

HIV and other sexually transmitted diseases among female prostitutes in Kinshasa

Nzilambi Nzila*, Marie Laga^{†‡}, Manoka Abib Thiam*, Kivuvu Mayimona*,
B. Edidi*, Eddy Van Dyck[†], Frieda Behets*[†], Susan Hassig*, Ann Nelson*[§],
K. Mokwa*, Rhoda L. Ashley^{††}, Peter Piot[†] and Robert W. Ryder*[‡]

In 1988, 1233 prostitutes from different geographic areas of Kinshasa participated in a cross-sectional survey on HIV infection and other sexually transmitted diseases (STDs). Despite relatively good knowledge about AIDS and STDs, the reported preventive behaviour was poor. Only 12% of the women reported regular use of condoms, while > 50% of the women reported regular use of antibiotics and 38% reported doing nothing specific to prevent STDs. Thirty-five per cent of the women were HIV-positive compared with 27% in a similar survey in Kinshasa in 1986. The prevalence of other STDs was very high, ranging from 5% for genital ulcer disease (GUD) to 23% for gonococcal infection. HIV-positive women were older than HIV-negative women (26.9 versus 25.4 years; $P < 0.001$), had a significantly lower level of reported condom use (9 versus 14%, $P = 0.009$), and reported more frequent use of antibiotics to prevent STDs (55 versus 42%, $P = < 0.001$). The prevalence of syphilis, gonorrhoea, chlamydial infection and trichomoniasis was not higher in HIV-positive women compared with HIV-negative women. However, HIV-positive women had a higher prevalence of GUD (9 versus 3%, $P < 0.001$), antibodies against *Haemophilus ducreyi* (82 versus 57%, $P < 0.001$), antibodies against herpes simplex virus type 2 (96 versus 76%, $P < 0.001$), condylomata accuminata (5 versus 1%, $P = 0.003$) and cytologic evidence of human papilloma virus on Papanicolaou cervical smear (11 versus 5%, $P = 0.006$). This study confirms the high incidence of HIV and other STDs among prostitutes in Africa. Taking into account the low frequency of effective preventive behaviour, these women are at high risk of acquiring and/or transmitting HIV. Targeted interventions aimed at increasing condom use and lowering STDs levels among this population are of the highest priority.

AIDS 1991, 5:715-721

Keywords: HIV, sexually transmitted diseases, prostitutes, prevalence, Africa.

Introduction

The prevalence rates of HIV infection among prostitutes vary geographically, with the highest rates occurring in Africa and in areas with a large number of HIV-infected intravenous drug users (IVDUs) [1]. There is emerging evidence that core groups of high frequency transmitters play a key role in perpetuating

the AIDS epidemic in parts of the world where heterosexual contact is the predominant mode of transmission [2,3].

Furthermore, heterosexual transmission of HIV may be enhanced in the presence of other sexually transmitted diseases (STDs) [4,5]. Thus, female prostitutes are at increased risk of acquiring and transmitting HIV

From the *Projet SIDA, Department of Public Health, Kinshasa, Zaire, the [†]Institute of Tropical Medicine, Antwerp, Belgium, the [‡]Centers for Disease Control, Atlanta, Georgia, the [§]Armed Forces Institute of Pathology, Washington, DC, and the ^{††}University of Washington, Seattle, Washington, USA.

Sponsorship: This study was supported in part by grants from the European Economic Community, Brussels, Belgium, the American Foundation for AIDS Research, Beverly Hills, and the Rockefeller Foundation, New York City, USA.

Requests for reprints to: Dr Marie Laga, Department of Microbiology, Institute of Tropical Medicine, Nationalestraat 155, 2000 Antwerpen, Belgium.

Date of receipt: 8 November 1990; revised: 28 February 1991.

infection, not only because they are highly sexually active, but also because they may have a high prevalence of other STDs which promote HIV transmission.

In a survey conducted in 1986 in Kinshasa, Zaire, 27% of female prostitutes were HIV-antibody-positive [6]. Prostitute contact among men may be high in this city as among 7000 male employees in two work sites, 28% admitted having had sex with a prostitute during the last year [7].

