Epidemiol. Infect. (2003), **131**, 859–865. © 2003 Cambridge University Press
DOI: 10.1017/S0950268803008860 Printed in the United Kingdom

Socio-demographic characteristics and sex practices related to herpes simplex virus type 2 infection in Mexican and Central American female sex workers

F. URIBE-SALAS[1]*, C. J. CONDE-GLEZ[1], L. JUAREZ-FIGUEROA[1] AND A. HERNANDEZ-CASTELLANOS[2]

[1] *Centro de Investigaciones Sobre Enfermedades Infecciosas, Instituto Nacional de Salud Pública, Cuernavaca, Morelos, México*
[2] *Secretaría de Salud del Estado de Chiapas, Jurisdicción Sanitaria VII, Tapachula, Chiapas, México*

(*Accepted 31 March 2003*)

SUMMARY

This study aimed to evaluate the relationship between HSV-2 infection and several socio-demographic and sexual practices of Mexican and Central American female sex workers (FSWs) in the Soconusco region in the State of Chiapas, Mexico. A cross-sectional study was carried out based on a sample frame of bars where FSWs were active in the Soconusco region. FSWs consented to investigations and answered a questionnaire and provided a blood sample for specific HSV-2 antibody analysis.

One hundred and sixteen bars were studied and 484 women were interviewed. The overall frequency of HSV-2 infected women was 85·7%. Variables that reflected exposure to HSV-2 were significantly associated with the frequency of the infection. Additionally, variables such as education and country of origin were significantly associated with HSV-2 infection. These results suggest that this infection is highly endemic in the Soconusco, posing a health risk for the study population.

INTRODUCTION

Ever since the identification of specific antibodies against herpes simplex virus type 2 (HSV-2) by the Western blot technique, using the gG2 glycoprotein as antigen [1], several studies have been carried out to evaluate risk factors such as sexual practices and socio-demographic characteristics in different populations [2–4]. Such has been the epidemiological value of this laboratory tool that some authors have considered the presence of antibodies against HSV-2 as a serological marker of sexual life style in populations [5], and also to study the sero-epidemiological and sero-sociological patterns of HSV-2 infection in the world [6]. In Mexico female sex workers (FSWs) have been shown to have the highest frequencies of HSV-2 infection in the population [7, 8]. These results suggest that in Mexico the presence of antibodies against HSV-2 can be used as a marker of sexual practices in the population as well as to evaluate those factors relating to exposure to the infection [7]. Nevertheless, HSV-2 serology has not been utilized yet in Mexico to evaluate demographic characteristics of FSWs such as origin country or mobility between different commercial sex establishments, especially in those geographical regions where the international migratory flows are important, as in the Soconusco region, in the state of Chiapas. During the last 20 years, demographic movement of women has acquired relevance, specially among women who provide commercial sex in the Soconusco [9]. Such has been the importance

* Author for correspondence: Instituto Nacional de Salud Pública, Av. Universidad 655, Col. Sta. Ma. Ahuacatitlán, Cuernavaca, Morelos, México 62508.

of this phenomenon that 93% of the women who have provided commercial sex in Suchiate, one of the Soconusco's municipalities that borders with Guatemala, were of Central American origin [10]. As a result, we were interested in utilizing the HSV-2 infection marker to evaluate some indicators of FSWs demographic mobility in addition to sexual practices.

METHODS

Study population

A cross-sectional study approved by the Ethics Committee of the National Institute of Public Health of Mexico was conducted during August 1998 to estimate the prevalence of HIV and other sexually transmitted infections (STI), and to evaluate the population mobility of FSWs in the Soconusco region in the state of Chiapas, Mexico [11]. Briefly, a sampling framework was carried out by interviewing key informants to identify those places where FSWs worked in the municipalities of the Soconusco. As a result, we found that female commercial sex activity was concentrated among 8 of 16 municipalities in the Soconusco. We identified 237 bars and estimated the presence of about 1153 FSWs in March 1998. During August 1998, 484 FSWs from 116 bars were interviewed at the local clinics in the referant municipalities.

