

HTLV-1 INFECTION IN A POPULATION-BASED COHORT OF OLDER PERSONS IN GUINEA-BISSAU, WEST AFRICA: RISK FACTORS AND IMPACT ON SURVIVAL

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In 1989, a population-based cohort of persons aged ≥ 50 years was established in an urban area of Guinea-Bissau, West Africa. Overall, 346 persons were interviewed in detail about risk behaviors and had capillary blood drawn. Among women, 12.4% were HTLV-1 seropositive, compared with 4.6% in men. No HTLV-2 was found. Seropositivity varied considerably according to place of birth and ethnic group. In women, but not in men, HTLV-1 seropositivity was strongly associated with early sexual debut (10–14 yrs, 33.3%; 15–17 yrs, 26.0%; 18–20 yrs, 6.5%; 21+ yrs, 0%; $p_{\text{trend}} = 0.001$), lifetime number of male partners ($p_{\text{trend}} = 0.006$), and the male partner's number of co-wives ($p_{\text{trend}} = 0.006$). There was also a 3.1-fold increased risk of being HTLV-1 seropositive if the woman was also HIV-2 seropositive. In a multivariate-risk-factor analysis, the strongest association with HTLV-1 was a history of having been bitten by a monkey ($n = 11$; combined $OR_{\text{adjusted}} = 10.1$; 95% CI 2.3–44.4). Ornamental scarification was associated with a 3.3-fold increased risk. Ethnic affiliation also significantly influenced the risk of being HTLV-1 seropositive. Follow-up performed in January 1996 revealed no difference in survival between HTLV-1-seropositive and -seronegative individuals over 6 years (rate ratio = 1.4, 95% CI 0.7–2.8). In conclusion, this population, which has very high HIV-2 seroprevalence, is also highly endemic for HTLV-1. Whereas sexual behaviors are clearly important for HTLV-1 spread in women, non-sexual risk factors were the only ones of potential importance in men. HTLV-1 had no impact on survival in this older population. *Int. J. Cancer* 76:293–298, 1998.

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Human T-lymphotropic-virus-type-1 (HTLV-1) infections occur worldwide, but are particularly prevalent in parts of Japan, in the Caribbean area, and in West Africa. Studies from Japan and the Caribbean show that between 1 and 5% of HTLV-1-infected subjects develop adult T-cell leukemia/lymphoma over a lifetime and approximately half as many will suffer from tropical spastic paraparesis/HTLV-1-associated myelopathy (TSP/HAM). Other and generally less severe HTLV-1-associated diseases of unknown incidence are infective dermatitis, polymyositis, uveitis, and arthritis (Blattner, 1994).

HTLV-1 appears to have been endemic in Africa for centuries, and its impact on the health of these populations is clearly minor compared with that of human immunodeficiency virus (HIV) (IARC, 1996). However, there are no population-based cohort studies from African countries evaluating the impact of HTLV-1 infection on overall survival. Moreover, our knowledge of micro-geographical clustering of HTLV-1 and its characteristics is based primarily on studies from Japan and the Caribbean area (IARC, 1996).

We took advantage of a community-based cohort in Guinea-Bissau, initially established to study risk factors for HIV-2, to examine the impact of HTLV-1 infection on overall survival and to investigate risk factors for HTLV-1. Of special interest was the association between HTLV-1 and HIV-2 infection which is endemic in this community (Poulsen *et al.*, 1989).

SUBJECTS AND METHODS

The community-based study was initiated in late 1989 in Bandim 2, an urban area of the capital of Guinea-Bissau. For many years the populations of Bandim 2 and neighboring areas have been followed closely as part of ongoing community studies of childhood mortality (Aaby *et al.*, 1990). All persons who would be 50 years or more at the beginning of the study in late 1989 were identified on the basis of census lists from 1986–1987. These persons were visited by a trained interviewer, who informed them about the study and invited them to participate. Simultaneously, information, including vital status, residency, and other particulars, was obtained on persons not available at the visit or who refused to participate. Those who agreed to participate were interviewed in detail regarding demographic characteristics and risk exposures. Finally, a sample of capillary blood was drawn on filter paper, air-dried at room temperature, and subsequently frozen at -20°C . Overall, 617 persons meeting the criteria were identified from the census lists; at the time of the house visit, 94 had moved, 62 had died, and 4 could not be reidentified, leaving 457 individuals for inclusion in the study.

