

Ureaplasma urealyticum and chlamydia trachomatis among general married migrants in three cities of China: a workplace-based study

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Research article

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Abstract

Background

Genital tract infections with ureaplasma urealyticum (UU) and chlamydia trachomatis (CT) are the most frequent sexually transmitted infections (STIs). The aim of this study is to understand the prevalence of UU and CT among general internal married migrants and to explore some possible influencing factors, so as to provide some evidences for STIs prevention in China.

Methods

A cross-sectional study was conducted in three cities of China from March 2016 to February 2017. A total of 3180 internal-married migrants were included. The structured questionnaire survey, gynecological or andrology examination and laboratory detection were conducted by the trained research fellows. The prevalence of UU and CT was laboratory-confirmed in this study.

Results

The prevalence of laboratory-confirmed UU and CT were 45.41%, 5.75%, respectively. The co-infection rate was 4.09%. The rates of UU and CT of Shanghai participants (54.01%, 7.35%) were the highest, and the lowest were that of Yinchuan (37.74%, 4.52%). In Urumqi, the prevalence of UU and CT were 44.77%, 5.42%, respectively, but it has the highest co-infection rate. The multiple stepwise logistic regressions found that the prevalence of UU among three cities were different, and the male's UU infection was lower than that of women (OR=0.71, 95%CI:0.61-0.83), and the 20-34 age group participants had lower UU and CT risk, compared with that of 45-49 age group. Moreover, the white-collar workers had lower risk of UU infection (OR=0.64, 95%CI: 0.49-0.83), compared with laborer, and using condom could reduce the UU infection (OR=0.74, 95%CI: 0.63-0.87). Compared with urban migrants, the rural participants had higher risk of CT infection (OR=1.68, 95%CI: 1.12-2.52), and sex behavior during menstruation could increase the prevalence of CT (OR=1.49, 95%CI: 1.05-2.11).

Conclusion

The prevalence of UU and CT were high and the co-infection was also serious among general internal married migrants. More health promotion measures about UU and CT should be taken to help general migrants of China, especially women and those with lower social-economic status (laborers from rural area), risky sexual behaviors such as having sex during menstruation should be warned of and condom-use should be promoted.

Background

Ureaplasma urealyticum (UU) and chlamydia trachomatis (CT) are the most frequent sexually-transmitted disease in the world^[1]. And UU is one of the most common micro-organisms that infect the reproductive system including the lower genitourinary tract of sexually active persons, which is associated with non-

gonococcal urethritis (NGU), infertility of men and women, postpartum endometriosis, chorioamnionitis, spontaneous abortion, premature birth, even still birth and perinatal morbidity and mortality^[1, 2]. Moreover, CT is also one of the most common agents of sexually transmitted infections (STIs)^[3], which is found only in humans. Infection with CT is considered as one of the most prevalent STIs, surpassing syphilis and gonorrhoea. Xie et al^[4] found that UU and CT infections were the risk factors of ectopic pregnancy and infertility. Genital infections with UU or CT are one of the major health problems worldwide because of its high prevalence^[5,6].

Tomusiak et al^[7] found that the prevalence of infection with UU was 28% among 3115 women who attended the Cervico-Vaginal Pathology Unit for routine gynecological care between 2003 and 2010. In another study, UU was identified in 9% of the infertile women and in 8% of the fertile women^[8]. Women with fertility problems (39.6%) have slightly higher incidence of UU in the genitourinary tract, compared with the control group (34.7%)^[8]. A relatively high prevalence of UU (54.5%) was found in the detected urine samples of infertile men, and infertile men with positive UURNA had higher sperm DNA fragmentation index^[9]. The prevalence of *Ureaplasma* spp. in semen specimens was 39.6% and 19.2% in infertile and control men, respectively^[10]. The morphological alterations of spermatozoa induced by UU are the possible factors for male infertility^[11].

