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Sexually Transmitted Infections Among Pregnant Women Attending an Antenatal Clinic in Fuzhou, China

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Objective: **To determine the prevalence of sexually transmitted infections (STIs) among women attending an antenatal clinic in urban China and to show whether reported symptoms and findings on clinical examination predicted STIs in this population.**

Study Design: **Cross-sectional descriptive study was conducted among 504 pregnant women attending an antenatal clinic in Fuzhou, China. Structured questionnaires were used to collect demographic and behavioral information, and clinical and gynecologic examinations were performed to detect clinical signs of STIs. Blood samples, vaginal swabs, and cervical swabs were collected, respectively, to test for antibodies to syphilis, culture *Trichomonas vaginalis* (T. vaginalis), and perform PCR to detect *Chlamydia trachomatis* (C. trachomatis) and *Neisseria gonorrhoeae* (N. gonorrhoeae).**

Results: ***C trachomatis*** **was detected in 51 (10.1%), *N gonorrhoeae* in 4 (0.8%), *T vaginalis* in 16 (3.2%), and syphilis in 1 (0.2%) of the 504 pregnant women. Fifty-two (73%) of 71 women with any STI were asymptomatic. Multiple logistic regression analysis indicated that age ≤25 years (OR = 2.72) and monthly income >RMB 2000 yuan (OR = 3.57) were significant independent risk factors for chlamydial infection ($P < 0.05$). The reported symptom of vaginal discharge or the clinical sign of either vaginal or cervical discharge poorly predicted infection with *C trachomatis*, *N gonorrhoeae*, or *T vaginalis*, with a positive predictive value <25% for each STI.**

Conclusion: **A substantial prevalence of STIs, including a large proportion of asymptomatic infections, was found among pregnant women in the study area. These results support a strategy of screening pregnant women for bacterial STIs (followed by treatment of infections), which could be integrated into routine pregnancy care in China.**

SEXUALLY TRANSMITTED INFECTIONS (STIs) constitute a major public health problem worldwide, particularly among women and neonates,[1] as they are among the most common diseases and significant causes for economic burden in both developed and developing countries.[2,3] According to the World Health Organization (WHO) estimates, 340 million new cases of STIs occurred worldwide in 1999.[4] These included 92 million cases of chlamydial infection, 62 million of gonorrhea, 174 million of trichomoniasis, and 12 million of syphilis. In China, more than 742,000 STI cases were reported to the National Sexually Transmitted Disease (STD) Surveillance System (a national universal case-reporting system) in 2004,[5] and it is recognized that many more cases have gone unreported. Fujian Province is among the provinces in which the most STI cases have been reported to the national system.

STIs contribute to a variety of obstetric and gynecologic complications in women, including increased risk of tubal infertility and pelvic inflammatory disease, and have been associated with chronic pelvic pain.[6,7] They are also significantly associated with adverse pregnancy outcomes such as spontaneous abortion, preterm delivery, ectopic pregnancy, premature rupture of membranes, intrauterine infection of the fetus, and low birth weight in infants.[8,9] In addition, STIs have been implicated as cofactors of human immunodeficiency virus (HIV) transmission and infectivity.[10] In China, epidemiologic data indicate that HIV prevalence among pregnant women, who are one of the most vulnerable populations to the infection, has reached 5% in some areas.[11] The growing HIV epidemic in China increasingly threatens the health and economic welfare of its people, and women—particularly pregnant women—are one of the most vulnerable populations to infection. Increasing STI prevalence among pregnant women suggests the possibility of an expanded heterosexual HIV epidemic. Although the roles of STIs in facilitating HIV transmission have been well documented, prevention and control of STIs has been largely neglected in China.