A follow-up of the vital status of all participants in the study was conducted between November 1995 and January 1996. Information on persons no longer resident in the study area was provided by relatives or neighbors living in the houses that the study subject had previously occupied. Information was obtained on all subjects in the study. Data relative to those reported to have died were verified at a second visit, where information on time of death and symptoms at death were obtained from a relative or a neighbor.

Capillary blood was eluted from the filter paper in PBS, giving a final serum concentration of 1:20. The specimens were screened and typed for HTLV-1 or HTLV-2 antibody by indirect immunofluorescence, as described (Gallo *et al.*, 1991). Briefly, each specimen was reacted on HTLV-1 (MT2) and HTLV-2 (clone 19) antigen slides. Reactive samples were titrated on both antigens and the higher titer was indicative of the HTLV type.

Statistical analysis

The magnitude of association between a risk factor and HTLV status was estimated by the odds ratio (OR) and its accompanying 95% confidence interval (CI). Trend test was performed based on a Mantel-Haenszel Chi-squared in SAS procedure PROC FREQ. The presented OR have been adjusted for age and gender where

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nothing else is stated. In analyses including only one gender, adjustment has been made for age. Logistic regression methods were used to control for multiple factors in the cross-sectional analysis using the SAS procedure PROC PROBIT. Univariate variables that were significant at the 5% level or of borderline significance were included in these models. Survival analysis was performed by multivariate Cox-regression using the SAS procedure PROC PHREG (SAS Institute, 1992).

RESULTS

Study population

Of 457 persons eligible for the study, 370 (81%) agreed to participate. Among persons who did not participate, 42 (9%) were repeatedly absent due to work, 16 (4%) were traveling, 5 (1%) were sick, 16 (4%) refused to participate, while the remaining 8 gave no reason for not participating.

No blood was available for 18 persons, leaving 352 persons with samples for HTLV testing. Of these, 31 persons were HTLV-1-antibody-positive; none was positive for HTLV-2; 6 cases in which unspecific reactivity was found which was not specifically directed against HTLV-1 or HTLV-2 were excluded from further analysis.

Risk factors for HTLV-1

Association with demographic variables. Women were significantly more likely to be HTLV-1-seropositive than men (OR 2.9; 95% CI 1.2–6.9, Table I). Overall, 24 of 193 women (12.4%) and 7 of 153 men (4.6%) tested HTLV-1-seropositive. As illustrated in Figure 1 and Table I, the age-specific prevalence was largely stable for all age groups above 50 years of age, with no significant trends for either gender. We obtained similar results, in an analysis where the OR for the different age groups presented in Table I were adjusted for gender and for HIV-2 status.

All but 11 of the subjects (3.2%) were born in Guinea-Bissau. As shown in Table I, seropositivity varied by place of birth between 0 and 13.3%. None of those born in the region of Oio was seropositive. Most inhabitants in Oio belong to the Balanta ethnic group, which in the present study also had the lowest seropreva-

lence, 1/58 (1.7%) (Table I). Papels had a seroprevalence of 8.0 (12/150), Muslim groups 15.8%, and other groups 12.6%.

The majority had no school experience (229/346, 66.2%), 12.1% had 1 to 2 years' experience, and 21.7% had 3 or more years of schooling. Persons with 1 to 2 years' school experience were significantly more likely to be HTLV-1 seropositive than those without any school experience (OR 2.9; 95% CI 1.1–7.9) (Table I).