The WHO estimates showed that, globally, approximately one million new infections occurred with four curable STIs (CT, trichomoniasis, gonorrhoea and syphilis) in people aged 15 to 49 each day^[12]. In 2012, among women of reproductive age, the estimated global prevalence of CT was 4.2%; among men, it was 2.7%^[12]. One study analyzed the data in 2002 and 2012 on women in Denmark, Norway and Sweden and found that in 2012, the prevalence of ever having STI were higher than that of 2005^[13]. In 2015, there were approximately 435,000 diagnoses of STIs occurring in England and the most commonly diagnosed was CT (200,288 diagnoses)^[14]. The asymptomatic infection made up a significant proportion which was up to 80% of CT infections in women, and most infections go undetected because of the absence of screening and treatment. If left untreated of CT infections in women, about 10% of them will progress to pelvic inflammatory disease^[15]. Moreover, there are some co-infections about the STI pathogens, such as *Ureaplasma* species, *M. hominis*, UU, CT, *Mycoplasma genitalium* (MG), *Neisseria gonorrhoeae* (NG), etc. Carne et al^[16] reported the prevalence rates of *Ureaplasma parvum*, UU, CT were 35.6%, 16.1% and 7.1%, respectively; there were also some double infection, even triple infection. Song et al^[17] found that among 2689 women with various genital symptoms, the prevalence of *Ureaplasma* species was 39.9%, *M. hominis* was 1.2% and the co-infection rate was 13.4%. While among 2336 men, the prevalence was 18.8%, 0.4%, respectively, and the co-infection rate was 2.9%. Abusarah et al^[18] found that the distributions of UU and CT in semen and FVU specimens among infertile and fertile men was 10.8% versus 5.7%, and 4.3% versus 1.4%, respectively; 2.2% of infertile men infected with 2 pathogens (UU plus MG).

In China, He et al^[18] reported the prevalence of UU, Mycoplasma hominis (MH) and CT among 965 patients with genital tract infection was 49.5%, and it has been increasing from 2011 to 2014; and the infection of UU (30.5%) was the most frequent (CT:0.3%; UU+MH:12.0%;UU+CT:2.4%; UU+MH+CT:2.4%). The positive rate of women was 53.3%, which was higher than that of men (34.8%), and the 20–39 years old person was at high risk (56.7%)^[19]. Among 9207 women in a population-based survey in Shenzhen, 4.12% tested positive for CT ^[20]. Another study found the prevalence of UU significantly differed between infertile (10.22%) and fertile (3.65%) men ^[21] in China. Zhu et al ^[22] reported that 43.7% of male patients were diagnosed to be positive with UU, MH or for both, and UU was detected most frequently. Comparing the global average, a significantly higher prevalence of UU (but a significantly lower prevalence of MH) in China was observed in both the infertile and fertile men ^[1].

During the past three decades, China has experienced a dramatic increase in rural-to-urban migration, because of the economic growth and expansion of large cities. Many adults, especially at the reproductive age, have migrated from rural to urban areas to seek for work opportunities and for higher salaries. Data from the National Bureau of Statistics of China ^[23] indicated that in 2017, there are 244 million migrants and 172 million migrant workers in cities with 1.5% increasing rate, compared with that of 2016. Migration is one of the causes to behavior change, because the environment and behavior norms might be different with those in their homeplace^[24]. When migrants leave their familiar environment, some risky sexual activities, such as multiple sexual partners, commercial sex, etc, might increase because of the anonymity and anything else ^[25]. Dai et al ^[26] reported that 15.2% of migrant workers had casual extramarital partners but 76.2% of them never or only occasionally used condoms. Migrants were more likely to have STI-associated risk behaviors than non-migrants. And women were more likely to have STIs than men; the prevalence of CT of migrant women was triple that of rural non-migrant ^[27].

The STIs of China's epidemic contributes significantly to the global burden, especially for the disease of CT and NG. In China, the National STI Surveillance Programme only tracks syphilis and gonorrhea by the internet-based routine reporting network, which might have somereal-time basis ^[28]. In recent years, studies on STIs prevalence in China have been conducted, but mainly focus on some high-risk groups, including patients^{[17][19][22]}, infertility^{[4][21]}, female sex workers(FSWs)^[29], men who have sex with men (MSM)^[30] and general population-based women^[19]. But studies of STIs among general migrants, particularly UU and CT among men and women, are very limited. The only study was conducted in the year from 1999 to 2000^[27]. In this paper, we present a workplace-based study on prevalence of UU and CT among general married migrants including men and women aged 20–49 in three cities of China, and some possible risk factors are explored, so as to provide some evidences for STIs prevention among migrants in China.