The objectives of the present study were: (1) to document the prevalence of major STDs among prostitutes in Kinshasa; (2) to compare the HIV seroprevalence rate among these prostitutes in 1988/1989 with the rate in 1986; (3) to describe attitudes and preventive behaviour towards these STDs; (4) to determine risk factors for HIV infection among this population.

Methods

Study population

There is no organized system of prostitute registration in Zaire. Prostitution is illegal but tolerated. Based on the method of recruiting clients, three types of prostitution can be distinguished in Kinshasa (the capital of Zaire): hotel-based prostitutes, home-based prostitutes and street-based prostitutes. 'Hotels' are in fact brothels, where rooms are rented out only for the purpose of having sex with the women who work there. Home-prostitutes receive their clients at their own homes. They live in well-defined, poor areas of the city and come from rural areas, seeking a better life in Kinshasa, but, as they fail, enter into prostitution instead. Street prostitutes attract clients by soliciting in town, near major commercial centres, on the main roads or in international hotels.

Data collection

In May 1988, Projet SIDA opened a Prostitute Health Centre in Kinshasa. During several meetings organized at the study site, prevention and control of AIDS and STDs were discussed with hotel and bar managers, local political chiefs and female prostitutes. Prostitutes from various areas of Kinshasa were visited at their work place by a team of social workers, who invited them to participate in the study. All women who considered themselves as prostitutes because they had multiple sexual partners in exchange for money or goods, were eligible to enrol in the study. Informed verbal consent was obtained from all women before any activity.

Information regarding identification, sexual activity, health seeking and preventive behaviour for STDs, history of STDs, and current status of illness, was collected by a nurse during a face-to-face interview. A clinical examination, including a pelvic examination,

was carried out by a physician. Participants were tested for the presence of syphilis, HIV infection, gonorrhoea, *Chlamydia trachomatis* infection, trichomoniasis, chancroid, and candidiasis. Seronotification, specific counselling, health education, and free condoms were provided at a follow-up visit 1 week later. Appropriate treatment was given for bacterial and protozoal STDs.

Laboratory procedures

At the study site, a direct microscopic examination of the vaginal smear was performed to detect *Trichomonas vaginalis*, *Candida albicans* and spermatozoa. When genital ulcers were present, dark-field microscopy was performed. Endocervical swabs were obtained for *Neisseria gonorrhoeae* cultures and chlamydia detection.

Isolation of *N. gonorrhoeae* was performed on modified Thayer-Martin medium in a candle extinction jar at 35°C for 24-48 h. Isolates were identified on typical colonial morphology, oxidase reaction and sugar utilization patterns. Penicillinase production was detected by the chromogenic cephalosporin method.

C. trachomatis was detected in cervical specimens by an enzyme immunoassay (EIA Chlamydiazyme Abbott, North Chicago, Illinois, USA). Endocervical and exocervical scrapings were stained according to the Papanicolaou (PAP) technique. To avoid interreader variability, all slides were screened for cytologic evidence of human papilloma virus by the same pathologist, who was blinded to the serostatus of the women.

When a genital ulcer was present, specimens were cultured for *H. ducreyi* on Mueller-Hinton agar, enriched with foetal calf serum, and for herpes simplex virus on Vero cells.

Syphilis serology included rapid plasma reagin (RPR marker) and treponemal pallidum hemagglutination tests (TPHA marker). Sera were also tested for HIV antibody by a commercially available EIA (Vironostika, Organon Tecknika, Boxtel, The Netherlands). All positive samples were tested twice by enzyme-linked immunosorbent assay (ELISA) and confirmed by Western blot analysis (Du Pont de Nemours, Wilmington, Delaware, USA). Sera reacting with at least one band representative of the core proteins and one band representative of the envelope glycoproteins were considered positive for HIV antibody.

Serum immunoglobulin (Ig) G antibodies to *H. ducreyi* were detected by using an ultrasonicated whole cell antigen in an EIA [8]. Herpes simplex virus type 2 specific antibodies were detected by a Western blot (immunoblot) technique [9].

Statistical analysis

Data were analysed by SPSS statistical package. Univariate analysis was performed using Yates' corrected χ^2 and Student's t-tests. Logistic regression was performed using BMDP statistical package.

Results

Table 1. Selected characteristics of the study population.

