

## HTLV-I Infection Among Prostitutes and Pregnant Women in Kinshasa, Zaïre: How Important Is High-Risk Sexual Behavior?

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**Summary:** High-risk sexual behavior as risk factor for human T-cell lymphotropic virus type I (HTLV-I) infection was assessed in cross-sectional studies with 1,183 prostitutes and 1,166 pregnant women in Kinshasa, Zaïre. Eighty six (7.3%) prostitutes were positive for HTLV-I. The seroprevalence among prostitutes from the regions along the equator was 12.7%, whereas among prostitutes from the other regions it ranged between 0 and 4.3%. In the prostitutes from the high-prevalence regions, but not in the prostitutes from the low-prevalence regions, HTLV-I infection was associated with increasing age [odds ratio (OR) = 1.1 per year increment], active syphilis (OR = 2.3), and human immunodeficiency virus (HIV) infection (OR = 2.0). Forty three (3.7%) pregnant women were HTLV-I seropositive. Among the women from low-prevalence regions, there was no significant difference in HTLV-I seroprevalence between prostitutes (4.3%) and pregnant women (3.5%). In a group of 409 prostitutes who were observed for a mean duration of 23 months, the incidence of HTLV-I infection was 0.7 per 100 women-years, whereas the incidence of HIV infection was 9.8 per 100 women-years. We conclude that in Kinshasa prostitution per se was not associated with an increased risk of HTLV-I infection. **Key Words:** HTLV-I infection—Zaïre—Sexual transmission—Prostitutes—Pregnant women.

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Human T-cell lymphotropic virus type I (HTLV-I), the causative agent of adult T-cell leukemia/lymphoma (ATL) and of tropical spastic paraparesis (TSP), is highly endemic in Central Africa (1).

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Data were presented in part at the VIII International Conference on AIDS/III STD World Congress, 19-24 July 1992, Amsterdam, The Netherlands (Abstract no. PoC 4389).

Manuscript received July 22, 1994; accepted November 9, 1994.

Three routes of transmission of the infection have been identified, including mother-to-child transmission mainly via breast milk (2); parenteral transmission by blood transfusion and among intravenous drug users (3,4); and sexual transmission.

Evidence for the last transmission route has been provided by studies on sex partners of HTLV-I-positive persons (5). In addition, studies of prostitutes and attenders of clinics for sexually transmitted disease (STD) have found an association between HTLV-I infection and high-risk sexual behavior (6,7). Still it remains unclear to what extent

high-risk sexual behavior contributes to the spread of HTLV-I infection.

We report a study of HTLV-I infection in two groups of women in Kinshasa, including a group of prostitutes and a group of pregnant women. The main objective of the study was to explore the association between high-risk sexual behavior and HTLV-I infection. Secondly, the incidence of HTLV-I infection was estimated in a cohort of prostitutes.

## METHODS

### Study Populations

Between May 1988 and August 1988 a cross-sectional study was conducted among 1,183 female prostitutes in Kinshasa. A detailed description of the enrollment procedure is given elsewhere (8). All women who gave their informed consent, underwent a clinical examination, including laboratory testing for sexually transmitted diseases (STDs) and human immunodeficiency virus (HIV) infection. They were also interviewed on sexual activity and demographic and socioeconomic characteristics. Thirty-five percent of the women were HIV seropositive and 16% had serological evidence of active syphilis. Four hundred and thirty-one HIV-seronegative prostitutes who participated in this study were then observed at monthly intervals for 3 years, in order to assess the role of STDs in the transmission of HIV infection (9).

A second cross-sectional study, conducted between March 1990 and August 1990, assessed the prevalence of STDs and HIV infection among pregnant women in Kinshasa (10). A random sample was taken of women who attended antenatal clinic for the first time, and a total of 1,166 women were enrolled after they gave informed consent. All women were examined for STDs and HIV infection and were administered a questionnaire on demographic and socioeconomic variables. Data on the region of origin remained incomplete and the region of origin could be ascertained only for the women from Bandundu and Bas Zaire. The prevalence of HIV infection was 5%, whereas active syphilis was detected in 1% of the women.

Stored serum samples of both studies were tested for HTLV-I infection. For the prostitutes who were negative for HTLV-I and HIV at the beginning of the follow-up the serum sample of the last follow-up visit was retested for HTLV-I. For 409 prostitutes, at least one follow-up sample was of sufficient quantity to permit testing for HTLV-I infection. In calculating the incidence of HTLV-I infection, the number of seroconversions was taken as the numerator whereas the cumulative number of person-years of follow-up between the two tests was taken as the denominator.