A high prevalence of other STIs has been reported among pregnant women in many developing and even in some developed countries.[12–14] A previous study among women attending family planning clinics for induced abortions in an urban area of China found STI prevalences of 4.8% for *Chlamydia trachomatis* (C. trachomatis), 0.4% for *Neisseria gonorrhoeae* (N. gonorrhoeae), 2.5% for *Trichomonas vaginalis* (T. vaginalis), and 0.4% for syphilis.[15] However, the prevalence of these infections is not well known among women attending routine antenatal care in China. Additionally, although gonorrhea and syphilis are considered "target infectious diseases" in China's Law of Maternal

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and Child Health Care, China does not have a national policy on STI prevention and control targeting pregnant women.

We determined the prevalence of several STIs and the potential risk factors for these infections among women attending an antenatal clinic in urban China. We also measured the values of reported symptoms and clinical signs in predicting STIs in this population.

Methods

This cross-sectional observational study was conducted between July and September 2002 in the antenatal clinic of Fujian Provincial Maternal and Child Hospital in Fuzhou, the capital of Fujian Province along the coast of China. The study was approved by the medical ethics committees of the National Center for STD Control.

Based on an estimated prevalence of each STI of less than 5% obtained from the study among pregnant women attending family planning clinics in China,[15] in which a precision of 2% was used, a sample size of at least 457 women would allow a reasonable estimate of STI prevalence in our study. Five hundred six pregnant women attending the antenatal clinic during their first prenatal visit to this clinic were invited to participate in the study. The sampling method was used to recruit up to 20 consecutive women per day. Those who agreed to participate in the study gave their informed consent and were enrolled. After informed consent was obtained, a questionnaire was administered to each woman by a trained nurse through an interview in a separate counseling room in the clinic. The questionnaire covered demographic and behavioral information including age, education level, marital status, monthly income, age at first sex, rate of sex during pregnancy, rate of condom use, occupation of both the woman and her husband or sexual partner, history of STIs, and symptoms of STIs.

Each woman also underwent a clinical and gynecologic examination by gynecologic doctors to identify any genital ulcers, genital warts, and vaginal or cervical discharge. Vaginal swabs were collected to test for *T vaginalis* using the Trichomonas In-Pouch TV culture kit (Biomed Diagnostics, San Jose, CA). Cervical swabs were collected to test for *C trachomatis* and *N gonorrhoeae* using the Roche Amplicor CT/NG polymerase chain reaction kit (Roche Diagnostic, Branchburg, NJ) according to the manufacturer's instructions. To identify cases of syphilis, 5 ml of blood was collected and serum was obtained at the central laboratory of the hospital for the rapid plasma regain test (Syphilis Regain Card Test, BIOTEC Laboratories Ltd, Suffolk, UK). If this test was positive, the *T pallidum* particle agglutination test kit (SERODIA, Fujirebio Inc., Tokyo, Japan) was used to confirm the seropositivity of syphilis.

All data from questionnaires, clinical and gynecologic examinations, and laboratory tests were entered into a computer database. Prevalences of infection with *C trachomatis*, *N gonorrhoeae*, *T vaginalis*, and syphilis, with 95% confidence intervals (CIs), were measured. Odds ratios (ORs) for risk factors for acquiring the infections and positive predictive values of symptoms and clinical signs were also determined. Data analysis was conducted using the Statistical Package for Social Sciences for Windows (version 11.0; SPSS Inc., Chicago, IL). As infections with *C trachomatis* were most prevalent, univariate analysis was performed only to assess the relationship of each variable (potential risk factor) with *C trachomatis* infection. Only the variables that were significant at $P < 0.05$ were then entered into a multivariate logistic regression model for selecting significant variables. For this model, $P < 0.05$ was considered statistically significant.

Results

Only 2 (0.4%) of 506 eligible women refused participation in the study. Five hundred four pregnant women enrolled in the study and underwent questionnaire-based interviews, clinical and gynecologic examinations, and sample collection. The mean age of the study population was 26.9 years (SD = 3.3 years), and the mean gestational age of fetuses was 17.6 weeks (SD = 3.5 weeks), ranging from 11 to 25 weeks. A total of 254 (50.5%) participants were from the city where the study was conducted, and 49.5% were migrated from either its suburban areas (8.0%), other cities of the province (36.4%), or even other provinces (5.2%).