Questionnaire and analysis of results

Following informed consent, the participants answered a questionnaire to evaluate socio-demographic characteristics such as age, education, parity and country of origin. Secondly, we studied previous and current experience of commercial sex as an indicator of demographic mobility and risk for STI. Finally, some indicators of risky sexual practices were evaluated: age at first intercourse, time working as a commercial sex worker and the number of clients per week. We also considered condom use during the last sex relationship as a risk factor for STI.

The risk of HSV-2 infection was estimated by using the prevalence odds ratio (POR) and its corresponding confidence intervals according to socio-demographic characteristics and sexual practices of FSWs. Likewise, one-way analysis of variance was performed with age as a dependent variable and country of origin as an independent one. We performed a single and multi-variable analyses using logistic regression for both. The purpose of multivariable analysis, by logistic regression, was to evaluate the independent relationship of demographic characteristics, previous experience in commercial sex and sexual practices. All those mentioned analyses were done with SPSS (Statistical Package for Social Sciences, version 10 for Windows, Chicago, IL).

HSV-2 antibody test

The 468 participants who consented provided blood samples which were tested for HSV-2 antibodies by Western blotting, using a recombinant gG2 glycoprotein as antigen [8].

RESULTS

We found that 75% of the women who worked in commercial sex, among the different municipalities of the Soconusco, had Central American origin: 40·8, 16·0, 18·2 and 23·3 were born in Guatemala, El Salvador, Honduras and Mexico, respectively. Eight participants (1·7%) were from other countries. Even though the overall prevalence of antibodies against HSV-2 was 85·7%, it varied according to the women's countries of origin, thus women from Honduras had the lowest frequency (70·6%) and those from El Salvador had the highest (90·7%) (Table 1).

All the variables that reflect periods of exposure to the HSV-2 infection such as age, parity, starting age in commercial sex and time working in commercial sex, had a significant impact on the risk of HSV-2 infection (Table 1). As a result of the one way analysis of variance, we found that only the women's mean age was statistically different between countries of origin ($P=0{\cdot}002$). According to the Scheffe test, Honduran women's mean age was significantly lower than that for Guatemalan, Salvadoran and Mexican women (23·09 years *vs.* 26·26, 26·07 and 25·82 years, respectively).

Most of the women studied had a low educational level; more than half (54·8%) were illiterate or had incomplete elementary school education. These women had the highest HSV-2 antibodies prevalence (87·5%). This result is much higher than that for women with high school and college education (67·8%) who represent only 6% of the total women studied (Table 1).

Of all the women studied, 48·3% had at least one previous experience of commercial sex in the Soconusco. These women had two times higher prevalence

https://doi.org/10.1017/S0950268803008860 Published online by Cambridge University Press

Table 1. *HSV-2 infection prevalence in 468 FSWs according to their socio-demographic characteristics in the Soconusco region in the state of Chiapas, Mexico, during the Summer of 1998*

Characteristics	Number*	HSV-2 antibody prevalence (%)	POR†	95% CI	POR‡	95% CI
Age (years)						
15–19	90	68·9	1·0		1·0	
20–24	164	85·4	2·6	1·4–4·9¶	2·4	1·0–5·6
25–29	98	91·8	5·1	2·2–11·9‖	2·5	0·7–8·8
30–34	56	89·3	3·8	1·4–9·8¶	1·3	0·3–6·2
⩾35	59	98·3	26·1	3·5–197¶	5·3	0·5–54
Education						
Low	256	87·5	1·0		1·0	
Middle	183	85·8	0·9	0·5–1·5	1·4	0·7–2·7
High	28	67·8	0·3	0·1–0·7¶	0·3	0·1–0·8§
Starting age in commercial sex						
<16 years old	90	78·9	1·0			
17–20 years old	161	81·4	1·2	0·6–2·2	0·9	0·4–2·2
21–25 years old	112	89·3	2·2	1·0–4·9§	1·0	0·3–2·8
>25 years old	105	94·3	4·4	1·7–11·6¶	1·4	0·4–5·2
Parity						
None	87	66·6	1·0			
1	137	87·6	3·5	1·8–7·0‖	3·7	1·6–8·7¶
2	111	90·1	4·5	2·1–10·0‖	3·4	1·2–9·5§
⩾3	133	92·5	6·1	2·8–13·5‖	3·8	1·2–11·8¶
Country of origin						
El Salvador	75	90·7	1·0		1·0	
Mexico	109	88·1	0·8	0·3–2·0	0·8	0·3–2·7
Guatemala	191	89·5	0·9	0·4–2·2	0·8	0·3–2·4
Honduras	85	70·6	0·2	0·1–0·6¶	0·2	0·1–0·6¶
Time working in commercial sex						
<1 year	158	72·2	1·0			
1–3 years	168	91·1	3·9	2·0–7·4‖	3·6	1·7–7·9¶
>3 years	142	94·4	6·5	2·9–14·2‖	3·5	1·4–9·3§
Previous work in commercial sex						
No	237	81·4	1·0		1·0	
Yes	221	90·0	2·0	1·2–3·6§	1·1	0·6–2·2
Condom use**						
No	83	90·3	1·0		1·0	
Yes	385	84·7	0·6	0·3–1·3	0·9	0·4–2·4
Number of clients††						
None	145	79·3	1·0		1·0	
1–5	209	86·6	1·7	0·9–2·9	1·3	0·6–2·8
>5	114	92·1	3·0	1·4–6·7¶	1·9	0·7–5·2