Characteristic	Category of prostitute		
	Hotel (n = 693)	Home (n = 448)	Street (n = 85)
Mean age (\pm s.d.)	24.8 (\pm 5.8)	28.4 (\pm 7.9)	21.2 (\pm 4.7)
Zairian nationality	96%	98%	92%
Never been to school	30%	47%	17%
Duration of prostitution (per month)	41.9 (\pm 46)	72.6	56.2 (\pm 108)
Number of clients (per week)	8.0 (\pm 7.9)	8.1 (\pm 8.5)	9.4 (\pm 8.7)
Prostitution only income	85%	85%	86%
Number of pregnancies	2.6 (\pm 2.1)	3.3 (\pm 2.7)	1.8 (\pm 1.5)
Contraception during last 5 years			
None	81%	77%	68%
Oral	11%	8%	13%
Injections	2%	4%	3%
Other			
Induced abortion during last 5 years	23%	24%	36%
Medical examination last year	36%	29%	31%
Measures to prevent STD			
None	29%	53%	26%
Condoms	11%	9%	31%
Oral medication	56%	33%	42%
Vaginal medication	31%	20%	52%
Ever heard about AIDS	99%	98%	100%
Knows sex is predominant route of transmission	75%	77%	89%
Perceives herself at high risk for AIDS	76%	78%	86%
Reported regular condom use	8%	6%	20%

STD, sexually transmitted diseases.

Description of the study population

During a 5-month period a total of 1233 women were enrolled in the study, including 693 hotel prostitutes (HP), 448 home prostitutes (HMP) and 85 street prostitutes (SP; Table 1). Home prostitutes were older (age 28.4 versus 24.8 years for HP, and 21.2 years for SP) and had been in prostitution for a longer time (72.6

versus 41.9 months for HP, and 56.2 months for SP), but had an equal mean number of sex partners per week. Prostitution was the only source of income for 85% of the women. Street prostitutes were better educated (17% had never been to school, compared with 30% of HP and 47% of HMP). Only 13% of the women had never been pregnant, with a mean number of pregnancies of 2.6 for HP, 3.3 for HMP, and 1.8 for SP. Contraception had been practised during the last 5 years by only 22% of the women. The most commonly used contraceptive was oral (11% among HP, 8% among HMP and 13% of SP), and traditional methods believed to be effective for preventing pregnancies, such as quinine tablets or traditional medicine. Twenty-four per cent of the women reported at least one induced abortion during the last 5 years; this was not significantly different in the three groups.

Attitudes and preventive behaviour towards AIDS and STDs

Most women reported taking some preventive measures against STDs, but only 11% of HP, 9% of HMP, and 31% of SP mentioned condom use as a way of preventing STDs (Table 1). Both oral and vaginal medication were used extremely frequently to prevent STDs (87% of HP, 53% of HMP, and 94% of SP). Eighty-nine per cent of oral medications were antibiotics, while vaginal medication varied from antimycotics, antibiotics and antiparasitic drugs to traditional medication.

Ninety-nine per cent of the women had heard about AIDS, but only 77% knew that sex was the predominant mode of transmission and, overall, 78% perceived themselves as high risk. Regular condom use with clients was reported in 8% of HP, 6% of HMP, and 20% of SP. The most commonly cited reasons for not using condoms included: (1) client's refusal; (2) ignorance about condoms (about usage and usefulness); (3) negative traditional beliefs (mostly that condom can get lost in the vagina); and (4) desire to become pregnant. Cost of condoms was cited as prohibitive by less than 3% of the women. Sixty-eight per cent of the women reported having a stable partner. Condom

Table 2. Prevalence of sexually transmitted diseases among three groups of prostitutes in Kinshasa.

	Total group	Hotel prostitutes (n = 693)	Home prostitutes (n = 448)	Street prostitutes (n = 85)	P value*
HIV	35%	36%	36%	24%	0.06
Syphilis	16%	14%	19%	11%	0.03
<i>Neisseria gonorrhoeae</i>	23%	29%	16%	13%	<0.001
<i>Chlamydia trachomatis</i>	13%	14%	12%	13%	0.6
<i>Trichomonas vaginalis</i>	22%	22%	21%	26%	0.6
<i>Candida albicans</i>	10%	8%	12%	16%	0.009
Genital ulcer disease	5%	8%	3%	1%	<0.001
Candylomata acuminata	3%	3%	1%	4%	0.08

*P value when comparing the rates in the three subgroups.

use with stable partners was reported by none of these women.