The mean age at first sex was 23.6 years (SD = 2.9 years), and 16% of the pregnant women had their first sex at age ≤20 years. During pregnancy, 364 (72.5%) of 502 women had had sex. One hundred fifty-two (41.7%) of 364 of these women usually had more than 4 sex acts per month, but only 11 (3.0%) of 363 consistently used condoms, and 24 (6.6%) of 363 used condoms for more than half of their sex acts. Only 33 (9.1%) of 362 women used a condom at last sex.

Of the 504 pregnant women, 71 (14.1%) had at least 1 of the infections under investigation (Table 1). *C trachomatis* was detected in 51 women (10.1%), *N gonorrhoeae* in 4 (0.8%), *T vaginalis* in 16 (3.2%), and syphilis in 1 (0.2%). One woman (0.2%) was coinfected with *C trachomatis* and *T vaginalis*.

Bivariate analysis indicated that age of the women and monthly incomes of both the women and their husbands were significantly associated with chlamydial infection ($P < 0.05$) (Table 2). However, in a multiple logistic regression model, only age ≤25 years (OR = 2.72; 95% CI = 1.11–6.95) and the women's monthly income >RMB 2000 yuan (OR = 3.57; 95% CI, 1.17–10.89) were significant independent risk factors for chlamydial infection ($P < 0.05$).

One hundred seven (21.2%) of 504 women presented with symptoms or signs of an STI, including abnormal vaginal or cervical discharge, genital ulcers, genital warts, or lower abdominal pain. The remaining 397 women (78.8%) were asymptomatic. Among 71 women with any STI, 52 (73.2%) were asymptomatic.

The women with and without symptoms did not differ in demographic characteristics such as mean age (26.2 versus 26.9 years, $P = 0.8$), education level (58.9% versus 68.0%; $P = 0.8$), local residence (56.1% versus 59.2%, $P = 0.55$), and marriage (96.3% versus 98.7%, $P = 0.19$).

Prevalences of *C trachomatis*, *N gonorrhoeae*, and *T vaginalis* infections were associated with the presence of vaginal discharge identified by clinical assessment. However, no difference in prevalences was observed between women with and women without abnormal cervical discharge identified through clinical assessment (Table 3). Regarding abnormal vaginal discharge, a statistically significant correlation was identified between reported symptoms

TABLE 1. Prevalence of STIs Among Women Attending an Antenatal Clinic in Fuzhou, China (n = 504)*

STI	Number Infected	Prevalence, % (95% CI)
Chlamydia trachomatis	51	10.1 (7.8–13.1)
Neisseria gonorrhoeae	4	0.8 (0.3–2.0)
Trichomonas vaginalis	16	3.2 (2.0–5.1)
Syphilis	1	0.2 (0–1.1)
Any STI	71	14.1 (11.3–17.4)

CI = confidence interval; STI = sexually transmitted infection.
*The sample size for some tests was less than 504.

TABLE 2. Prevalence of Chlamydial Infection by Demographics, Sexual Behavior, and STI Knowledge (Univariate Analysis)