* The sample size varies slightly for some variables because of missing data.
† Crude prevalence odds ratio.
‡ Adjusted prevalence odds ratio by logistic regression.
§ $P<0{\cdot}05$, ¶ $P<0{\cdot}01$, ‖ $P<0{\cdot}0001$.
** During the last sex relationship.
†† During the last week.

of HSV-2 infection than those without such previous experience (Table 1). A history of condom use during the last sex intercourse tended to correlate with a lower prevalence of HSV-2 infection but the difference between those women that used it and those that did not, was not significant. History of an increased

https://doi.org/10.1017/S0950268803008860 Published online by Cambridge University Press

number of clients during the last week was associated with a higher prevalence of HSV-2 infection, particularly among those women who had sex with more than five clients.

As a result of multi-variable analysis by logistic regression, we found an independent association between HSV-2 infection and education, parity, country of origin and time working in commercial sex. Women with the highest education level (POR = 0·3, 95% CI 0·1–0·8) and those from Honduras (POR = 0·2, 95% CI 0·1–0·6) had a significantly lower risk of HSV-2 infection compared with the group with the lowest education level and Salvadorans, respectively. Women's parity and time working in commercial sex were associated with HSV-2 infection regardless of the number of babies delivered or years of work. Thus, FSWs who had 1 delivery as compared to 3 or more deliveries showed no statistical difference for risk of HVS-2 infection, as well as, FSWs with 1–3 years working in commercial sex when compared to those with a longer working time in commercial sex (Table 1).

The information contained in Table 2 shows a high variability of HSV-2 infection prevalences among different women's populations in the Americas. The overall prevalence found in our study is the highest ever reported in the continent.

DISCUSSION

Women in this study showed a high prevalence of HSV-2 antibodies (85·7%), which is higher than the results from two previous surveys conducted in Mexican FSWs (60·8 and 65·1%) [7, 8]. Other studies have documented high prevalences of antibodies against HSV-2 in FSWs in the United States, 78·6%; Japan, 78·6%; Senegal, 95·7% [6]; Eritrea, 80% [12]; Japan, 80% [13]; Peru, 82% [14].

HSV-2 antibody prevalence among the FSWs in the Soconusco region, is the highest reported in the Americas. The differences for the results shown in Table 2 may be explained in part because of the different laboratory tests used, in addition to different sampling methods to select the populations under study. Most studies with FSWs have shown the highest frequencies of HSV-2 infection among women (higher than 60%) [6–8, 14, 15, 17]. Austin's study [16], based on women attending an STD clinic, reported an HSV-2 antibody prevalence of 64% where African–American women had the highest frequency. Other authors have also reported that African–American women have higher prevalences of HSV-2 infection compared to white women [3, 29], including pregnant women [6]. Other studies in South and Central America, have reported high prevalences of antibodies against HSV-2 in different women's populations (non FSWs), that ranged from 36–59·7% in Brazil, Colombia and Costa Rica [2, 4, 18–22]. These frequencies are higher than that reported in non-FSWs women from Mexico City (29·8%) [26].