Prevalence of STDs

STDs were highly prevalent among the three groups of prostitutes (Table 2). Seventy-five per cent of the women presented with at least one STD. Overall, 35% of the women were HIV-positive. Sixteen per cent had serologic evidence of active syphilis (RPR+ and TPHA+), with the HMP having the highest rate (19%).

Twenty-four per cent of the women had a positive *N. gonorrhoeae* culture, including 64% penicillinase-producing strains, and 13% had a chlamydial infection. The prevalence of trichomoniasis was 22%, and of candidiasis 10%. At physical examination 5% of the women presented with a genital ulcer (8% of HP, 3% of HMP and 1% of SP) and 3% had genital condylomata accuminata. *H. ducreyi* was the most common identifiable cause of GUD (38% of cases), followed by herpes simplex virus (12% of cases).

Epidemiologic variables by HIV status

When comparing all HIV-positive women with all HIV-negative women, HIV positive women were older (mean age of 26.9 versus mean age of 25.4 years of HIV-negative women $P < 0.01$), but duration of prostitution and mean number of partners per week did not differ among the two groups (Table 3). The mean number of pregnancies was also similar in both groups (2.9 versus 2.7).

No specific sexual practice was reported more frequently by HIV-positive women. Introduction of pharmaceutical or indigenous products in the vagina, and contraceptive practices such as oral contraceptives or progesterone injections were not associated with HIV infection. Induced abortions were also equally common among both groups. However, regular use of oral medication to prevent and cure STDs was significantly more common among HIV-positive women (55 versus 42%, $P < 0.001$).

Regular condom use with clients was more commonly reported by HIV-negative women (9% in HIV-positive versus 14% in HIV-negative, $P = 0.009$).

Prevalence of STDs by HIV status

Table 4 shows the prevalence of both current STDs and serologic evidence of past and current STDs in HIV-positive and HIV-negative women. No difference was found regarding the prevalence of 'active syphilis' (defined as both RPR+ and TPHA+), old syphilis, gonococcal infection, chlamydial infection, trichomoniasis and candidiasis.

Conditions which were significantly more common among HIV-positive women included genital ulcer disease (GUD) (9 versus 3%, $P < 0.001$), antibody to *H.*

ducreyi (82 versus 57%, $P < 0.001$), antibodies to herpes simplex virus type 2 (96 versus 76%, $P < 0.001$) condylomata accuminata (5 versus 1%, $P = 0.003$), and cytologic evidence of human papilloma virus on PAP smear (11 versus 5%, $P = 0.006$).

Multivariate analysis of variables associated with HIV infections

After multivariate regression analysis, HIV seropositivity in prostitutes was independently associated with age group 26 to 30 years, regular use of oral medication, presence of genital ulcer, antibody to *H. ducreyi* and cytologic evidence of human papilloma virus on PAP smear (Table 5).

The following variables were included in the model, but were not significantly associated with HIV infection: all other age groups, duration of prostitution, mean number of partners per week, condom use, category of prostitute, oral contraceptive use, and all other STDs investigated.

Discussion

This study confirms the high prevalence of HIV infection among prostitutes in a large African city, but also illustrates the high burden of many other STDs among this population. Previous studies from Kenya [10,11] showed a high prevalence of gonococcal infections and GUD among high- middle- and lower-class prostitutes in Nairobi. In our study, women were asked to participate by the research team, regardless of present signs and symptoms, instead of being self-referred, as is the case in STD clinics or other health-care services. The prevalence rates thus found may therefore reflect representative prevalence rates for prostitutes in Kinshasa. Because both ulcerative and non-ulcerative STDs may enhance transmission of HIV [12,13], prostitutes who have a high prevalence of both HIV and other STDs may be at particularly high risk of acquiring and transmitting HIV.

Compared with a smaller study conducted in a similar fashion in Kinshasa in 1986 [6], which showed an HIV prevalence of 27% among 377 hotel prostitutes, the prevalence has risen to 37% in 1988 among this group. Although this is a significant increase, it is not comparable to the rapid increase from 30 to 90% in a well defined group of Nairobi prostitutes between 1985 and 1988 [2]. This seems rather paradoxical, since HIV infection may have been introduced earlier in Kinshasa than in Nairobi [14,15]. The reasons for these different dynamics of the HIV epidemic in these two populations are not clear. The prostitutes studied in Kinshasa appear to be a less stable population than the Nairobi group (there is a large turnover of recent recruits and women leaving the 'business'). Twenty-three per cent of our study population had been working as prostitutes for less than 1 year, in contrast to 10% in Nairobi.

