Prevalence of Sexually Transmitted Diseases in High-Risk Women in the Republic of Panama

WILLIAM C. REEVES, MD, AND EVELIA QUIROZ, DSc

From the Gorgas Memorial Laboratory, Panama City, Republic of Panama

This study enrolled 1,032 sexually active women attending social hygiene clinics in Panama City; clinic attendance is mandatory for women employed in houses of prostitution, bars, and cabarets. Women were interviewed, and endocervical specimens were obtained for culture of *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, herpes simplex virus, and cytomegalovirus. Four occupational groups attended the social hygiene clinics: prostitutes, bar girls denying prostitution, cabaret entertainers, and streetwalkers detained by the police. Prevalence of sexually transmitted disease, nationality, race, contraceptive method, and self-medication varied significantly by occupation; 31% of streetwalkers had gonorrhea as did 10% of prostitutes, 5% of bar girls, and 3% of cabaret entertainers. Rates of positive serologic tests for syphilis followed the same trend: 23% in streetwalkers, 7% in prostitutes, and 3% in nonprostitutes. Rates of chlamydial infection were significantly higher in cabaret entertainers (8%) than in any other occupational group (2%). Cytomegalovirus and herpes simplex virus infections were uncommon and were found in 5% and 1% of the women, respectively. Prevalence of *N. gonorrhoeae* varied with self-medication and years of "professional" experience. Only one of 160 *N. gonorrhoeae* isolates was resistant to penicillin and also β-lactamase-positive.

SEXUALLY TRANSMITTED diseases (STD) constitute an increasingly important public health problem in the United States and other industrialized countries. STD are important because they cause acute disease in young adults, contribute significantly to postpartum morbidity, perinatal morbidity and mortality, and may cause chronic disease in both adults and children. Acute bacterial STD such as gonorrhea and syphilis are significant health problems in the developing world.[1,2] Most STD research in the Third World has been limited to patients with acute clinical disease due to readily diagnosed bacterial infections. Little is known concerning the epidemiology of agents such as herpes simplex virus, cytomegalovirus, *Chlamydia trachomatis*, genital papillomavirus, and human T-lymphotropic viruses, all of which require relatively sophisticated laboratory support for diagnosis.

The major objective of this study was to describe the prevalence of STD agents in Latin American women who are very sexually active and to use this information to help interpret the epidemiology of invasive cervical cancer. Cervical cancer is a major public health problem in Latin America, where the incidence exceeds one case per 1,000 of 20- to 49-year-old Panamanian women[3] and sexual risk factors of men (particularly utilization of prostitutes) appear to be important determinants.[4,5] A secondary objective was to evaluate whether STD in prostitutes can be controlled with mandatory weekly screening programs.

This report presents the analysis of a 20-month study of women at high risk for STD in Panama City and Colon, Republic of Panama. Participants were recruited from social hygiene clinics operated by the Ministry of Health. The study collected epidemiologic and clinical data as well as results of endocervical cultures for *N. gonorrhoeae*, herpes simplex virus, cytomegalovirus, and *C. trachomatis*, and of serologic tests for syphilis.

Materials and Methods

Study Population

Between July 1978 and March 1980 we enrolled 1,032 women as they attended Ministry of Health social hygiene clinics in Panama City and Colon. These clinics are part of the ministry's Sexually Transmitted Disease Control Program. All women employed in after-hours establishments such as bars, night clubs, cocktail lounges, and in houses of prostitution are required to attend a neighbor-

hood social hygiene clinic each week. Clinic staff perform pelvic examinations and collect endocervical swabs to be examined by Gram's stain for *N. gonorrhoeae*. Women found to be infected on the basis of a stained smear are treated with probenicid and penicillin in the clinic at the time of diagnosis. Repeat smears and culture specimens are not taken after therapy.