Factor	Category	Sample Size*	Prevalence, % (95% CI)	Odds Ratio
Demographics				
Age	≤25 y	193	18.1 (13.3–24.2)	4.06†
	>25 y	309	5.2 (3.2–8.2)	1
Educational level	≤Junior school	171	11.1 (7.2–16.7)	1.17
	≥Senior school	331	9.7 (6.9–13.3)	1
Marital status	Married	493	9.9 (7.6–12.9)	1
	Unmarried	6	33.3 (9.7–70.0)	1.46
Residence	Local resident	292	8.9 (6.1–12.7)	1
	Migrant	208	12.0 (8.3–17.1)	1.40
Monthly income of study participant	≤2000 RMB yuan	262	6.5 (4.1–10.1)	1.0‡
	>2000 RMB yuan	26	19.2 (8.5–37.9)	3.43
Monthly income of participant's husband/partner	≤2000 RMB yuan	329	8.5 (5.9–12.0)	1‡
	>2000 RMB yuan	157	14.6 (10.0–21.0)	1.84
Sexual behavior				
Age at first sex	<20 y	28	14.3 (5.7–31.5)	1.48
	20–24 y	289	11.4 (8.2–15.6)	1.69
	>24 y	184	7.1 (4.2–11.7)	1
Condom use before pregnancy	≥50% Of sex acts	74	9.5 (4.7–18.3)	1
	<50% Of sex acts	427	10.3 (7.8–13.5)	1.10
Condom use at last sex	Yes	35	2.9 (0.5–14.5)	1
	No	328	13.1 (9.9–17.2)	5.13
Sexual frequency after pregnancy	<5 Times per month	349	9.5 (6.8–13.0)	1
	≥5 Times per month	151	11.9 (7.7–18.1)	1.30
Occupation of husband/partner§	Group A	299	9.7 (6.8–13.6)	1
	Group B	203	10.8 (7.3–15.9)	1.13
STI knowledge				
Can STIs be transmitted through mother to fetus?	Yes	470	9.8 (7.4–12.8)	0.59
	No or unknown	32	15.6 (6.9–31.7)	1
Can infection be transmitted by sexual contact?	Yes	473	10.6 (8.1–13.7)	3.28
	No or unknown	29	3.4 (0.6–17.2)	1

CI = confidence interval; STI = sexually transmitted infection.
*The sum of sample sizes in some categories was less than 504 because some participants did not respond to some questions.
†$P < 0.01$.
‡$P < 0.05$.
§Group A consisted of factory workers, farmers, and government clerks. Group B consisted of uniformed service workers (military and police), drivers, and self-employed individuals.

and clinical signs ($r = 0.13$, $P < 0.05$). However, among the 397 participants reporting no symptoms of STIs, on clinical assessment 113 (28.5%) had an abnormal vaginal discharge and 110 (27.7%) had an abnormal cervical finding. *C trachomatis*, *N gonorrhoeae*, or *T vaginalis* infections were not detected in 131 (85.6%) of 153 pregnant women with positive cervical findings through clinical assessment. The predictive value of using symptom reports of vaginal discharge or using clinical signs of either vaginal or cervical discharge to distinguish between women with and women without *C trachomatis*, *N gonorrhoeae*, or *T vaginalis* infections was poor, with positive predictive values <25% for the infections (data not shown).

Discussion

The results of this study provide data that can be used to develop an STI prevention and control strategy among pregnant women in China. The most common organism we identified among pregnant women in the study was *C trachomatis*. We found a prevalence of 10.1%, which is higher than that observed among all women in a national population-based survey in China (2.6%).[16] Numerous surveys have been carried out in other countries to study the prevalence of *C trachomatis* infection among pregnant women or women attending antenatal clinics.[17,18] Our prevalence is comparable to those found in several other countries: 10% in Thailand,[17] 8% in Botswana, and 9% in Kenya[19] where HIV is very prevalent, 12.1% in Scotland,[14] and 9.7 to 9.9% in England.[20] However, our prevalence is much higher than those found in other studies of hospital-based antenatal patients in developed countries[21,22] and lower than those found in studies in some countries located in the Pacific.[12,18] The prevalences of *N gonorrhoeae* and *T vaginalis* in our population are comparable with those observed among women seeking abortion in Shandong Province, China, but the prevalence of chlamydial infection (10.1%) is significantly higher than that in the abortion women (4.8%). This difference is probably due to the geographic variation in terms of socioculture and economic determinants. Data from the National STD Surveillance System have suggested that STD is more prevalent in the coastal areas.