Methods

Study field and population

This study was conducted in Shanghai (east of China), Yinchuan and Urumqi (northwest of China). The method of quota-sampling was used to enroll the qualified migrants in this study. Two districts were randomly selected in each city. The sampling districts need to meet the following criteria. First, they should have a high concentration of migrants at reproductive age. Second, they should have a better foundation of health care and family planning service work. In the two selected districts of each city, four types of workplaces, including factories, service industry, construction industry and enterprises, were sampled in this study, because of the high concentration of migrant workers. Four types of married migrants was recruited: (1) laborers worked in manufacturing, construction, transport, storage and expressage; (2) service workers; (3) white collar workers and (4) others (worked in wholesale, retail trades and so on).

The eligible participants were: (1) separated from registered and actual residences and residing in the city at least three months; (2) married with 18–49 years; and (3) volunteered to participate in this study. The exclusion criteria were: (1) pregnancy; (2) confirmed with RTIs or STIs when recurring.

Structured questionnaire survey

After the eligible migrants signed the informed consent form, a structured questionnaire survey was conducted by a face to face interview and the investigators were trained by the research group. Information about gender, age, education, occupation, monthly income, household registration, duration of staying at the residence, contraceptive method use, sexual behaviors were filled in the questionnaire.

Gynecological or andrology examination

The gynecological or andrology examination was conducted by the professional gynecologist or male doctor. The gynecological examination included an examination for vulva, vagina and cervix and the cervical secretions were collected for the UU and CT laboratory detection. The male group examinations included an examination for the external genitalia, and their urethral secretions were also collected.

Laboratory detection

In laboratory, UU and CT were detected by the culture method, which has its own advantages, such as low requirement of technical equipment, easy operation, and possibility of drug sensitivity test at the same time ^[31].

Data management and statistical analysis

Collected data were coded and inputted into computer by Epidata 3.0 software. Double data input and data check were done by two postgraduate students who were receiving higher education in Fudan University and were employed by our research team for this work. The statistical analysis was conducted by SAS 9.4 software. The general information and the prevalence of UU and CT were described and compared by three centers. Chi-square test and multiple stepwise logistic regressions ($\alpha = 0.05$, $\beta = 0.10$) were used for the influencing factors exploration.

Results

General information and socio-demographics characteristics

From March 2016 to February 2017, a total of 3570 internal married migrants of reproductive age were recruited, of which 1200 came from Shanghai, 1170 from Yinchuan, 1200 from Urumqi. Of those, 89.07% (3180/3570; 1061 from Shanghai, 1105 from Yinchuan, 1014 from Urumqi) finished the whole study procedures, including the questionnaire, investigation, physical examination, and laboratory test.

Of 3180 participants (men: 39.31% and women: 60.69%), 50.28% were between the ages of 25–34, and the minimum age was 20. And 42.61% of them finished junior high school education, 39.25% of them were laborers. When surveyed, 44.77% of the families earned 3000–4999 (CNY) per capita monthly in the last year. In addition, 76.23% came from rural areas and 76.18% of them stayed in current residence for 12 months per year (Table 1). There were some significant statistical differences about those socio-demographics characteristics among three cities (Table 1).

Prevalence of UU and CT

The prevalence of UU infection was 45.41%, and it was 5.75% of CT infection. There were also some significant statistical differences among three cities. From table 2, we could find that the prevalence rates of UU and CT were the highest (UU: 54.01%; CT: 7.35%) in Shanghai, and the lower rates were those (UU: 37.74%; CT: 4.52%) in Yinchuan. In Urumqi, the prevalence of UU and CT were 44.77%, 5.42%, respectively, but it has the highest co-infection rate (12.11%). From table 3, it was found that the all CT infection was along with the UU infection in Urumqi. The co-infection of UU and CT in Shanghai and in Yinchuan were 3.68%, 3.26%, respectively. The paired chi-square test showed that there were significant statistical differences, which indicated that the co-infections existed in all three research centers and in total (tables 3).

Influencing factors of UU and CT infections

The Chi-square test showed that the prevalence of UU infection were significantly statistical different among research centers, genders, age groups, education groups, occupation groups, income groups, household registration groups, and staying duration in current residence per year groups. As to the CT infection, the three research centers' rates were different, but the gender difference was not found. Different age groups, education groups, and household registration groups had significantly statistical difference in CT infection. Having sex during menstruation could increase the CT infection rate, but it could not influence to the outcome of UU infection. The condom use group had lower UU and CT infection (Table 4).