In Panama City six district health centers operated clinics every Friday, and on Wednesdays a single clinic served the city of Colon. We worked at different clinics on a rotating basis; 50–60 women were examined at the smaller clinics weekly, and the larger clinics processed up to 200. We selected ~50 women for study during each visit to a clinic. We chose participants according to their order in the queue, and at large clinics we attempted to sample women who had not been previously enrolled.

In addition to those attending the routine weekly clinics, two other groups were included: women working as "cabaret entertainers," i.e., dancers and singers who attended a special monthly, union-sponsored health clinic; and "streetwalkers," i.e., prostitutes detained by law-enforcement authorities for failure to attend the social hygiene clinic.

Women were volunteers with respect to interview participation and phlebotomy, but pelvic examinations were done and endocervical swab specimens were collected routinely from all women. We abstracted demographic and employment data from each participant's clinic record. Many women were seen multiple times during the study, and we assumed that each visit (minimum, six to seven weeks apart) represented an independent chance for infection. Thus the 1,032 women enrolled represented a total of 1,858 clinic visits.

Measurements

Routine endocervical swab specimens and smears for detection of *N. gonorrhoeae* were obtained from all study participants. In addition, three other endocervical swabs were taken for culture of *N. gonorrhoeae*, *C. trachomatis*, and herpes simplex virus/cytomegalovirus. A 10-ml venous blood specimen was collected for syphilis serology and measurement of antibiotics in serum; finally each woman had a standardized interview by a female Panamanian interviewer.

Laboratory Studies

All specimens were obtained with cotton-tipped applicators. Swabs for isolation of *N. gonorrhoeae* were streaked onto Thayer-Martin agar plates immediately after collection; the plates were placed in a candle jar and transported to the laboratory. Suspected *N. gonorrhoeae* colonies were examined by Gram's stain, tested for oxidase positivity, and confirmed by carbohydrate fermentation.[6] All *N.*

gonorrhoeae isolates were tested for penicillin resistance by use of standard 100-μg penicillin disks, and any found resistant were further tested for β-lactamase with a standard chromogenic cephalosporin test.[7]

Endocervical specimens for isolation of *C. trachomatis* were obtained with a calcium alginate swab, which was placed in holding medium and kept on wet ice until specimens could be frozen at −70 C pending culture. Specimens were cultured with use of iododeoxyuridine-treated McCoy cells according to the method of Wentworth and Alexander.[8] All specimens were blind-passaged once. Those specimens producing iodine-containing cytoplasmic inclusions were considered positive.

Herpes simplex virus was isolated in tube cultures of Vero and FT cells.[9] Tubes were examined twice weekly for two weeks for CPE characteristic of herpes simplex virus. The cytomegalovirus assay utilized FT cells, which were examined twice weekly for five weeks.[10]

Serum specimens were screened for evidence of past exposure to syphilis by the rapid plasma reagin (RPR) card test (Brewer Diagnostics). We measured serum antibacterial activity using *Sarcina lutea* and *Bacillus subtilis* growth inhibition assays.[11] We assumed that growth inhibition reflected antibiotic activity in serum as these organisms are extremely sensitive to the antibiotics frequently used in Panama to treat STD (E. Quiroz, unpublished data).

Data Processing and Statistical Analysis

Standardized forms were used for documentation of interviews, physical examinations, follow-up visits, and laboratory studies. All data were coded and entered into interactive computer disk files on a General Automation SPC 16/65 computer system. Data processing used the Conversational Computer Statistical System.[12] Statistical analyses were done using the χ^2 statistic for R × C tables and Fisher's exact test or the χ^2 test for trend.

Results

Occupational Groups

The social hygiene clinics screen both prostitutes and women who do not practice prostitution. We defined prostitutes by interview response and assigned them to subcategories depending upon employment in a house of prostitution ($n = 144$), as prostitutes working in bars, canteens, etc. ($n = 470$), or as streetwalkers who were detained by law-enforcement authorities ($n = 39$). All 144 participants from houses of prostitution admitted to being prostitutes as did 470 (59%) of 790 women employed in bars, etc. Women with more than one interview were classified as prostitutes if they admitted to prostitution at any interview.