Gonorrhea is another frequently reported STI in China. A prevalence of 0.8% in our population is comparable to that observed among pregnant women in Nigeria and Mali[23,24] but lower than that observed in many other developing countries.[12,18,19] Considering the serious consequences of *N gonorrhoeae* infection, a few studies have recommended screening pregnant women for it.[25]

The prevalence of syphilis in our study population (0.2%) is comparable to that found among pregnant women in some Asian countries[26,27] but much lower than that obtained in many African countries.[19,28,29] However, the reported incidence of syphilis in

TABLE 3. Prevalence of STIs by Age, Presence or Absence of Symptoms and Clinical Signs, and History of STIs

Characteristic	Number (%) of Women With Particular STI*			
	Ct	Ng	Tv	Any STI†
Symptom				
Current abnormal discharge				
Yes	13 (13.4)	1 (1.0)	4 (4.1)	19 (19.6)
No	38 (9.4)	3 (0.7)	12 (3.0)	52 (12.8)
Previous abnormal discharge				
Yes	17 (13.9)	1 (0.8)	5 (4.1)	24 (19.7)
No	34 (8.9)	3 (0.8)	11 (2.9)	47 (12.3)‡
Current lower abdominal pain				
Yes	1 (14.3)	0 (0.0)	0 (0.0)	1 (14.3)
No	50 (10.1)	4 (0.8)	16 (3.2)	70 (14.1)
Clinical sign				
Abnormal vaginal discharge§				
Yes	22 (14.0)	4 (2.5)	9 (5.7)	35 (22.3)
No	29 (8.4)‡	0 (0.0)‡	7 (2.0)‡	36 (10.4)‡
Abnormal cervical discharge‖				
Yes	14 (9.2)	3 (2.0)	5 (3.3)	22 (14.4)
No	37 (10.6)	1 (0.3)	11 (3.1)	49 (14.0)
History of any STI				
Yes	0 (0.0)	0 (0.00)	0 (0.0)	1 (20.0)
No	51 (10.3)	4 (0.8)	16 (3.2)	70 (14.0)

Ct = *C trachomatis*; Ng = *N gonorrhoeae*; Tv = *T vaginalis*; STI = sexually transmitted infection.
*The denominator for calculating percentage may be smaller than 504 because some participants did not respond to particular questions.
†Any STI includes Ct, Ng, Tv, and syphilis.
‡$P \leq 0.05$, based on use of the χ^2 test or Fisher exact test.
§Abnormal vaginal discharge refers to cottage cheese–like, frothy or mucopurulent, yellowish, greenish, or bloody discharge, with or without a strong odor.
‖Abnormal cervical discharge refers to endocervical mucus, mucopurulent discharge, or bloody discharge.

China increased, based on data from the National STD Surveillance System, nearly 20 times from 1990 to 1998 (from 0.2–4.3 cases per 100,000 inhabitants)[30] and again to 6.2 cases per 100,000 inhabitants in 2004 after a short-term decline in the early 2000s. Women accounted for an increasing proportion of persons newly diagnosed with an STI over the decade. Moreover, the reported incidence of congenital syphilis has increased continuously and dramatically since the 1990s, with a 146.8% increase from 2000 to 2003 and a 69.5% increase from 2003 to 2004.[5] We consider that the true prevalence of syphilis may be even higher than that reported. Similar to what has been found in some other countries,[31,32] a pilot project of universal syphilis screening among pregnant women at antenatal clinics in Shenzhen (in southern China) proved effective for preventing congenital syphilis. Other studies have indicated that such syphilis screening is cost-effective, even at relatively low prevalence.[33]