The high prevalence of antibodies against HSV-2 found in the FSWs studied in the Soconusco region, could be explained by several epidemiological characteristics such as education level, parity, country of origin and time working in commercial sex, which were significantly associated with the prevalence of HSV-2. While 54·8 and 31·2% of the women had low and middle levels of education respectively and had similar prevalences of HSV-2 infection, by contrast only 6% of all women had a high educational level and a significantly lower frequency of HSV-2 infection.

Honduran women had the lowest prevalence of HSV-2 antibodies compared with Mexican, Salvadoran and Guatemalan women. This result could be due to the youngest age average of Honduran with respect to those women already mentioned but could also indicate that the frequency of HSV-2 infection is lower in Honduras with respect to that in other countries.

The sexual activity of the women in this study did not correlate with the prevalence of HSV-2 infection among the women studied, using as indicator the number of clients during the last week of work. This result is consistent with a previous findings that when the prevalence of HSV-2 antibody in the women surveyed is so high (85·7%), the evaluation of the number of sexual partners, in a relatively short and recent period, did not discriminate the overall infection, since most women could be seropositive at the moment of the study [7]. By contrast, women's characteristics related with periods of exposure, such as parity and time working in commercial sex, were highly associated with HSV-2 infection. Unexpectedly, other characteristics that represent periods of exposure such as age and starting age in commercial sex had no independent association with HSV-2 infection.

The condom usage would be expected to show a protective effect against HSV-2 infection. A protective effect of condom use was found (POR = 0·6), although the difference between women that used

Table 2. *HSV-2 antibody seroprevalences in FSWs and in different women's populations and countries in The Americas*

Location/reference	Population	Year	Sample size	Prevalence	Type of HSV-2 antibody test*
Soconusco, Mexico [Current work]	FSWs	1998	484	87·5	WB G2
Lima, Perú [14]	FSWs	1991–1992			WB G2
	– Non-registered		116	82·8	
	– Registered		283	82·0	
7 cities, USA [6]	FSWs	1986	NA	78·6	NA†
Rio de Janeiro, Brazil [15]	FSWs	1994	20	70·0	EIA G2
Mexico City [7]	FSWs	1992	997	65·1	WB G2
Alabama, USA [16]	STD clinic	1992–1995	1103	64·0	ID G2
	– African–American		980	66·0	
	– White		123	55·0	
Cali, Colombia [17]	FSWs	NA			MN
	– Mestizo		196	63·0	
	– African–American		147	62·0	
Mexico City [8]	FSWs	1992	757	60·8	WB G2
Colombia [18]	Population based – controls	1985–1988	149	59·7	EIA gC2
Atlanta, USA [6]	Public practice	1984–1985	NA		NA
	Pregnant				
	– African–American			53·4	
	– Whites			34·9	
	Private practice	1983–1985			
	Pregnant				
	– African–American			50·2	
	– White			25·3	
Campinas City, Brazil [19]	STD clinic	1993–1997	96	53·1	EIA + WB G2
São Paulo, Brazil [20]	Hospital, pregnant, low income patients	1988–1989	173	46·0	Unclear method
Multicenter study (Mexico, Colombia, Panama, Costa Rica) [21]	Overall controls	1986–1987	1312	42·8	WB
São Paulo, Brazil [4]	Hospital controls	1990–1991	181	42·0	EIA G2 + WB
Costa Rica [22]	Population based – controls	1984–1985	764	42·0	ID G2
San Francisco suburbs, USA [3]	Population based	1988–1989	611	41·0	WB G2
Costa Rica, Central America [2]	Population based – controls	1984–1985	766	39·4	ID G2
São Paulo, Brazil [20]	Hospital, pregnant, low and middle class	1988–1989	127	36·0	Unclear method
Northern CA Counties, USA [23]	Adult 18–29 years	1996–1998	1635	34·8	RIBA
Stanford University, CA, USA [24]	Prenatal care	1988–1991	352	30·0	EIA + WB
Cincinnati, Ohio, USA [25]	College students 18–25 years	NA	96	30·0	EIA G2
Mexico City [26]	Population based	1994–1996	730	29·8	WB G2
New Mexico, USA [27]	Controls matched	NA	333	29·4	ID G2
Toronto, Canada [28]	Adults 35–50 years	1978–1980	429	17·5	RIA
British Columbia, Canada [29]	Adults 15–44 years	1999	1215	17·3	EIA G2