TABLE 1. Occupation, Place of Birth, and Race of Population of Women Attending Social Hygiene Clinics in Panama

| | No. (%) in Indicated Category | | | | |
| | Prostitute | | | Nonprostitute | |
Origin	House	Bar	Streetwalker	Bar Girl	Cabaret
Panama	5 (2)	174 (37)	38 (97)	272 (85)	13 (22)
South America	108 (75)	254 (54)	1 (32)	3 (1)	28 (47)
Central America	33 (23)	18 (4)	· · ·	3 (1)	11 (19)
Other	0	0	· · ·	0	7 (12)
Unknown	0	24 (5)	· · ·	42 (13)	0

| | Percentage in Indicated Category | | | |
| | Prostitute | | Nonprostitute | |
Race	House or Bar $n = 614$	Streetwalker $n = 39$	Bar Girl $n = 320$	Cabaret $n = 59$
Mestizo	71	25	71	39
Black	12	75	28	15
White	17	0	1	46

Note. Results of statistical analysis: Bar girl vs. cabaret entertainer: $\chi^2 = 137.3$; $df = 2$; $P < .001$. Bar girl vs. prostitute: $\chi^2 = 78.0$; $df = 2$; $P < .001$. Streetwalker vs. prostitute: $\chi^2 = 107.9$; $df = 2$; $P < .001$.

Nonprostitutes included women working in bars, canteens, cocktail lounges, or similar businesses (usually as waitresses or cashiers) who consistently denied working as prostitutes ($n = 320$); the group also included cabaret entertainers, all of whom denied practicing prostitution ($n = 59$).

Significantly different patterns of nationality and race were apparent according to occupation (table 1). Age distribution did not vary with either occupation or race; the range was 15 to 57 years (mean, 27 years).

Prevalence of STD

Rates of infection with STD were generally low and varied significantly according to occupation (table 2).

Since infection rates did not differ markedly between prostitutes from houses of prostitution and those working in bars, they were combined as a single group for analyses. The prevalence of active *N. gonorrhoeae* infection was significantly greater in streetwalkers (31%) than in any other group, and prostitutes (10%) had significantly greater infection rates than nonprostitutes (5%). The same was true for positive screening tests for syphilis (range, 2–23%); we did not confirm positive screening tests or ascertain active syphilis infection. In contrast, nonprostitute cabaret entertainers had significantly higher rates of infection with *C. trachomatis* (8%) than any other occupation (1–3%). The prevalences of cytomegalovirus (5%) and herpes simplex virus (1%) were low in all groups. Most subjects denied symptoms of genital disease, and there was no cor-

TABLE 2. Prevalence of Sexually Transmitted Disease Agents by Occupation of Women Attending Social Hygiene Clinics in Panama

| | No. Positive/No. Tested (% Positive)* | | | |
| | Prostitute | | Nonprostitute | |
	Streetwalker	Bar or House	Bar Girl	Cabaret
Gonorrhea	12/39 (31)	100/956 (10)	22/433 (5)	2/59 (3)
Syphilis serology†	8/35 (23)	31/455 (7)	4/161 (2)	2/57 (4)
Chlamydia trachomatis	1/38 (3)	15/920 (2)	5/357 (1)	5/59 (8)
Herpes simplex virus	0/38	9/974 (1)	5/453 (1)	1/59 (2)
Cytomegalovirus	1/38 (3)	46/962 (5)	20/448 (4)	4/58 (7)