Table 3. Comparison of selected epidemiologic variables in HIV-positive (HIV+) and HIV-negative (HIV-) women.

	HIV+ women (n = 432)	HIV- women (n = 791)	P value
Age (years)	26.9 (± 6.9)	25.4 (± 6.9)	< 0.001
Duration of prostitution (weeks)	52.2 (± 62)	53.1 (± 56)	
Mean no. of partners per week	7.9 (± 7.8)	8.3 (± 8.2)	
Transfusion (ever)	13%	12%	
Mean no. of pregnancies	2.9 (± 2.3)	2.7 (± 2.4)	0.08
Non-Zairian clients:			
Other Africans	39%	36%	0.05
Europeans	21%	20%	
Sex practices:			
Vaginal (always)	100%	99%	
Anal (ever)	13%	15%	
Oral (ever)	23%	26%	
During menses (always)	11%	11%	
Regular use of vaginal pharmaceutical products	28%	29%	
Indigenous leaves	27%	27%	
Regular use of oral medication for STD prevention	55%	42%	< 0.001
Contraception last 5 years			
Oral contraception	10%	8%	
Injections	3%	3%	
Induced abortions	22%	25%	
Regular condom use	9%	14%	0.009

STD, sexually transmitted diseases.

Table 4. Prevalence of current and past sexually transmitted diseases in HIV-positive (HIV+) and HIV-negative (HIV-) women.

	HIV+ (n = 434)	HIV- (n = 799)	P
Conditions not associated with HIV infection			
Active syphilis	16%	15%	
Positive TPHA	31%	27%	
Gonorrhoea	25%	22%	
Proportion of PPNG strains	64%	64%	
<i>C. trachomatis</i> infection	15%	12%	
Trichomoniasis	25%	20%	
Candidiasis	8%	11%	
Conditions associated with HIV infection			
Genital ulcer	9%	3%	< 0.001
<i>H. ducreyi</i> antibodies	82%	57	< 0.001
HSV-2 antibodies	76/79 (96%)	142/186 (76%)	< 0.001
Condylomata acuminata	5%	1%	< 0.003
HPV on PAP smear	25/228 (11%)	17/365 (5%)	< 0.006

TPHA, *Treponemal pallidum* hemagglutination; PPNG, penicillinase-producing *Neisseria gonorrhoeae*; HSV-2, herpes simplex virus type 2; HPV, human papilloma virus; PAP, Papanicolau test.

Other explanations for the geographical difference in HIV trends may be: (1) a lower mean number of part-

ners among Kinshasa prostitutes (mean number of partners per day was 2.0 in Kinshasa and 3.8 in Nairobi [11]; (2) a lower prevalence rate of HIV among clients in Kinshasa; (3) a lower prevalence of putative risk factors for HIV transmission such as the presence of other STDs especially GUD, and lack of circumcision in men. In Kinshasa over 95% of the men are circumcised (versus ± 75% in Kenya), and the prevalence of various STDs in the general population seems rather low, as suggested by a recent survey among pregnant women attending primary health-care centres [16]. The prevalence of GUD in prostitutes was also strikingly lower in Kinshasa (5%) than in Nairobi (28%) [11].

Table 5. Variables associated with HIV infection after stepwise logistic regression analysis.

Variable	Adjusted odds ratio	95% CI
Age group 26–30 years	2.22	1.14–4.32
Oral medication	2.14	1.37–3.32
Genital ulcer disease	2.32	1.05–5.13
<i>Hameophilus ducreyi</i> antibody	4.31	2.53–7.32
HPV on PAP smear	2.30	1.14–4.63

The following variables were included in the models but were not significantly associated with HIV infection: all other age groups, duration of prostitution, partners per week, condom use, category of prostitute, oral contraceptive use, and all other sexually transmitted diseases. HPV, human papilloma virus; PAP, Papanicolau test.