* Test notations: WB G2, Western blot using HSV-2 purified or recombinant G2 protein; RIA, Radioimmunoassay previous adsorption of cross-reactive antibodies; EIA G2, Enzyme immunoassay using G2 protein; EIA + WB G2, Enzyme immunoassay plus Western blot G2 to the positive results; EIA G2 + WB, Enzyme immunoassay using G2 protein plus Western blot to the positive results; RIBA, Strip-recombinant immunoblot; WB, Western blot using whole HSV-2 lisate; ID G2, Immunoblot using G2 protein; EIA + WB, Enzyme immunoassay plus Western blot using whole HSV-2 lisate; EIA gC2, Enzyme immunoassay using specific antigens (gC2) for HSV-2; MN, Microneutralization.

† NA, Not available.

https://doi.org/10.1017/S0950268803008860 Published online by Cambridge University Press

a condom during the last sex relationship and those who did not, was not significant (95% CI 0·3–1·4). Similarly, other authors have not been able to observe the protective effect of condom use against HSV-2 infection among FSWs [6, 7, 16], indicating the limits of cross-sectional designs to evaluate the benefit of condom use in these populations.

The high seroprevalence of HSV-2 infection found in the FSWs surveyed has great importance in public health terms in the study region because FSWs could be a significant source of infection for the local heterosexual population. Also, high rates of HSV-2 infection may be important in enhancing HIV transmission [30].

ACKNOWLEDGEMENTS

The authors would like to thank the operative support provided by Dr Aminain Solis-Jiménez, director of the Soconusco's Sanitary Jurisdiction, during the performance of the study. We would also like to acknowledge the technical help provided by the INSP-STI laboratory technical staff. This research was supported by the National Institute of Public Health of Mexico.

REFERENCES

1. Lee FK, Coleman RM, Pereira L, et al. Detection of herpes simplex virus type-2 specific antibody with glycoprotein G. J Clin Microbiol 1985; **22**: 641–644.
2. Oberle MW, Rosero-Bixby L, Lee FK, et al. Herpes simplex virus type 2 antibodies: high prevalence in monogamous women in Costa Rica. Am J Trop Med Hyg 1989; **41**: 224–229.
3. Siegel D, Golden E, Washington E, et al. Prevalence and correlates of herpes simplex infections. The population-based AIDS in multiethnic neighborhoods study. JAMA 1992; **268**: 1702–1708.
4. Smith JS, Herrero R, Muñoz N, et al. Prevalence and risk factors for herpes simplex virus type 2 infection among middle-age women in Brazil and the Philipines. Sex Transm Dis 2001; **28**: 187–194.
5. Cowan FM, Johnson AM, Ashley R, et al. Antibody to herpes simplex virus type 2 as serological marker of sexual lifestyle in populations. BMJ 1994; **309**: 1325–1329.
6. Nahmias AJ, Lee FK, Beckman-Nahmias S. Sero-epidemiological and sociological patterns of herpes simplex virus infection in the world. Scand J Infect Dis 1990; **69**: 19–36.
7. Uribe-Salas F, Hernández-Avila M, Juárez Figueroa L, et al. Risk factors for herpes simplex virus type 2 infection among female commercial sex workers in Mexico City. Int J STD AIDS 1999; **10**: 105–111.
8. Conde-Glez CJ, Juárez-Figueroa L, Uribe-Salas F, et al. Analysis of herpes simplex virus 1 and 2 infection in women with high risk sexual behavior in Mexico. Int J Epidemiol 1999; **28**: 571–576.
9. Angeles H, Rojas ML. Migración femenina internacional en la frontera sur de México. Rev Perfiles Población 2000; **6**: 127–151.
10. Uribe-Zuñiga P, Bronfman-Pertzovsky M, Sejenovich-Firbank G, et al. Migration, commercial sex and HIV infection: problems and possible interventions [abstract Tu.D.2905]. In: Programme and Abstracts of the XI International Conference on AIDS (Vancouver) Canada, 1996.
11. Uribe-Salas F, Conde-Glez CJ, Juárez-Figueroa L, Hernández-Castellanos A. Sociodemographic dynamics and sexually transmitted infections in female sex workers at the Mexican-Guatemalan border. Sex Transm Dis 2003; **30**: 266–271.
12. Ghebrekidan H, Rudén U, Cox S, et al. Prevalence of herpes simplex virus types 1 and 2, cytomegalovirus, and varicella-zoster virus infections in Eritrea. J Clin Virol 1999; **12**: 53–64.
13. Hashido M, Lee FK, Nahmias AJ, et al. An epidemiologic study of herpes simplex virus type 1 and 2 infection in Japan based on type-specific serological assay. Epidemiol Infect 1998; **120**: 179–186.
14. Sánchez J, Gotuzzo E, Escamilla J, et al. Sexual transmitted infection in female sex workers: reduced by condom use but not by a limited periodic examination program. Sex Transm Dis 1998; **25**: 82–89.
15. Da Rosa-Santos OL, Gonçalves Da Silva A, Perreira AC. Herpes simplex virus type 2 in Brazil: seroepidemilogic survey. Int J Dermatol 1996; **35**: 794–796.
16. Austin H, Macaluso M, Nahmias A, et al. Correlates of herpes simples virus seroprevalence among women attending a sexually transmitted disease clinic. Sex Transm Dis 1999; **26**: 329–334.
17. Dueñas A, Adam E, Melnick JL, et al. Herpesvirus type 2 in a prostitute population. Am J Epidemiol 1972; **95**: 483–489.
18. De Sanjosé S, Muñoz N, Bosch FX, et al. Sexually transmitted agents and cervical neoplasia in Colombia and Spain. Int J Cancer 1994; **56**: 358–363.
19. Carvalho M, de Carvalho S, Pannuti CS, et al. Prevalence of herpes simplex type 2 antibodies and clinical history of herpes in three different populations in Campinas City, Brazil. Int J Infect Dis 1999; **3**: 94–98.
20. Weinberg A, Canto CLM, Pannuti CS, et al. Herpes simplex virus type 2 infection in pregnancy; asymptomatic viral excretion at delivery and seroepidemilogic survey of two socioeconomically distinct populations in São Paulo, Brazil. Rev Inst Trop São Paulo 1993; **35**: 285–290.
21. Hildesheim A, Mann V, Brinton LS, et al. Herpes simplex virus type 2: a possible interaction with human papilloma virus types 16/18 in the development of invasive cervical cancer. Int J Cancer 1991; **49**: 335–340.
22. Stone KM, Zaidi A, Rosero-Bixby L, et al. Sexual behavior, sexually transmitted diseases, and risk of cervical cancer. Epidemiology 1995; **6**: 409–414.