### Laboratory Procedures

Testing for HTLV-I was done by enzyme-linked immunosorbent assay (ELISA; Cambridge Biotech, Worcester, MA, U.S.A.). Positive samples were confirmed by Western blot (Cambridge Biotech). A test was considered positive if antibodies to the *gag* (p19 and/or p24) and to the *env* (gp 46 and/or p21)

gene products were present. Sera without HTLV-I-specific bands were considered negative, sera with other profiles were considered indeterminate (11). Study subjects with indeterminate results were not included in the analyses.

Syphilis serology included RPR (rapid plasma reagin) and TPHA (*Treponema pallidum* hemagglutination). A combination of positive RPR and positive TPHA was considered as evidence of active syphilis infection. Screening for HIV infection was by ELISA (Vironostika, Organon Tecknika, Boxtel, The Netherlands). Positive samples were retested by ELISA and confirmed by Western blot analysis (Du Pont de Nemours, Wilmington, DE, U.S.A.).

## Data Analysis

The risk of sexual transmission of HTLV-I was explored in the prostitutes by comparing the HTLV-I-positive women with the HTLV-I-negative women on the following markers of high-risk sexual activity: number of years as prostitute, number of clients per day, condom use, active syphilis, and HIV infection. Age and region of origin being known risk factors for HTLV-I infection were treated as confounders. Length of residence in Kinshasa was also considered a potential confounding factor, as a longer stay in an area of high endemicity (out of Kinshasa) could be a risk factor for HTLV-I infection while at the same time being associated with number of years in prostitution (93% of women started prostitution after they moved to Kinshasa).

Further evidence for a role of high-risk sexual behavior in the transmission of HTLV-I was sought in a comparison of the HTLV-I seroprevalence in the prostitutes and the pregnant women. As data on region of origin were incomplete for the pregnant women, only pregnant women and prostitutes from Bandundu and Bas Zaire were compared with each other.

All analyses were done with use of the statistical package SPSS-PC. In the prostitutes, first associations between HTLV-I infection and the different risk factors were explored by univariate analysis. Thereafter, the different risk factors were assessed with logistic regression.

## RESULTS

### HTLV-I Infection in the Prostitutes

Of 1,183 prostitutes 86 (7.3%) were seropositive for HTLV-I and 20 (1.7%) had indeterminate test results. In univariate analysis increasing age, region of origin, shorter stay in Kinshasa ( $\leq 15$  years), and active syphilis were significantly associated with HTLV-I infection (see Table 1). There was no significant association with number of years in prostitution, number of clients per day, current condom use, and HIV-1 infection.

After allowing for age, prostitutes from Haut Zaire and Equateur, i.e., the regions along the equator (see Fig. 1), had a threefold probability of being HTLV-I positive compared with prostitutes from other regions. In the group of prostitutes from Haut Zaire and Equateur the HTLV-I seroprevalence

TABLE 1. Risk factors for human T-cell lymphotropic virus type I (HTLV-I) infection in prostitutes

Risk factor	HTLV-I seroprevalence	Odds ratio (95% CI)
Age (yr)		
≤20	7/289	2.4%
21-25	25/349	7.2%
26-30	16/259	6.2%
31-35	12/151	7.9%
>35	23/103	22.3%
		11.6 (4.5-30.9)
	p < 0.001	
	test for trend: p < 0.001	
Region		
Bandundu/Bas Zaire	17/396	4.3%
Haut Zaire/Equateur	62/489	12.7%
Kasai/Shaba	5/184	2.7%
Kivu	0/32	0%
		p < 0.001
No. of years living in Kinshasa		
≤15	50/488	10.2%
>15	34/663	5.1%
		0.5 (0.3-0.8)
		p < 0.001
Years as prostitute		
<1	13/194	6.7%
1-5	42/559	7.5%
5-10	19/265	7.2%
≥10	12/135	8.9%
		1.4 (0.6-3.3)
		p = 0.9
No. of clients per day		
<3	50/626	8.0%
≥3	36/535	6.7%
		0.8 (0.5-1.3)
		p = 0.04
Condom use		
Never	80/1,019	7.9%
Ever	5/132	3.8%
		0.5 (0.2-1.2)
		p = 0.13
Active syphilis		
No	58/977	5.9%
Yes	28/184	15.2%
		2.8 (1.7-4.7)
		p < 0.001
HIV infection		
No	49/758	6.5%
Yes	37/403	9.2%
		1.5 (0.9-2.3)
		p = 0.09

Totals do not add up to 1,163 and vary for different risk factors because of missing data. CI, confidence interval.

went up from 4.6% among the women younger than 20 years to 39.3% among the women older than 35 years ( $\chi^2$  test for trend:  $p = 0.0000$ ). In the group of prostitutes from the other regions, the seroprevalence went up from 1.3% in the women ≤20 years old to 6.1% in the women between 20 and 25 years, but decreased to 2.3% in the women >35 years of age ( $\chi^2$  test:  $p = 0.16$ ) (see Table 2). In order to facilitate computation and interpretation of odds ratios (ORs), prostitutes were subsequently classified as coming from high-prevalence regions (Haut Zaire and Equateur) or low-prevalence regions (Bandundu, Bas Zaire, Kasai, Shaba, and Kivu).

