Prevalence of Chlamydia trachomatis *Infection in Registered Female Sex Workers in Northern Mexico*

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Background: Little is known about the epidemiology of *Chlamydia trachomatis* infection in female sex workers (FSWs) in Mexico.

Goal: The goal of the study was to determine the prevalence of *C trachomatis* infection in registered FSWs from northern Mexico and to determine the sociodemographic characteristics associated with the infection.

Study Design: An enzyme immunoassay was used to test 354 FSWs in three northern Mexican cities for cervical *C trachomatis* infection. All participants were registered in a government health office. Recruitment was consecutive and voluntary. The association between clinical and sociodemographic characteristics of FSWs and *C trachomatis* infection was evaluated.

Results: The overall prevalence of *C trachomatis* infection among participants in the three cities was 12.4%. Women of low socioeconomic level and those younger than 25 years were the most frequently infected. Among FSWs in Durango, a higher frequency of *C trachomatis* infection was found for those who did not use condoms.

Conclusion: *C trachomatis* is an important pathogen in the sexually transmitted diseases of registered FSWs in northern Mexico.

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CHLAMYDIA TRACHOMATIS is a pathogenic bacterium spread worldwide. In adults, *C trachomatis* infections are primarily sexually transmitted. These infections result in a spectrum of clinical manifestations, including urethritis, cervicitis, salpingitis, ectopic gestation, preterm delivery, infertility, and perihepatitis. In addition, *C trachomatis* infection may be vertically transmitted; newborns of infected women can develop inclusion conjunctivitis and pneumonia. There are a large number of asymptomatic cases, which represent an important risk for spreading of the infection.[1–3]

Female sex workers (FSWs) are of particular epidemiologic importance since they are at a high risk of being infected with *C trachomatis* and infected sex workers may spread the infection further. Prevalence of *C trachomatis* infection in registered FSWs varies widely around the world.[4–15] Reported rates of prevalence have been obtained by means of several diagnostic methods. However, few have been determined by means of the enzyme immunoassay Chlamydiazyme (Abbott Laboratories, Abbott Park,

IL), the method used in the current study. The following reported prevalence rates have been determined with this assay: 19.8% in Japan,[16] 14.3% in Senegal,[17] and 2.5% in Austria.[18]

Little is known about the epidemiology of *C trachomatis* infection in northern Mexico. This region has epidemiologic importance because of the high migration rates from Mexico to the United States. In order to obtain knowledge of the prevalence and characteristics of *C trachomatis* infection in FSWs in this region, we performed a cross-sectional survey that included three northern cities of Mexico. The aims of the study were to determine the prevalence of *C trachomatis* infection in registered FSWs from northern Mexico and to determine the demographic and other characteristics of the sex workers who were infected.

Methods

Study Population

Registered FSWs in three northern Mexican cities were studied: (1) Durango, Durango State (n = 198); (2) Zacatecas, Zacatecas State (n = 96); and (3) Torreón, Coahuila State (n = 60). The participants in this study were enrolled consecutively as they applied to the Health Clinic of the Municipal Office of Public Health in each of the three cities to be tested for sexually transmitted disease (STD). All sex workers who applied for an examination during the study period agreed to participate. We estimated that there were about 300 registered FSWs in each municipal office; however, because those offices consider the number of registered FSWs as confidential, we were unable to determine the proportion of registered FSWs in each city who participated in the study. This study was performed from 1999 to 2001. FSWs working in Durango were recruited from 1999 to 2000; those working in Zacatecas were recruited in 2000; and those working in Torreón were recruited from 2000 to 2001. A single test was performed on all participants according to the cross-sectional design of the study. Within 4 to 10 days after the sample was obtained, the results of the tests were communicated to the Health Clinic of the Municipal Office of Public Health in each of the three cities. Women who tested positive were treated with a single dose of azithromycin (1

g). Written informed consent was obtained from all the women participating in the study.