At the time of our study, few women used condoms regularly with their clients (< 15%), but those who reported condom use were less likely to be HIV-positive. Oral and vaginal medication (mainly antibiotics) to prevent (or cure) STDs were a very common practice. Antibiotics are freely available in drug stores and markets in Zaire and self-medication for the treatment of STDs is thought to be common. The indiscriminate use of antibiotics may have contributed to the high proportion of gonococcal strains resistant to penicillin and tetracycline isolated from these women [17]. The association of oral medication with HIV infection, which was also found in a previous survey in Kinshasa [6], may be interpreted as follows: (1) HIV-positive women have more health problems and therefore take more drugs; (2) HIV-positive women may have had a higher incidence of STDs before or after seroconversion, which led to more frequent use of antibiotics (although the women claimed they used the antibiotics to prevent STDs, the difference between ‘preventing’ and ‘treating’ is not always clear for women with a low level of education); (3) women who are taking antibiotics used condoms less frequently, and were therefore at higher risk of acquiring HIV. In this study, however, we did not find an inverse correlation between oral medication and condom use. A fourth explanation could be that frequent antibiotic use might in fact increase the

risk of HIV acquisition, by altering the vaginal flora and predisposing to *Candida vaginitis* or perhaps other STDs, but in this study group there was no association between oral medication and the prevalence of any STD. This study did not confirm the association between HIV infection and oral contraceptive use found previously in Nairobi [11], although the overall use of oral contraceptives may have been too low to detect such an association.

In this cross-sectional survey, the prevalence rates of certain STDs were significantly higher in HIV-positive than HIV-negative women. The higher frequency of antibodies against *H. ducreyi* and herpes simplex virus type 2 in HIV-positive women provides additional evidence that GUD is a risk factor for HIV acquisition, as previously shown [12,19]. The fact that genital ulcers were more commonly seen in HIV-positive women may be due to an increased susceptibility to genital ulcers among HIV-positive women, a higher recurrence rate of genital herpes, a longer duration of these ulcers and a less optimal response to treatment in this group. Preliminary data from an ongoing cohort study in the same population in Kinshasa showed a significantly increased incidence of genital ulcers among HIV-positive compared with HIV-negative women [20]. All this demonstrates the complexity in the relationship between genital ulcers and HIV infection, and shows that cross-sectional studies are inadequate to address this issue.

The higher prevalence of condylomata acuminata among HIV-positive women, as previously described by Quinn *et al.* [21], may be a consequence of decreased immunity leading to clinical manifestations of otherwise subclinical infection with human papilloma virus, or a higher susceptibility to HIV in women with genital warts.

The association of cytologic evidence of human papilloma virus with HIV infection is less clear. It certainly needs further study to determine whether impaired immunity due to HIV infection aggravates the natural history of human papilloma virus infection and the consequent risk of cervical cancer.

In conclusion, the burden of HIV and other STDs is very high among Kinshasa prostitutes. Taking into account the low frequency of effective preventive behaviour, these women are at very high risk of acquiring and/or transmitting HIV. Targeted interventions aiming at increasing condom use and lowering levels of other STDs among this population are therefore of highest priority. This study also shows how complex the relationship between STDs and HIV is, and that a cross-sectional survey cannot adequately address this issue. To what extent STDs are risk factors for HIV transmission, markers of high-risk behaviour or markers for HIV-related impaired immunity is currently being addressed in an ongoing prospective study among the same population in Kinshasa [13].

Acknowledgements

We wish to thank the staff of the Matonge Prostitute Centre, the 'Service d'Hygiene de Kinshasa' and the staff of the Department of Microbiology of the Institute of Tropical Medicine, Antwerp for their hard work and support; Dr W. Heyward, Dr H. Gayle and Dr T. Quinn for their assistance; and Yvette Baeten and Karin Janssens for their typing assistance.