For each group of prostitutes the ORs for HTLV-I seropositivity associated with age, length of residence in Kinshasa, number of years in prostitution, number of clients per day, condom use, active syphilis, and HIV infection were then as-

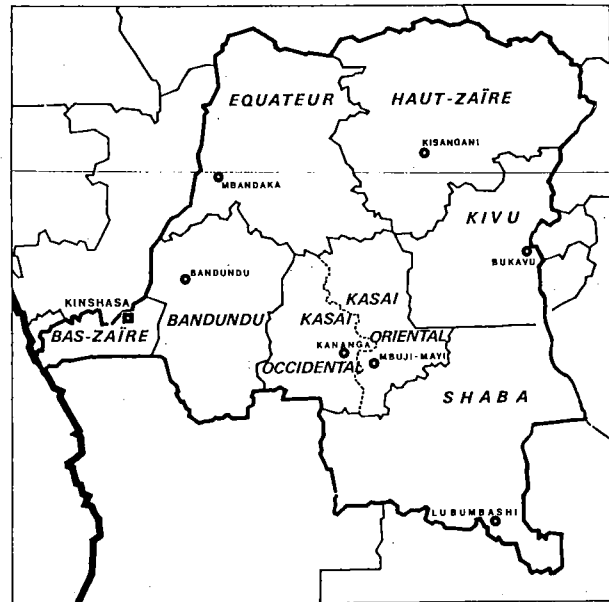


FIG. 1. Map of Zaire.

sessed in a logistic regression model (see Table 3). In the prostitutes from high-prevalence regions, HTLV-I infection was significantly associated with increasing age, active syphilis, and HIV infection. Increasing number of years in prostitution, number of clients per day, and condom use showed no association with HTLV-I infection. In the prostitutes from low-prevalence regions, none of the risk factors were significantly associated with HTLV-I infection. In multivariate analysis shorter stay in Kinshasa was not any more associated with increased risk of HTLV-I infection. In univariate analysis region of origin appeared to be confounding this association, as prostitutes from high-prevalence regions had stayed on average for a shorter time in Kinshasa than did prostitutes from low-prevalence regions.

TABLE 2. Human T-cell lymphotropic virus type I (HTLV-I) seroprevalence by age in the prostitutes from high-prevalence and low-prevalence regions

Age (yr)	High-prevalence regions	Low-prevalence regions
≤20	4.6% (5/109)	1.3% (2/157)
21-25	9.4% (13/139)	6.1% (12/197)
26-30	9.4% (11/117)	3.8% (5/131)
31-35	12.5% (6/60)	2.4% (2/83)
≥35	39.3% (22/56)	2.3% (1/43)
	test for trend: $p < 0.001$	test for trend: $p > 0.05$
Total population	11.8% (57/481) (95% CI: 8.9%-14.7%)	3.6% (22/611) (95% CI: 2.1-5.1%)

CI, confidence interval.

**TABLE 3.** Association between human T-cell lymphotropic virus type 1 (HTLV-I) infection and markers of high-risk sexual activity in prostitutes from high-prevalence and low-prevalence regions

Risk factor	Odds ratios (95% CI)	
	High-prevalence regions (n = 477)	Low-prevalence regions (n = 598)
Age (yr)	1.10 (1.06–1.15) <sup>a</sup>	0.99 (0.92–1.08) <sup>a</sup>
Years as prostitute		
<1	1.0	1.0
1–5	0.8 (0.3–2.0)	1.5 (0.4–5.5)
5–10	0.7 (0.2–1.8)	0.8 (0.1–4.1)
≥10	0.3 (0.1–0.99)	1.5 (0.2–10.3)
No. of clients per day		
<3	1.0	1.0
≥3	1.0 (0.5–1.8)	1.0 (0.4–2.4)
Condom use		
Never	1.0	1.0
Ever	0.7 (0.4–1.5)	1.2 (0.9–1.6)
Active syphilis		
No	1.0	1.0
Yes	2.3 (1.2–4.2)	0.4 (0.05–3.4)
HIV infection		
No	1.0	1.0
Yes	2.1 (1.1–3.7)	0.7 (0.2–1.9)
No. of years living in Kinshasa		
≤15	1.0	1.0
>15	0.7 (0.4–1.3)	0.9 (0.3–2.4)

Total numbers are not the same as in Tables 1 and 2 because of missing data. CI, confidence interval.

<sup>a</sup> Odds ratio per 1-year increment in age.