Note. Results of statistical analyses: For gonorrhea, $\chi^2 = 34.89$; $df = 3$; $P < .001$; street vs. bar/house prostitute, $\chi^2 = 15.47$; $P < .001$; bar prostitute vs. bar nonprostitute, $\chi^2 = 12.11$; $P < .001$. For syphilis serology, $\chi^2 = 21.00$; $df = 3$; $P < .001$; street vs. bar/house prostitute, $\chi^2 = 11.42$; $P < .001$; bar/house prostitute vs. nonprostitute, $\chi^2 = 4.68$; $P < .05$. For chlamydial infection, $\chi^2 = 14.68$; $df = 3$; $P < .01$; cabaret vs. bar nonprostitute, $\chi^2 = 10.80$; $P < .01$; cabaret vs. bar/house prostitute, $\chi^2 = 12.80$; $P < .001$.
* Denominators may vary because of incomplete testing.
† The rapid plasma reagin card test (Brewer Diagnostics) was used for syphilis serology.

TABLE 3. Relationship of Years of Experience as a Prostitute to Occupational Category of Women in Panama

Experience (years)	No. (%) in Category	
	House (n = 144)	Bar (n = 470)
<1	51 (35)	206 (44)
1	18 (13)	77 (16)
2	11 (8)	50 (11)
3	12 (8)	48 (10)
≥4	52 (36)	89 (19)

Note. $\chi^2 = 18.49$; $df = 4$; $P = .001$.

relation of signs or symptoms with isolation of STD agents, either overall or in subgroups.

Number of years of experience as a prostitute was also ascertained during the interview (table 3). However, more than half of the streetwalkers refused to cooperate in the interview, so data such as years of experience could not be reliably estimated. In the case of women interviewed more than once, the greatest number of reported years of experience was used. Most had less than one year's experience, and house prostitutes had significantly more years of professional experience than did bar prostitutes. We did not document the number of customers.

Rates of infection with *N. gonorrhoeae* diminished with increasing number of years of experience as a prostitute; 67 (13%) of 533 prostitutes with two or fewer years of experience had positive cultures, as compared with 18 (10%) of 180 with two to four years of experience and 18 (7%) of 243 with four or more years of experience (χ^2 for trend $= 4.76$; $df = 1$; $P = .029$). The frequencies of *C. trachomatis*, herpes simplex virus, and cytomegalovirus

infection were too low for analysis according to experience.

Overall, 186 (13%) of serum samples collected and tested had antimicrobial activity as detected by bioassay, and the frequencies varied significantly by occupation (table 4). House prostitutes were most likely (22%) to have antimicrobial activity in serum, but prevalence did not vary with experience. Antimicrobial activity in serum was associated with lower rates of isolation of *N. gonorrhoeae* in all occupations, except streetwalkers. We isolated *N. gonorrhoeae* from three (60%) of five streetwalkers with antimicrobial activity in serum, compared with nine (26%) of 34 streetwalkers whose sera lacked activity. Only one of the 160 *N. gonorrhoeae* isolates was resistant to penicillin; the isolate was also β-lactamase-positive and was from a prostitute. *C. trachomatis* was isolated significantly more often from subjects with no antimicrobial activity in serum (table 4), but the number of isolates was small and analysis by occupation was noncontributory.

Finally, although some subjects had *N. gonorrhoeae* isolated more than once, there was no indication that chronic infection was particularly common. Some subjects had multiple agents isolated, but the numbers were too small for meaningful analysis.

Contraceptive usage varied by occupation (table 5). More than 60% of study participants used some form of birth control; however, only 40% of streetwalkers admitted to practicing birth control. Oral contraceptives were used by most house prostitutes, bar prostitutes, and cabaret entertainers. Surgical sterilization was unusually common among nonprostitute bar girls. Intrauterine devices were used by <8% of the total group, and barrier methods were used by <4%. We did not detect meaningful differences

TABLE 4. Antimicrobial Activity in Serum, Occupation, and Isolation: Social Hygiene Clinic