Multiple-factor analysis using multiple stepwise logistic regressions ($\alpha = 0.05$, $\beta = 0.10$) found that the prevalence of UU among three cities were different. Compared with that of Urumqi, the UU infection in Shanghai was higher (OR = 1.32, 95%CI:1.07–1.63) but it was lower in Yinchuan (OR = 0.75, 95%CI:0.63–0.90). The male's UU infection was lower than that of women (OR = 0.71, 95%CI: 0.61–0.83), and the 20–34 age group participants had lower UU (OR = 0.70, 95%CI:0.55–0.90) and CT (OR = 0.53, 95%CI:0.34–0.82) risk, compared with that of 45–49 age group. Moreover, the white-collar workers had lower risk of UU infection (OR = 0.64, 95%CI: 0.49–0.83), compared with laborers, and using condom could reduce the UU infection (OR = 0.74, 95%CI: 0.63–0.87). Compared with urban migrants, the rural participants had higher risk of CT infection (OR = 1.68, 95%CI: 1.12–2.52), and sex behavior during menstruation could increase the prevalence of CT (OR = 1.49, 95%CI: 1.05–2.11) (Table 5).

Discussion

In our study, the prevalence of Laboratory-confirmed UU and CT were 45.41%, 5.75%, respectively (UU in Shanghai: 54.01%, Urumqi: 44.77%, Yinchuan: 37.74%; CT in Shanghai: 7.35%, Urumqi: 5.42%, Yinchuan: 4.52%), and the co-infection rate was 4.09% among general married migrants. The UU prevalence was higher than that of patients with genital tract infection in Shanghai (30.5%)^[19], and the prevalence of CT was a little bit higher than that of women in a population-based survey in Shenzhen (4.12%)^[20]. In the Chinese Health and Family Life Survey (CHFLS) of 1999–2000, the prevalence of CT among female migrants was 4.79%, which was higher than that among rural non-migrants (2.52%); but it was 1.77% among male migrants, which was not different from that of male non-migrants (urban non-migrants:2.16%; rural non-migrants:2.05%)^[27]. In our study, the prevalence of CT (women: 5.80%; men: 5.68%) was a little bit higher than that of CHFLS survey^[28] and the estimated global prevalence^[28] of CT in urine specimen (women:4.2% men:2.7%)^[12]. Our study and other studies^{[16][17][18][32]} all indicated that the most common infection was UU or Ureaplasma species. But generally, comparison of the prevalence of UU or CT infections across countries or areas is complicated, because there are some different diagnostic methods, and the sample selection techniques may be also different^[33].

One study reported that the known urethral pathogens were detected in only 50.7% of 367 men with nongonococcal urethritis (NGU), of which, CT was 22.3%, UU was 24.0%, MG was 12.5%, Trichomonas vaginalis (TV) was 2.5%, with multiple infection detected was 9.5%^[34]. Carne et al^[16] reported that the

prevalence of co-infection of UU and CT was 1.05%. In another study, first void urine was analyzed, 12.8% of 1729 participants was tested for UU and 6.5% for CT, and a significant association was found between UU and CT, and CT was associated with similar social demographics and sexual risk behaviors as UU^[35], which might suggested that UU has a possible role as an STI pathogen, that could lead the spread of other STIs. In our study, the co-infection rate of UU and CT was 4.09%, which also indicated the co-infection about the pathogens of STIs.

Many factors, such as age, gender, socioeconomic status, menstrual cycle of women, pregnancy history, sexual behaviors, hygienic habits and the use of contraceptives could affect the detection rates of UU and CT. Illiteracy, poor socio-economic conditions, increased parity and poor menstrual hygiene have direct effects on the occurrence of RTI^[36]. Kim et al^[37] reported that the median age of the STIs infection (including UU and CT) group (47 years, range 42–52) was younger than the no-STIs group (49 years, range 43–56) among healthy Korean women. An et al^[38] found that patients with age from 21 to 30, service personnel and unemployed persons had higher rates of CT, UU and/or NG infection. The rates of CT, UU and/or NG infection were elevated, along with the number of previous pregnancies, sexual partners and the frequency of sexual intercourse increasing. Moreover, the sexual intercourse during menstruation period and the lack of cleaning before sexual intercourse could lead to an increased rate of CT, UU and/or NG infection. The use of intrauterine devices also could lead to higher STIs infection rate^[38]. The women using unhygienic method during menstruation were more likely to have STIs symptoms and vaginal discharge^[39]. Verteramo et al^[6] found that in multi-logistic regression analysis, age (<35 years), intrauterine devices and sexual partners number were significantly associated with UU among 3115 women. In Portuguese women of reproductive age (15–44 years), women aged 20–29 years was associated with an increased UU infection risk and lifetime numbers of sexual partners was one of predictors of UU infection^[39].