Association with HIV-2, sexual and other exposure variables. Among men, 14.4% (22/153) were HIV-2-seropositive but none of these was also HTLV-1-seropositive. In contrast, 24.3% of the HIV-2-seropositive women were HTLV-1-positive vs. 9.6% of HIV-2-seronegative women (OR 3.1; 95% CI 1.2–8.2) (Table II). There was no clear association between HTLV-1 and any of the sexual lifestyle variables studied in men (e.g., age at sexual debut, lifetime number of wives, history of prostitute visits). However, in women HTLV-1 seropositivity was strongly associated with young age at sexual debut, the risk association being above 7-fold for women with a debut age of 10- to 14 years as compared with the reference group of those with a debut age of 18 to 20 years (Table II). HTLV-1 seropositivity was also strongly associated with increasing lifetime number of male sexual partners. Half of the women who reported more than 3 lifetime partners (spouses) were HTLV-1-seropositive. For women there was also an association with increasing number of reported co-wives of the husband (Table II). In separate and combined analyses of men and women, neither genital ulcer (ever/never) nor history of gonorrhea (times ever) were significantly associated with HTLV-1 seropositivity.

Increasing number of hospitalizations tended to increase the risk of HTLV-1 among men but not women, whereas the combined increased risk of HTLV-1 with ever having received a blood transfusion (OR 1.9; 95% CI 0.5–7.4) was explained by an insignificantly increased risk of transfusions in women. Ornamental scarifications were associated with increased risk of HTLV-1 positivity in men (OR 10.1; 95% CI 0.7–144.8) and women (OR 2.0; 95% CI 0.8–5.1) and in a combined analysis this association was found to be of borderline significance (OR 2.3; 95% CI 0.9–5.6) (Table I).

Because of the similarity between human and simian retroviruses, and because of the possibility of species-to-species transmission, we also obtained detailed information on contacts with monkeys. In the present study of HTLV, 4 (36.4%) of 11 persons who reported ever being bitten by a monkey were HTLV-1-seropositive (OR 6.8; 95% CI 1.7–26.2), whereas there was no association with ever having prepared or eaten monkey meat (Table I). Among 6 women who reported being bitten by a monkey, 3 were found to be HTLV-1-seropositive (OR 7.7; 95% CI 1.4–42.2), while 1 of 5 men with a similar exposure history were HTLV-1-seropositive (OR = 6.4; 95% CI 0.5–74.4).

On the basis of our univariate results, we constructed 2 multivariate regression models. The first included men and women and the following variables from Table I: age, gender, ethnic background, educational level, whether bitten by a monkey, and ornamental scarifications.

Monkey bites (OR 10.1; 95% CI 2.3–44.4), ornamental scarifications (OR 3.3; 95% CI 1.2–8.7) and being Muslim (OR 5.1 1.2–22.6) were independently associated with a higher risk of HTLV-1. Women were also more likely to be HTLV-1-seropositive than men (OR 2.5; 95% CI 1.0–6.7). The other multivariate model was restricted to females and included all variables (except gender) from the first model, as well as HIV-2 status age at sexual debut (continuous), and number of lifetime sexual partners (continuous). For women, the following variables were associated with an independently increased risk of HTLV-1 seropositivity: having been bitten by a monkey (OR 15.4; 95% CI 1.6–144.4), high number of sexual partners (OR 2.1; 95% CI 1.0–4.2), early age at

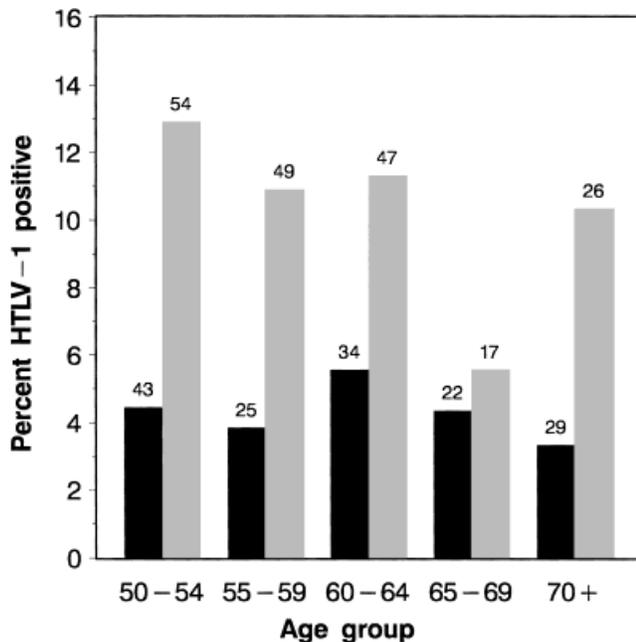


FIGURE 1—Population-based age- and gender-specific seroprevalence of HTLV-1 in persons above 50 years of age, Guinea-Bissau, West Africa. The number of persons in each age group is specified.

