests for syphilis were confirmed by the *Treponema pallidum* particle assay (TPPA) test (Serodia-P·PA-Fujirebio, Fuji, Japan). Vaginal swabs were collected and a wet mount was prepared to detect *Trichomonas vaginalis* (TV). Urine was tested for traces of illicit drugs. FSWs were classified as using illegal drugs if they self-reported drug use or tested positive through urine screening. To protect confidentiality, all subjects, subject surveys and collected specimens were assigned a corresponding participant identity number. Subjects were scheduled for follow-up visits 4-6 weeks after the initial visit to receive test results and post-test counseling. FSW participants with STIs were referred to Local Dermatology Hospital, where participants were entitled to receive a 60% discount on STI treatment. Those

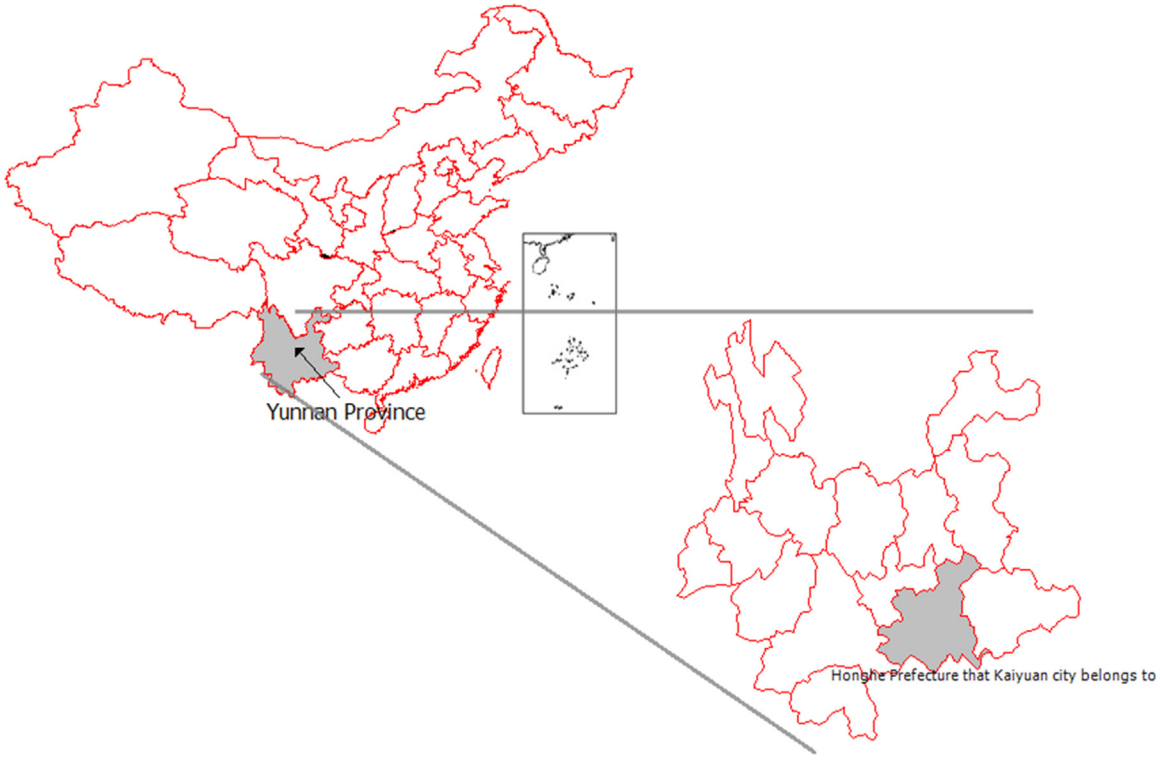

Figure 1. Location of study site in Yunnan Province, China.