A population-based study focused on age 20 to 44 in China found the risk factors of CT infection among men included the unprotected sex with commercial sex worker and having recent sex with their spouses or other steady partner; among women, risk factors were living in city and having a spouse or other steady sexual partner who earned a high income; less education was the some risk factors for men and women^[40]. Another study focused on the sub-fertile patients found that the age group between 26 to 35 years old had the highest-risk of infection with CT, and both partners were infected in about one third of the couples^[41]. Using methods other than condom and having adverse pregnancy history significantly associated with CT infection^[20]. We also found that the presence of UU and CT among women is higher than that of men. And the lower socioeconomic status (laborer, the household registration was rural area) could increase the STI infection. But we found that the 20–34 years old participants had lower risks of UU and CT infection than that of 45–49. We speculate that the reasons might be as the following: the migrants aged 45–49 in our study might have lower education and lower income, but they might have more risks, such as history of STIs, induced abortion among women, more lifetime numbers of sexual partners and less use of condom. As to the difference of UU and CT among research centers in this study,

it might be due to the differences of demography. Anyway, the prevalence of STIs (including UU and CT) and the risk factors among migrants of China need more studies to explore.

Contraceptive methods are related with RTIs and STIs, and dual protection methods (condoms) are key strategies to prevent against both unintended pregnancy and STIs, including HIV^[42]. Condoms are one of the most effective methods of protection against STIs, when used properly and consistently. The correct and consistent condom use was also protective for CT (OR = 0.4; 95%CI: 0.2–1.0)^[42]. In our study, the results showed that condom use could reduce the risk of UU infection, and in the condom use group, the CT rate was 4.28%, which was lower than that of another group. But one study focused on adolescents and young adults mentioned that condom use did not significantly decrease the STI prevalence^[43]. It might be due to the lower rate of condom use. Another study among women considered that the significant reason for genitourinary infections was inadequate hygiene practices rather than use of different contraception methods^[44], so the IUD or other contraceptive methods could not increase the rate of STIs.

To our best knowledge, this is a multi-center and large-sample-sized workplace-based study to estimate the prevalence of UU and CT among internal migrants in China. The sample size was similar to the first nationwide population-based survey with non-migrants and migrants, in which 1738 women and 1688 men were included (the participating rate was 69%)^{[27][40]}. But our study is a cross-sectional study, which couldn't induce the cause-effect relationship. Even so, some risk factors of STIs, including low social-economies (laborer, came from rural area), risk sexual behaviors (sex during menstruation) were found by our study. And the condom's protective effect was verified by this study. So, our findings could have significant implications for STIs prevention among migrants. But we investigated few risk sexual behaviors due to the sensitivity, and more studies about STIs risk factors among migrants of China should be conducted in the future.

Because of the asymptomatic infections of UU^[20] and CT^[45], early and active detection of those infections plays an important role in decreasing the STIs infection. Although routine screening of asymptomatic person or routine testing of symptomatic individuals for UU is not recommended in the European STI Guidelines^[46], the situation of China might be different, especially for the internal migrants of China. The screening for UU and CT in general internal migrants of China might be needed. But the assessments about the screening acceptability, feasibility and cost-effectiveness^[20] for UU and CT in general internal migrants are required, before local or national STIs (UU or CT) screening will be conducted in China.

Conclusion

In conclusion, UU and CT infections are widely prevalent among general internal married migrants of China, especially among laborers who came from rural areas and among migrants who have sex during menstruation. We verify that the condom use could reduce the prevalence of UU and CT among general migrants. Thus, condom use should be promoted among general migrants of China.