T vaginalis is a common—and also readily treatable—sexually transmitted pathogen. Traditionally, it has not been viewed as a major public health problem in China, as evidenced by the fact that it is not reported in the National STD Surveillance System. However, *T vaginalis* has been shown to be independently associated with a variety of adverse health consequences in women.[34] Although the prevalence of *T vaginalis* infection in our study (3.2%) was not as high as that in many developing countries, it still has significant public health implications because of the number of infections in such a highly populated country. Some studies recommend screening pregnant women for this infection, but such screening has been limited by currently available tests, which tend to be insensitive, expensive, or require a delay before results are reported. However, a recent study found that a latex agglutination test had a high sensitivity for detecting *T vaginalis* infection and could be a simple rapid test for potential use in screening for *T vaginalis*.[35]

Many studies have also assessed the risk factors for STIs, particularly chlamydial infection, among sexually active women. Their results indicate that age, either ≤20 years or ≤25 years, is one of the important factors involved in the acquisition of *C trachomatis* infection.[36–39] The data from our study, in broad agreement with most studies, supported this, showing that young women aged ≤25 years were almost 3 times more likely to have a chlamydial infection than were older women. We also found high monthly income to be a risk factor for chlamydial infection, which is different from that found in a study among Mexican-American pregnant women with a similar prevalence of infection[40] and a study with higher prevalences.[41]

The population-based study in China has revealed the significant association of the high income or frequent socializing per week with chlamydial infection in men.[16] In our study, the association was found between month's income and the infection. Although the explanations may be not same as the men's, such association was also supported by the findings from a study among rural-to-urban migrants in Beijing, in which 63.4% participants are women.[42]

In our study, symptoms and clinical signs had only relatively low positive predictive values (<25%) for predicting recurrent *C trachomatis*, *N gonorrhoeae*, or *T vaginalis* infections. These values were similar to those reported in other studies.[19] Findings regarding these low predictive values for infections in pregnant women have indicated the poor correlation of clinical symptoms

and/or signs and infections, which would have important implications for treatment (e.g., application of syndromic management in this setting), as well as for prevention of further transmission to fetuses and sexual partners.

Screening pregnant women for STIs is likely to be the best opportunity to achieve significant population coverage and reduce long-term STI prevalence, as well as adverse pregnant outcomes. Based on the findings in previous studies concerning age and risk factors, many programs recommend a selective screening strategy among sexually active women aged ≤25 years and those at increased risk for chlamydial infection.[43] In our study, screening women aged ≤25 years, which accounted for 38.3% of the study population, would have identified 35 (68.6%) of the 51 chlamydial infections. Screening women aged ≤25 years and those aged >25 years who had an income >RMB 2000 yuan per month, which accounted for 42.3% of the population, would have identified 74.5% (38/51) of the infections. However, using the latter criteria for selective screening would be challenging for routine pregnancy services because of practical difficulties in implementation and potential psychological pressure on the patients. In addition, lack of infrastructure and prohibitive cost for screening are issues to be considered. Analysis of cost-effectiveness, as well as studies of feasibility and acceptability for difference scenarios (e.g., local prevalence rate and laboratory infrastructure), is further needed in China.

The current study also has some limitations that could be addressed in subsequent studies. First, self-reported risk behaviors and STI histories may have been underreported during interviews, because some women may have been reluctant to divulge this information because of the conservative nature of Chinese culture regarding sex. Furthermore, the sample size was relatively small and limited in representing the pregnant population in urban areas or throughout the study province.

Conclusions

Our findings suggest a high prevalence of STIs and a large proportion of asymptomatic infections among pregnant women in an antenatal clinic in Fuzhou, China. The results suggest that screening for bacterial STIs (followed by treatment of infections) would be an effective strategy for enhancing efforts to control STIs among pregnant women and to prevent adverse pregnancy outcomes. Such a strategy could be integrated into routine pregnancy care in China. However, studies on the feasibility and acceptability, as well as the cost-effectiveness, of this strategy are needed to further validate the strategy before our findings can be translated into local or even national policies.

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