References

- PIOT P, LAGA M: Prostitutes: a high-risk group for HIV infection? *Soc Prev Med* 1988, 33:336-339.
- PIOT P, PLUMMER FA, REY MA, *ET AL*: Retrospective sero-epidemiology of AIDS virus infection in Nairobi populations. *J Infect Dis* 1987, 155:1108-1112.
- PADIAN N: Prostitute women and AIDS: epidemiology. *AIDS* 1988, 2:413-419.
- KREISS J, CARAEL M, MEHEUS A: Role of sexually transmitted diseases in transmitting human immunodeficiency virus. *Genitourin Med* 1988, 64:1-2.
- HOLMBERG SD, HORSBURGH C, WARD JW, JAFFE HW: Biologic factors in the sexual transmission of human immunodeficiency virus. *J Infect Dis* 1989, 160:116-125.
- MANN JM, NZILA N, PIOT P, *ET AL*: HIV infection and associated risk factors in female prostitutes in Kinshasa, Zaire. *AIDS* 1988, 2:249-254.
- RYDER RW, NDILU M, HASSIG SE, *ET AL*: Heterosexual transmission of HIV-1 among employees and their spouses at two large businesses in Zaire. *AIDS* 1990, 4:725-732.
- MUSEYI K, VAN DYCK E, VERVOORT T, TAYLOR D, HOGE C, PIOT P: Use of an enzyme immunoassay to detect serum IgG antibodies to *Haemophilus ducreyi*. *J Infect Dis* 1988, 157:1039-1043.
- ASHLEY RL, MULTONI J, LU FRANCIS, NAHMIA A, COREY L: Comparison of Western blot (immunoblot) and glycoprotein G-specific immunodot enzyme assay for detecting antibodies to herpes simplex types 1 and 2 in human sera. *J Clin Microbiol* 1988, 26:662-667.
- D'COSTA LJ, PLUMMER FA, BOWMER I, *ET AL*: Prostitutes are a major reservoir of sexually transmitted diseases in Nairobi, Kenya. *Sex Transm Dis* 1985, 12:64-67.
- SIMONSEN JN, PLUMMER FA, NGUGI EN, *ET AL*: HIV infection among lower socioeconomic strata prostitutes in Nairobi. *AIDS* 1990, 4:139-144.
- CAMERON DW, SIMONSEN JN, D'COSTA LJ, *ET AL*: Female-to-male transmission of human immunodeficiency virus type 1: risk factors for seroconversion in men. *Lancet* 1989, ii:403-407.
- LAGA M, NZILA N, MANOKA AT, *ET AL*: Non-ulcerative sexually transmitted diseases (STDs) as risk factors for HIV infection. *VI International Conference on AIDS*. San Francisco, June 1990 [abstract ThC97].
- BRUN-VÉZINET F, ROUZIQUX C, MONTAGNIER L, *ET AL*: Prevalence of antibodies to lymphadenopathy-associated retrovirus in African patients with AIDS. *Science* 1984, 226:453-456.
- PIOT P, LAGA M, RYDER R, *ET AL*: The global epidemiology of HIV infection: continuity, heterogeneity and change. *J Acquir Immuno Defic Syndr* 1990, 3:403-412.
- LUYEYE M, GERNIERS M, LEBUGHE N, *ET AL*: Prevalence et facteurs de risque pour les MST chez les femmes enceintes dans les soins de santé primaires à Kinshasa. *V International Conference on AIDS in Africa*. Kinshasa, October 1990 [abstract TPC8].
- VAN DYCK E, ROSSAN R, DUHAMEL M, *ET AL*: Antimicrobial susceptibility of *Neisseria gonorrhoeae* in Zaire: high level plasmid-mediated tetracycline resistance in Central Africa. *enitourin Med* (in press).
- SIMONSEN JN, CAMERON BW, GAKINYA M, *ET AL*: Human immunodeficiency virus infection among men with sexually transmitted diseases. Experience from a center in Africa. *N Engl J Med* 1988, 319:275-278.

19. STAMM WE, HANDSFIELD H, ROMPALO AM, ASHLEY RL, ROBERT PL, COREY L: The association between genital ulcer disease and acquisition of HIV infection in homosexual men. *JAMA* 1988, 260:1429-1433.
20. MALELE B, KWUVU M, NZILA N, ET AL: Genital ulcer disease (GUD) among HIV+ and HIV- prostitutes in Kinshasa: prevalence, incidence and etiology. *V International Conference on AIDS in Africa*. Kinshasa, October 1990 [abstract FOA4].
21. QUINN TC, GLASSER D, CANNON RO, ET AL: Human immunodeficiency virus infection among patients attending clinics for sexually transmitted diseases. *N Engl J Med* 1988, 318:197-203.