Sample Collection and Handling

Specially trained nurses and physicians obtained cervical samples according to the manufacturer's instructions for the Chlamydiazyme test. In brief, excess mucus from the exocervix was removed with a cotton ball and discarded. A clean swab was rotated in the endocervix for 15 to 30 seconds. Then, the swab was placed into a tube containing specimen storage reagent and was stored at 4 °C until analyzed. All samples were tested within 5 days after collection.

Laboratory Tests

Diagnosis of *C trachomatis* infection was established by means of the Chlamydiazyme enzyme immunoassay, which detects *C trachomatis* antigen in endocervical samples. The test was performed according to the manufacturer's instructions.

Questionnaire

The study participants completed a standardized interviewer-administered questionnaire that assessed their clinical and socio-demographic characteristics. Specially trained nurses and physicians administered the questionnaire. The interviewers were personnel of the health offices in each of the three cities. All data requested in the questionnaire, such as history of STDs and obstetric history, were obtained through direct questioning; no data were obtained from medical records. Alcohol use and drug use were considered positive when a subject used any quantity of them. Socioeconomic status was determined on the basis of Bronfman's criteria.[19] In brief, six socioeconomic variables were evaluated: number of persons in the house, number of rooms in the house, material of the floor of the house, availability of drinkable water, presence and type of plumbing in the house, and education level of the head of the family.

Statistical Analysis

Results were analyzed with Epi Info software, version 6 (Centers for Disease Control and Prevention, Atlanta, GA). Odds ratios (ORs) with 95% exact confidence intervals were calculated. In addition, the software SSPS for Windows (version 8.0; SSPS, Chicago, IL) was used to perform multivariate analysis by means of logistic regression with the Enter method.

Results

Thirty-two (16.2%) of 198 registered FSWs in Durango tested positive for *C trachomatis* antigen. Five (5.2%) of 96 registered FSWs in Zacatecas and 7 (11.7%) of 60 registered FSWs in Torreón tested positive for *C trachomatis*. The overall prevalence of *C trachomatis* infection among the study participants in the three cities was 12.4%.

Of the participants working in Durango, most of them (77.8%) had been born in Durango State and the rest in other Mexican states (21.2%) and abroad (1%). The mean age of these women was 29.5 years. The socioeconomic status of 84.9% of these participants was classified as low; 15.1% were of medium socioeconomic status. Only four (2%) did not use condoms (they never used them during their practice of prostitution), and three of those women tested positive for *C trachomatis* infection (univariate analysis: OR = 17.07; 95% CI = 1.29–901.17). Forty-four of the participants (22.2%) had experienced condom breakage at least

once during their practice of prostitution. A history of STDs was reported by 30 women (15.1%). More than half (56.1%) had also practiced prostitution in Mexican states other than Durango State, while 27 (13.6%) had also practiced prostitution in the United States. In principle, registered FSWs from Durango were seen once because our study design was cross-sectional. However, all 44 infected FSWs were treated and nine (20.5%) agreed to be retested after treatment. Two of the nine women remained positive.

Of the participants working in Zacatecas, only 21 (21.9%) were born in Zacatecas State, and 75 (78.1%) were born in other Mexican states. The mean age of these women was 30.1 years. Medium socioeconomic status was noted for 93 women (96.9%), and high status was noted for three (3.1%). Five of the participants (5.2%) did not use condoms, and all five were negative for *C trachomatis* infection. Eighty-five participants (88.5%) had experienced condom breakage at least once during their practice of prostitution. Thirteen women (13.5%) had suffered from STDs. Thirty-six women (37.5%) had practiced prostitution in Mexican states other than Zacatecas State, and 13 (13.5%) had practiced prostitution in the United States and Japan.

Of the participants working in Torreón, 44 (73.3%) were born in Coahuila State and 16 (26.7%) in other Mexican states. The mean age of these women was 29.7 years. The socioeconomic status of the women was as follows: 5 (8.3%) were classified as low, 50 (83.3%) as medium, and 5 (8.3%) as high. A large number of this group (26.7%) did not use condoms; nevertheless, only one of them tested positive for *C trachomatis* infection. Ten women (16.7%) had experienced condom breakage at least once during their prostitution practice. A history of STDs was reported by four (6.7%). Seven women (11.7%) also practiced prostitution in Mexican states other than Coahuila State, and three of them were positive for *C trachomatis* infection (OR = 9.19; 95% CI = 0.94–76.43). Only one (1.7%) had practiced prostitution in the United States.