23. Buchacz K, McFarland W, Hernandez M, et al. Prevalence and correlates of herpes simplex virus Type 2 infection in a population-based survey of young women in low income neighborhoods of Northern California. Sex Transm Dis 2000; **27**: 393–400.
24. Kulhanjian JA, Soroush V, Deborah BS, et al. Identification of women at unsuspected risk of primary infection with herpes simplex virus type 2 during pregnancy. N Engl J Med 1992: **326**; 916–920.
25. Lewis LM, Bernstein DI, Rosenthal SL, et al. Seroprevalence of herpes simplex virus type 2 in African–American college women. J Natl Med Assoc 1999; **91**: 210–212.
26. Lazcano-Ponce E, Smith JS, Muñoz N, et al. High prevalence of antibodies to herpes simplex virus type 2 among middle-aged women in Mexico City, Mexico. Sex Transm Dis 2001; **28**: 270–276.
27. Becker TM, Lee F, Daling JR, et al. Seroprevalence of and risk factors for antibodies to herpes simplex viruses, hepatitis B, and hepatitis C among Southwestern Hispanics and non Hispanics white women. Sex Transm Dis 1996; **23**: 138–144.
28. Stavraky KM, Rawls WE, Chiavetta J, et al. Sexual and socioeconomic factors affecting the risk of past infections with herpes simplex virus type 2. Am J Epidemiol 1983; **118**: 109–121.
29. Patrick DM, Dawar M, Cook DA, et al. Antenatal seroprevalence of herpes simplex virus type 2 (HSV-2) in Canadian women. Sex Transm Dis 2001; **28**: 424–428.
30. Wasserheit JH. Epidemiological synergy. Interrelationships between human immunodeficiency virus infection and other sexually transmitted diseases. Sex Transm Dis 1992; **19**: 61–77.