Abbreviations

ureaplasma urealyticum: UU;

chlamydia trachomatis: CT;

sexually transmitted infections (STIs);

Mycoplasma hominis: MH;

Mycoplasma genitalium: MG

OR: Odds ratio;

95%CI: 95% confidence interval;

Declarations

Ethics approval and consent to participate

The study protocol was approved by the Research Ethics Committee of the Shanghai Institute of Planned Parenthood Research (code: PJ2014–20). The study was performed according to the Declaration of Helsinki. Written informed consents for privacy protection and information security were obtained from all the participants prior to data collection.

Consent for publication

Not applicable.

Availability of data and materials

The dataset using in this paper are not publicly available due to participant privacy but is available from the corresponding author on reasonable request.

Competing financial interests

There are no conflicts of interest to declare.

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Authors' contributions

LYY conducted the data analyses and manuscript writing, participated in the design of study project and questionnaire and participated in the survey; ZY and XSF participated in the questionnaire survey and helped to analyze the data; ZJX conducted the field survey; JN helped the manuscript writing; ZR and LYR participated in the questionnaire survey; WJQ designed the study project.

All authors read and approved the final manuscript.

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Tables

Table 1 Socio-demographic characteristics of study participants

Variables	Shanghai (N=1061)		Yinchuan (N=1105)		Urumqi (N=1014)		Total (N=3180)	
	n	%	n	%	n	%	n	%
Gender**								
Male	488	45.99	369	33.39	393	38.76	1250	39.31
Female	573	54.01	736	66.61	621	61.24	1930	60.69
Age**								
20-	14	1.32	167	15.11	105	10.36	286	8.99
25-	373	35.16	543	49.14	683	67.36	1599	50.28
35-	416	39.21	293	26.52	214	21.10	923	29.03
45-	258	24.21	102	9.23	12	1.18	372	11.70
Education**								
Elementary or lower	119	11.22	181	16.38	64	6.31	364	11.45
Junior high school	544	51.27	493	44.62	318	31.36	1355	42.61
High school	218	20.55	264	23.89	309	30.47	791	24.87
College or higher	180	16.97	167	15.11	323	31.85	670	21.07
Occupation**								
Laborer	729	68.71	287	25.97	232	22.88	1248	39.25
Service worker	60	5.66	331	29.95	341	33.63	732	23.02
White-collar worker	163	15.36	107	9.68	43	4.24	313	9.84
Other	109	10.27	380	34.39	398	39.25	887	27.89
Family per capita income monthly (yuan)**								
<3000	81	7.63	548	49.59	144	14.20	773	24.31
3000-	561	52.87	390	35.29	463	45.66	1414	44.77
5000-	419	39.49	167	15.11	407	40.14	993	31.23
Household registration (hukou)**								
Rural	893	84.17	770	69.68	761	75.05	2424	76.23
Urban	168	15.83	335	30.32	253	24.95	756	23.77
Staying duration in current residence per year (month)**								
3-6	27	2.54	97	8.78	14	1.38	138	4.34
6-11	483	45.52	60	5.43	13	1.28	556	17.48
12	551	51.93	948	85.79	987	97.34	2486	78.18

**p<0.01

Table 2 The prevalence of UU and CT of study participants

Variables	Shanghai (N=1061)		Yinchuan (N=1105)		Urumqi (N=1014)		Total (N=3180)	
	n	%	n	%	n	%	n	%
	UU**							
No	488	45.99	688	62.26	560	55.23	1736	54.59
Yes	573	54.01	417	37.74	454	44.77	1444	45.41
CT								
No	983	92.65	1055	95.48	959	94.58	2997	94.25
Yes	78	7.35	50	4.52	55	5.42	183	5.75

**p<0.01; Chi-square test for CT: Chi-square=8.27, p=0.016

Table 3 The co-infection of UU and CT and paired chi-square test (n, %)

Variables	Shanghai (N=1061)		Yinchuan (N=1105)		Urumqi (N=1014)		Total (N=3180)	
	CT		CT		CT		CT	
	No	Yes	No	Yes	No	Yes	No	Yes
UU								
No	449 (42.32)	39 (3.68)	674 (61.00)	14 (1.27)	560 (55.23)	0 (0.00)	1683 (52.92)	53 (1.67)
Yes	534 (50.33)	39 (3.68)	381 (34.48)	36 (3.26)	399 (39.35)	55 (12.11)	1314 (41.32)	130 (4.09)
c ² test	P=0.461		P<0.0001		P<0.0001		P<0.0001	
McNemar test	P<0.0001		P<0.0001		P<0.0001		P<0.0001	