Sociodemographic characteristics of the participants in all three cities were as follows: the mean age was 29.9 years (range: 18–52 years); the average number of sexual clients per week was 6.6 (range: 1–40); the majority worked in night clubs and bars, and the rest on the street; the mean number of years as a sex worker was 4.8 (range: 1 week to 30 years). The three cities are about 250 km away from each other in northwestern Mexico. Durango has about 491,436 inhabitants, Zacatecas has about 123,899, and Torreón has about 529,512.[20] Durango has a lower overall level of socioeconomic development than Zacatecas and Torreón. Marital status was determined for 353 of the 354 women: 256 (72.5%) were single, 41 (11.6%) were divorced, 25 (7.1%) were living together, 17 (4.8%) were married, and 14 (4.0%) were widowed. Nearly all of the women (93%) had had pregnancies: 293 (82.8%) had had vaginal deliveries, 73 (20.6%) had had cesarean sections, and 100 (28.2%) had had abortions. Most of them (94.1%) used contraception. Alcohol use and drug use were reported by 283 (80.0%) and 47 (13.2%), respectively.

Some characteristics of the women were correlated with *C trachomatis* infection in univariate analysis: age younger than 25 years (OR = 2.09; 95% CI = 1.10–3.96) and low socioeconomic status (OR = 2.24; 95% CI = 1.10–4.62). However, none of the characteristics were correlated in the multivariate analysis model.

Table 1 shows the correlation between the characteristics of the FSWs and *C trachomatis* infection.

Discussion

In this study, the overall prevalence of *C trachomatis* infection among registered FSWs in three northern Mexican cities was

TABLE 1.   Correlation Between Characteristics of the 354 Participants and *Chlamydia trachomatis* Infection

Clinical or Sociodemographic Characteristic	Female Sexworkers with Positive *C trachomatis* Test		
	With positive characteristics	With negative characteristics	OR (95% CI)
Place of birth			
Coahuila, Zacatecas, or Durango	31/219	13/135	1.47 (0.71–3.08)
Other Mexican state or abroad*	13/135	31/219	0.68 (0.32–1.41)
Age younger than 25 y	23/106	21/203	2.09 (1.10–3.96)
Socioeconomic level			
Low	30/173	14/181	2.24 (1.10–4.62)
Medium	12/173	32/181	0.39 (0.18–0.82)
High	2/8	42/346	1 (0.63–1.58)
Obstetric history			
Pregnancy	42/331	2/23	1.46 (0.34–13.20)
Vaginal delivery	38/293	6/61	1.32 (0.52–3.98)
Cesarean delivery	10/73	34/281	1.13 (0.50–2.52)
Abortion	17/100	27/254	1.6 (0.79–3.20)
Use of contraceptive method	39/333	5/21	0.49 (0.17–1.77)
Condom use	40/329	4/25	1.32 (0.32–4.09)
Condom breakage (ever) during intercourse	7/139	37/215	0.29 (0.11–0.69)
Sexually transmitted disease	5/44	39/310	0.9 (0.26–2.47)
Gonorrhea	2/20	42/334	0.8 (0.09–3.47)
Syphilis	1/6	43/348	1.35 (0.03–11.52)
Condyloma acuminata	0/2	44/352	0 (0–43.18)
Trichomoniasis	1/17	43/337	0.46 (0.01–3.10)
Prostitution practice in other states	24/154	20/200	1.56 (0.80–3.06)
Prostitution practice abroad	3/41	41/313	0.56 (0.11–1.88)
Alcohol use†	33/283	11/71	0.75 (0.35–1.67)
Drug use†	4/47	40/307	0.65 (0.16–1.93)

*Includes 1 woman from Guatemala and 1 from the United States.
†Positive history; all categories were included.