Occupation	Antimicrobial Activity*		*Neisseria gonorrhoeae* Antimicrobial Activity†				*Chlamydia trachomatis* Antimicrobial Activity†			
			Yes		No		Yes		No	
Prostitute										
Streetwalker	5/39	(13)	3/5	(60)	9/34	(26)	0/4		1/33	(3)
House	71/322	(22)	6/139	(4)	91/784	(12)	3/135	(2)	11/747	(1)
Bar	69/606	(11)	6/139	(4)	91/784	(12)	3/135	(2)	11/747	(1)
Nonprostitute										
Bar	39/415	(9)	1/39	(30)	17/360	(5)	0/36		5/303	(2)
Cabaret	2/58	(3)	0/2		2/56	(4)	0/2		5/56	(0)
Total	186/1440 (13)		10/185 (5)		119/1234 (10)		3/117 (0.2)		22/1139 (2)	

Note. Results of statistical analysis: *N. gonorrhoeae* isolation according to antimicrobial activity, $\chi^2 = 3.0$; $df = 1$; $P = .08$. *N. gonorrhoeae* isolation within the antimicrobial activity–positive population; overall, $\chi^2 = 30.2$; $df = 3$; $P < .001$; streetwalkers vs. all others, $\chi^2 = 20.5$; $df = 1$; $P < .001$.
* Antimicrobial activity results are expressed as number positive/number tested (percentage positive); denominators may vary because of incomplete testing.
† *N. gonorrhoeae* and *C. trachomatis* antimicrobial activity (yes or no) results are expressed as number positive/number tested (percentage positive) for the specific agent within those women with and without serum antimicrobial activity (presumably due to antibiotic ingestion).

in rates of isolation of *N. gonorrhoeae* or *C. trachomatis* according to contraceptive method.

Discussion

We designed this study in order to describe the epidemiology of STD in a defined population of high-risk women. This high-risk group included prostitutes, who may play an important role in transmission of STD within the general population. In many countries prostitution is illegal, and this illegal status impedes collection of epidemiologic data and complicates strategies for STD intervention. Panama and many other countries have chosen to institute legislation regulating prostitution. In Panama these regulations are coordinated by the General Director of Health, Ministry of Health. The population attending social hygiene clinics is defined on the basis of employment in specific businesses, and weekly screening is mandatory for these women. Full-time surveillance teams monitor compliance, and significant monetary fines are imposed on both women and businesses that do not comply. This type of surveillance can provide precise data that health authorities can use to plan and adjust public health programs and should result in lowering the rates of STD.

Between 3% and 5% of nonprostitutes whom we sampled had cultures positive for *N. gonorrhoeae;* this prevalence is comparable to that observed by family planning clinics and neighborhood health centers in the United States. Rates of gonorrhea in house prostitutes (10%) were similar to those recorded by STD clinics in the United States (18%).[13] Overall, rates of isolation of *N. gonorrhoeae* from prostitutes were very similar to those found in a 1969 study of high-risk women in the Philippines.[14] The inverse relation between isolation of *N. gonorrhoeae* and years of experience as a prostitute has been reported by other workers[14] and may reflect host immunity, intensity of sexual contact, or perhaps adoption of personal preventive measures.

The Ministry of Health in Panama publishes statistics concerning reported gonorrhea and syphilis, and their occurrence is similar to that in the United States. In 1978–1980, our study period, gonorrhea was the third-most-common reported transmissible disease in Panama (diarrhea and influenza were more common); the reported incidence in Panama City was 411 per 100,000, which is somewhat lower than rates of gonorrhea reported from cities of similar size in the United States (range, 300–3,000 per 100,000).[15]

In addition to data on gonorrhea and syphilis, the Ministry of Health compiles detailed statistics concerning all aspects of public health services received by the population. Although official statistics do not directly tabulate

TABLE 5. Current Contraceptive Usage (Percentage) by Occupation for Women Attending Social Hygiene Clinics in Panama City