Table 4 The chi-square test of UU and CT infections (n,%)

Variables	UU				p	CT				p
	No		Yes			No		Yes		
	n	%	N	%		n	%	n	%	
Area					<0.0001					0.016
Shanghai	488	45.99	573	54.01		983	92.65	78	7.35	
Yinchuan	688	62.26	417	37.74		1055	95.48	50	4.52	
Urumqi	560	55.23	454	44.77		959	94.58	55	5.42	
Gender					0.0002					0.884
Male	734	58.72	516	41.28		1179	94.32	71	5.68	
Female	1002	51.92	928	48.08		1818	94.20	112	5.80	
Age					<0.0001					0.0004
20-	166	58.04	120	41.96		278	97.20	8	2.80	
25-	928	58.04	671	41.96		1525	95.37	74	4.63	
35-	482	52.22	441	47.48		852	92.31	71	7.69	
45-	160	43.01	212	56.99		342	91.94	30	8.06	
Education					<0.0001					0.003
≤Elementary	180	49.45	184	50.55		333	91.48	31	8.52	
Junior school	702	51.81	653	48.19		1277	94.24	78	5.76	
High school	441	55.75	350	44.25		739	93.43	52	6.57	
≥College	413	61.64	257	38.36		648	96.72	22	3.28	
Occupation					<0.0001					0.186
Laborer	608	48.72	640	51.28		1163	93.19	85	6.81	
Service worker	424	57.92	308	42.08		694	94.81	38	5.19	
White-collar	198	63.26	115	36.74		300	95.85	13	4.15	
worker										
Other	506	57.05	381	42.95		840	94.70	47	5.30	
Family per capita income monthly (yuan)					0.0002					0.932
<3000	472	61.06	301	38.94		727	94.05	46	5.95	
3000-	746	52.76	668	47.24		1335	94.41	79	5.59	
5000-	518	52.17	475	47.83		935	94.16	58	5.84	
Household registration (hukou)					0.0004					0.016
Rural	1281	52.85	1143	47.15		2271	93.67	153	6.31	
Urban	455	60.19	301	39.81		726	96.03	30	3.97	
Staying duration in current residence per year (month)					0.0002					0.064
3-11	336	48.41	358	51.59		644	92.80	50	7.20	
12	1400	56.32	1086	43.68		2353	94.65	133	5.35	
Sex during menstruation					0.070					0.046
No	1369	53.79	1176	46.21		2409	94.66	136	5.34	
Yes	367	57.80	268	42.20		588	92.60	47	7.40	
Contraceptive method					<0.0001					0.011
No	459	52.22	420	47.78		832	94.65	47	5.35	
IUD	349	49.86	351	50.14		645	92.14	55	7.86	
Condom	661	61.49	414	38.51		1029	95.72	46	4.28	
Other	267	50.76	259	49.24		491	93.35	35	6.65	

Table 5 The multiple stepwise logistic regressions of UU and CT

Comparable G	Reference G	UU			CT		
		OR	95%CI	P	OR	95%CI	p
Area							
Yinchuan	Urumqi	0.75	0.63-0.90	<0.0001	-	-	-
Shanghai		1.32	1.07-1.63	<0.0001	-	-	-
Gender							
Male	Female	0.71	0.61-0.83	<0.0001	-	-	-
Age							
20-	45-	0.70	0.55-0.90	0.007	0.53	0.34-0.82	0.0001
35-		0.79	0.61-1.01	0.471	0.97	0.62-1.52	0.081
Occupation							
White-collar worker	Laborer	0.64	0.49-0.83	0.004	-	-	-
Other		0.84	0.71-1.01	0.567	-	-	-
Household registration (hukou)							
Rural	Urban	-	-	-	1.68	1.12-2.52	0.012
Sex during menstruation							
Yes	No	-	-	-	1.49	1.05-2.11	0.024
Condom							
Yes	No	0.74	0.63-0.87	0.0002	-	-	-