12.4%. When compared with the prevalence rates noted in other studies of similar populations with use of the same enzyme immunoassay method, this rate is lower than the rate of 19.8% reported in Japan,[16] similar to the rate of 14.3% reported in Senegal,[17] and higher than the rate of 2.5% reported in Austria.[18]

Differences among the prevalence rates found in the three cities in northern Mexico can be explained by the diversity of the women's sociodemographic characteristics. Analysis of these characteristics indicates that in Durango, the majority (84.9%) of the registered FSWs were of a low socioeconomic level, whereas only 8.3% of the registered FSWs of Torreón and none of the women of Zacatecas were of a low socioeconomic level. This is because Durango has a lower overall level of socioeconomic development than the other two cities. *C trachomatis* infection has been associated with a low socioeconomic level in different populations,[21–23] and this characteristic is the one most closely correlated with the presence of infection in the current study. Therefore, the correlation of low socioeconomic status and *C trachomatis* infection in female sexual workers seems to follow the same pattern found in other studies with different populations. A low socioeconomic status might favor the practice of habits and customs that influence the rate of *C trachomatis* infection.

In addition, practicing commercial sexual activity in Mexican states other than the one in which the sex workers are registered might increase the likelihood of becoming infected. FSWs of Durango practiced prostitution in other Mexican states more frequently than FSWs of Zacatecas and Torreón (56.1% versus 37.5% and 11.7%, respectively). Similarly, the FSWs of Durango reported a higher frequency of commercial sexual activity in the United States than that reported by the FSWs of Torreón (13.6%

versus 1.7%). The finding of a higher frequency of infection in traveling sex workers deserves to be further evaluated in future studies with a larger number of subjects. These studies could clarify whether traveling sex workers represent core transmitters that need special epidemiologic control.

We observed that registered FSWs younger than age 24 years had *C trachomatis* infection at a higher frequency than older women. This observation agrees well with those reported by other authors.[24,25]

Because medical records in offices set up for the detection of STDs were not complete, we obtained information directly from the FSWs. In general, the preventive measures carried out by the health offices are the following: provision of free condoms to the sex workers; diagnosis of syphilis, gonorrhea, and HIV infection; and education on reproductive health. Although the sex workers know about contraceptive methods, they still have pregnancies, deliveries, and abortions at a high rate. We think that they have unplanned pregnancies due to incorrect use of contraception or because of cultural factors. The sex workers in Mexico are frequently expected to have sexual intercourse without a condom, increasing the risk of pregnancy. In this study, any incidence of condom breakage during sexual intercourse was negatively associated with infection. This result should be interpreted with care because the magnitude and the site of the breakage were not evaluated.

The detection of *C trachomatis* antigen in cervical samples of registered FSWs is not a routine procedure in the health offices of any of the three northern Mexican states explored. Results indicate that *C trachomatis* infection is present in an important number of

FSWs; therefore, a *C trachomatis* test must be included in the health care of all registered FSWs.

The immunoassay used for the detection of *C trachomatis* antigen has a lower sensitivity than molecular biology methods. Therefore, it is likely that the true frequency of infection found in this study may be slightly higher. However, one advantage of the immunoassay method is its performance feasibility in the majority of laboratories. Other methods with higher sensitivity, such as molecular biology methods, require major infrastructure and experience. These additional methods are not widely used in Mexico yet. The sensitivity of the assay was not affected by the use of antibiotics, since none of the FSWs were using antibiotics at the time they were tested.

We conclude that (1) the overall prevalence of *C trachomatis* infection found in registered FSWs in the three northern Mexican cities was 12.4%; (2) the prevalence was significantly higher among those 24 years of age or younger; (3) there was a statistically significant association between *C trachomatis* infection and low socioeconomic status; (4) for FSWs in Durango, *C trachomatis* infection was associated with nonusage of condoms; and (5) for FSWs in Torreón, *C trachomatis* infection was more frequent in women who had commercial sexual activity in more than one Mexican state than those having activity in only one state.

These results indicate that FSWs should always use a condom during sexual intercourse and that prevention programs must pay special attention to younger women, those of a low socioeconomic level, and those who work in several states.

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