	None	Pill	Surgery	Intra-uterine Device	Other
Prostitute					
Street	60	24	8	5	3
House	8	74	7	5	6
Bar	22	56	10	7	5
Nonprostitute					
Bar	39	36	16	8	1
Cabaret	31	51	7	8	3

disease due to *Chlamydia, Mycoplasma,* herpes simplex virus, and cytomegalovirus, such agents appear to be important. For example, perinatal pneumonia, conjunctivitis, septicemia or meningitis, and low birthweight complicated 0.2–1% of the 14,607 deliveries at the Panama City Social Security Hospital in 1979–1981, and 0.7% of parturient women from this hospital developed endometritis. The national incidence in Panama of invasive cervical cancer was 28 per 100,000 women per year in 1974–1979 (3); this is one of the highest rates known to occur, and cervical cancer has been correlated with sexual risk factors such as promiscuity and genital infection with herpes simplex virus type 2[16] or papilloma virus.[17]

We were surprised that only one isolate of *N. gonorrhoeae* was resistant to penicillin. At the time of this study penicillinase-producing strains of *N. gonorrhoeae* accounted for ~10% of isolates in the United States and Europe and up to 30% of those from the Far East; penicillinase-producing strains were particularly common in U. S. military personnel.[18,19] It should be noted that additional penicillinase-producing *N. gonorrhoeae* has been isolated in Panama subsequent to our study, but resistant strains still constitute a low proportion of all isolates.

Rates of chlamydial infection were also considerably lower than we had predicted; only 1.9% of the study population was infected. Rates varied from 8% in cabaret entertainers to 1% in bar girls. Studies of high-risk female populations in other countries have documented rates of chlamydia infection in excess of 20%,[20,21] while the rates we observed were similar to those in normal sexually active women.[22–24] It is likely that the low rates in this study reflect the fact that participants were healthy women who may have taken prophylactic antibiotics before attending a routine screening clinic.

Finally, we should comment on the low rates of isolation of cytomegalovirus and herpes simplex virus (5% and 1%, respectively). Several studies in the United States[25,26] have documented that cytomegalovirus can be isolated from the endocervix of ~5% of normal women, and similar studies have shown that only ~1% of asymp-

tomatic women have active endocervical infection with herpes simplex virus.[25,27,28] Other published studies have shown that ~ 30% of Panamanian women have antibody to herpes simplex virus type 2;[4,16] this prevalence of antibody represents a rather high cumulative infection rate.