TABLE I – SELECTED RISK FACTORS FOR HTLV-1 POSITIVITY IN OLDER PERSONS. COMMUNITY-BASED STUDY IN GUINEA-BISSAU

| | HTLV-1 serostatus | | Crude OR (95% CI) | Adjusted OR ¹ (95% CI) |
|---------------------------|-------------------|--------------|-------------------|-----------------------------------|
| | Negative | Positive (%) | | |
| Age | | | | |
| 50–54 | 87 | 10 (10.3) | 1 | 1 |
| 55–59 | 67 | 7 (9.5) | 0.91 (0.33–2.51) | 0.82 (0.29–2.30) |
| 60–64 | 73 | 8 (9.9) | 0.95 (0.36–2.54) | 0.93 (0.35–2.51) |
| 65–69 | 37 | 2 (5.4) | 0.47 (0.10–2.25) | 0.52 (0.11–2.54) |
| 70+ | 51 | 4 (7.8) | 0.68 (0.20–2.28) | 0.74 (0.22–2.50) |
| Gender | | | | |
| M | 146 | 7 (4.6) | 1 | 1 |
| F | 169 | 24 (12.4) | 2.96 (1.24–7.07) | 2.89 (1.20–6.94) |
| Place of birth | | | | |
| Bissau region | 130 | 16 (11.0) | 1.29 (0.41–4.08) | 1.15 (0.36–3.72) |
| Oio | 56 | 0 (0.0) | — | — |
| Cacheu | 61 | 7 (10.3) | 1.20 (0.33–4.38) | 1.21 (0.33–4.50) |
| Bolama | 26 | 4 (13.3) | 1.62 (0.37–7.02) | 1.65 (0.37–7.40) |
| Other | 42 | 4 (8.7) | 1 | 1 |
| Ethnic group | | | | |
| Papel | 138 | 12 (8.0) | 1 | 1 |
| Balante | 57 | 1 (1.7) | 0.20 (0.03–1.59) | 0.22 (0.03–1.75) |
| Manjaco/Mancanha | 66 | 8 (10.8) | 1.39 (0.54–3.57) | 1.51 (0.58–3.95) |
| Muslim groups | 16 | 3 (15.8) | 2.16 (0.55–8.46) | 3.25 (0.78–13.61) |
| Other | 38 | 7 (15.6) | 2.12 (0.78–5.75) | 2.31 (0.83–6.43) |
| Educational level | | | | |
| 0 years | 208 | 21 (9.2) | 1 | 1 |
| 1–2 years | 35 | 7 (16.7) | 1.98 (0.78–5.01) | 2.92 (1.08–7.86) |
| 3+ years | 72 | 3 (4.0) | 0.41 (0.12–1.42) | 0.81 (0.20–3.22) |
| Gonorrhoea (times ever) | | | | |
| 0 | 246 | 27 (9.9) | 1 | 1 |
| 1 | 46 | 2 (4.2) | 0.40 (0.09–1.72) | 0.93 (0.17–4.90) |
| 2 | 12 | 1 (7.7) | 0.76 (0.10–6.67) | 1.93 (0.20–18.99) |
| 3+ | 11 | 1 (8.3) | 0.83 (0.10–6.67) | 1.81 (0.19–17.13) |
| Genital ulcer (ever) | | | | |
| No | 307 | 30 (8.9) | 1 | 1 |
| Yes | 8 | 1 (11.1) | 1.28 (0.16–10.57) | 0.98 (0.11–8.50) |
| Hospitalized (times) | | | | |
| 0 | 155 | 15 (8.8) | 1 | 1 |
| 1 | 94 | 9 (8.7) | 0.99 (0.42–2.35) | 1.18 (0.49–2.86) |
| 2 | 38 | 4 (9.5) | 1.09 (0.34–3.46) | 1.29 (0.39–4.23) |
| 3+ | 25 | 3 (10.7) | 1.24 (0.33–4.59) | 1.75 (0.45–6.83) |
| Blood transfusions (ever) | | | | |
| No | 300 | 28 (8.5) | 1 | 1 |
| Yes | 14 | 3 (17.7) | 2.30 (0.62–8.47) | 1.92 (0.50–7.37) |
| Ornamental scarifications | | | | |
| No | 275 | 22 (7.4) | 1 | 1 |
| Yes | 37 | 9 (19.6) | 3.04 (1.30–7.10) | 2.29 (0.94–5.56) |
| Bitten by a monkey | | | | |
| No | 308 | 27 (8.1) | 1 | 1 |
| Yes | 7 | 4 (36.4) | 6.52 (1.80–23.68) | 6.75 (1.74–26.20) |
| Eaten monkey | | | | |
| No | 118 | 11 (8.5) | 1 | 1 |
| Yes | 197 | 20 (9.2) | 1.09 (0.50–2.35) | 1.34 (0.60–3.00) |
| Prepared monkey meat | | | | |
| No | 240 | 23 (8.8) | 1 | 1 |
| Yes | 75 | 8 (9.6) | 1.11 (0.48–2.59) | 1.14 (0.48–2.71) |