#### Comparison of the HTLV-I Seroprevalence in the Prostitutes and the Pregnant Women from Bandundu and Bas Zaire

Of 1,160 pregnant women 43 (3.7%) were positive for HTLV-I. The HTLV-I seroprevalence among the pregnant women from Bandundu and Bas Zaire was 3.5% (23/650). Among the pregnant women from the other regions, it was 3.9% (20/510).

There was no significant difference in HTLV-I seroprevalence between prostitutes and pregnant women from Bandundu and Bas Zaire, the rates being 4.3% and 3.5%, respectively. After adjusting for age, the OR for HTLV-I infection associated with being a prostitute was 1.2 (95% confidence interval = 0.6–2.4). In contrast, the HIV seroprevalence rates among the same prostitutes and pregnant women were 34.7 and 4.8%, respectively.

#### Incidence of HTLV-I Infection in Prostitutes

Four hundred and nine prostitutes who were HIV negative and HTLV-I negative at the baseline study were observed for a mean duration of 23 months, accumulating a total of 8,707 women-months of follow-up. Five women seroconverted for HTLV-I, giving an incidence of 0.7 per 100 women-years.

During the same period, the incidence of HIV infection was 9.8 per 100 women-years.

#### DISCUSSION

Our finding of a higher HTLV-I seroprevalence among prostitutes from the regions along the equator is in keeping with the findings of earlier studies. A study conducted in Kinshasa in 1985 reported a seroprevalence of 7.2% (7/97) in prostitutes originating from the Equateur region and 1.8% (5/280) in prostitutes from other regions (12). A survey conducted in five Central African countries in 1987–1989 found a prevalence of HTLV-I infection ranging from 0.5% in the Sahelian and Sudano-Sahelian regions to 10.9% in the tropical rain forest (1).

The increase in HTLV-I seroprevalence with increasing age, which we found among the prostitutes from high-prevalence regions, was similar to what has been found in prostitutes in the United States and in Peru, and in the general population in Gabon and Japan (1,13,14). Cumulative infection through sexual intercourse has been proposed as explanation for this age-specific seroprevalence in regions of endemicity. However, the steep increase in seroprevalence after the age of 35 years, i.e., after the most sexually active years, suggests that, besides sexual activity, other factors also play a role in transmission. Increasing susceptibility to infection with increasing age has been suggested as explanation for the age-related increase in HTLV-I seroprevalence in Japan (5). Alternatively, the increase in HTLV-I seroprevalence with age could be explained by delayed expression of antibodies. Polymerase chain reaction (PCR) studies however suggest that this is not the case (15), unless it can be assumed that during the latent phase of infection the virus remains present in lymph glands and other tissues, inaccessible to detection by PCR.

Several studies have been conducted on the association between high-risk sexual behavior and HTLV-I infection. In the Caribbean a strong association has been found between HTLV-I infection and STDs, especially syphilis (6,7). In the United States the incidence of HTLV-I infection is higher among prostitutes and STD clinic attenders than among voluntary blood donors, though it is mainly associated with intravenous drug use (3). Two more studies—one in Peru, the other one in Côte d'Ivoire—found prostitution to be a risk factor for HTLV-I infection (16,17). Moreover, in the United States and in Peru, an association has been found

between risk of HTLV-I infection and number of years in prostitution (16). We did not find an association between HTLV-I infection and increasing number of years in prostitution or number of clients per day. As for the other markers of high-risk sexual behavior, i.e., active syphilis and HIV infection, there was an association with HTLV-I infection but only in the women from high-prevalence regions. The most likely explanation for this difference between women from high- and low-prevalence regions is that the former women are more likely to be sexually exposed to HTLV-I infection because they have among their clientele more men from their region of origin, i.e., a high-prevalence region. Additional evidence for a relatively low risk of HTLV-I infection associated with high-risk sexual behavior is provided by the lack of difference in HTLV-I seroprevalence between prostitutes and pregnant women from Bandundu and Bas Zaire.

In conclusion, our study suggests that, though there is a risk of acquiring HTLV-I infection through sexual intercourse, in Kinshasa this risk is much smaller than for HIV infection and thus an epidemic of HTLV-I infection on the scale of the HIV epidemic is unlikely to occur.

**Acknowledgment:** This study was supported by the ANRS (Agence Nationale de Recherche sur le SIDA, France), the Rockefeller Foundation, the European Community (Programme on Science and Technology for Development, and the AIDS Task Force) and the National Fund for Scientific Research (NFWO, Belgium). We wish to thank the staff of the Matonge Prostitute Centre, the Service d'Hygiène and Projet Santé pour Tous, Kinshasa; as well as the staff of the laboratories of Projet SIDA, Kinshasa, and of the Department of Microbiology of the Institute of Tropical Medicine, Antwerp.

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