References

1. Holmes KK, Mårdh P-A, eds. International perspectives on neglected sexually transmitted diseases. Washington: Hemisphere Publishing, 1983.
2. Pan American Health Organization. Health conditions in the Americas, 1977–1980. PAHO Scientific Publication no. 427, 1982; p 44–6.
3. Reeves WC, Brenes MM, DeBritton RC, Valoks PF, Joplin CF. Cervical cancer in the Republic of Panama. Am J Epidemiol 1984; 119:714–24.
4. Reeves WC, Brinton LA, Brenes MM, Quiroz E, Rawls WE, DeBritton RC. Case control study of cervical cancer in Herrera Province, Republic of Panama. Int J Cancer 1985; 36:55–60.
5. Skegg DC, Corwin PA, Paul C, Doll R. Importance of the male factor in cancer of the cervix. Lancet 1982; 2:581–3.
6. World Health Organization. *Neisseria gonorrhoeae* and gonococcal infections. WHO Tech Rep Ser 616, 1978.
7. O'Callaghan CH, Morris A, Kirby SM, Shingler AH. Novel method for detection of β-lactamases by using a chromogenic cephalosporin substrate. Antimicrob Agents Chemother 1972; 1:283–8.
8. Wentworth BB, Alexander ER. Isolation of *Chlamydia trachomatis* by use of 5-iodo-2-deoxyuridine–treated cells. Appl Microbiol 1974; 27:912–6.
9. Reeves WC, Corey L, Adams HG, Vontver LA, Holmes KK. Risk of recurrence after first episodes of genital herpes: Relation to HSV type and antibody response. N Engl J Med 1981; 305:315–9.
10. Neiman PE, Reeves WC, Ray G, et al. A prospective analysis of interstitial pneumonia and opportunistic viral infection among recipients of allogeneic bone marrow grafts. J Infect Dis 1977; 136:754–67.
11. Bennett JV, Brodie JL, Benner EJ, Kirby WMM. Simplified, accurate method for antibiotic assay of clinical specimens. Appl Microbiol 1966; 14:170–7.
12. Kronmal RA, Bender L, Mortensen J. A conversational statistical system for medical records. J R Stat Soc Series C 1970; 19:82–92.
13. Centers for Disease Control. Sexually transmitted disease (STD) statistical letter—calendar year 1979, issue no. 129. US Dept of Health and Human Services, CDC, Atlanta, GA.
14. Johnson DW, Holmes KK, Kvale PA, Halverson CW, Hirsch WP. An evaluation of gonorrhea case finding in the chronically infected female. Am J Epidemiol 1969; 90:438–48.
15. Centers for Disease Control. STD fact sheet, ed 35. U. S. Dept. of Health and Human Services. Publication no. (CDC) 81–8195.
16. Rawls WE, Lavery C, Marrett LD, et al. Comparison of risk factors for cervical cancer in different populations. Int J Cancer 1986; 37:537–46.
17. Prakash SS, Reeves WC, Sisson GR, et al. Herpes simplex type 2 and human papillomavirus type 16 in cervicitis, dysplasia and invasive cervical carcinoma. Int J Cancer 1985; 35:51–7.
18. Sparling PF, Holmes KK, Wiesner PJ, Puziss M. NIH Conference. Summary of the conference on the problem of penicillin-resistant gonococci. J Infect Dis 1977; 135:865–7.
19. Goh CL, Meija P, Sng EH, Rajan VS, Thirumoorthy T. Chemoprophylaxis and gonococcal infections in prostitutes. Int J Epidemiol 1984; 13:344–6.
20. Woolfitt JM, Watt L. Chlamydial infection of the urogenital tract in promiscuous and non-promiscuous women. Br J Vener Dis 1977; 53:93–5.
21. Oriel JD. Epidemiology of genital chlamydial infections. Infection 1982; 10(Suppl 1):S32–9.
22. McCormack WM, Rosner B, McComb DE, Evrard JR, Zinner SH. Infection with *Chlamydia trachomatis* in female college students. Am J Epidemiol 1985; 121:107–15.
23. Westrom L, Mårdh P-A. Genital chlamydial infections in the female. In: Mårdh P-A, Holmes KK, Oriel JD, Piot P, Schachter J, eds. Chlamydial infections. Amsterdam: Elsevier, 1982; pp 121–39.
24. Nsanze H, Waigwa SRN, Mirza N, Plummer F, Roelants P, Piot P. Chlamydial infections in selected populations in Kenya. In: Mårdh P-A, Holmes KK, Oriel JD, Piot P, Schachter J, eds. Chlamydial infections. Amsterdam: Elsevier, 1982:421–4.
25. Knox GE, Pass RF, Reynolds DW, Stagno S, Alford CA. Comparative prevalence of subclinical cytomegalovirus and herpes simplex virus infections in the genital and urinary tracts of low-income, urban women. J Infect Dis 1979; 140:419–22.
26. Stagno S, Whitley RJ. Herpesvirus infections of pregnancy. I. Cytomegalovirus and Epstein-Barr virus infections. N Engl J Med 1985; 313:1270–4.
27. Osborne NG, Grubin L, Pratson L. Vaginitis in sexually active women: Relationship to nine sexually transmitted organisms. Am J Obstet Gynecol 1982; 142:962–7.
28. Nahmias AJ, Dowdle WR, Naib ZM, Josey WE, McClune D, Domesci G. Genital infection with type 2 herpes virus hominis: A commonly occurring venereal disease. Br J Vener Dis 1969; 45:294–8.