¹Adjusted for age and gender, with the following exceptions: age was adjusted only for gender, and gender only for age.

sexual debut (OR 1.5; 95% CI 1.1–2.1), and HIV-2 seropositivity (OR 4.8; 95% CI 1.3–17.6).

Survival with HTLV-1

As illustrated in the Kaplan-Meier plot (Fig. 2), there was no difference in survival between HTLV-1-seropositive and HTLV-1-seronegative subjects. The same conclusion was drawn from a multivariate Cox-regression model which adjusted for age and gender (mortality rate ratio 1.5; 95% CI 0.7–3.0; $p = 0.27$). Because HTLV-1-seropositive women were at increased risk of being HIV-2-seropositive, and because HIV-2 seropositivity has been associated with slightly increased mortality (Poulsen *et al.*, 1997) we performed an additional model which included age,

gender and HIV-2 status. The results were unchanged (mortality rate ratio 1.4; 95% CI 0.68–2.81; $p = 0.38$).

DISCUSSION

In order to identify persons aged 50 years or above we used a census from 1986/87. At the time of the study, this information was already 4 to 5 years old, and it is therefore not surprising that approximately 10% of these oldest members of society had died. In addition, 15% of the subjects identified in the census had moved, possibly following the tradition at that age to move back to the villages from which the persons originally came and where in the

TABLE II – RISK FACTORS FOR HTLV-1 POSITIVITY IN GUINEAN WOMEN

| | HTLV-1 status | | Crude OR (95% CI) | Adjusted OR ¹ (95% CI) |
|--|---------------|--------------|---------------------------|-----------------------------------|
| | Negative | Positive (%) | | |
| HIV-2 status | | | | |
| Negative | 141 | 15 (9.6) | 1 | 1 |
| Positive | 28 | 9 (24.3) | 3.02 (1.20–7.59) | 3.09 (1.16–8.22) |
| Age at sexual debut (yrs) | | | | |
| 21+ | 13 | 0 (0.0) | — | — |
| 18–20 | 58 | 4 (6.5) | 1 | 1 |
| 15–17 | 37 | 13 (26.0) | 5.09 (1.54–16.82) | 5.56 (1.54–17.47) |
| 10–14 | 6 | 3 (33.3) | 7.25 (1.30–40.36) | 8.56 (1.45–50.51) |
| | | | (<i>p</i> trend = 0.001) | (<i>p</i> trend = 0.001) |
| Number of male partners (ever) | | | | |
| 1 | 51 | 5 (8.9) | 1 | 1 |
| 2 | 77 | 7 (8.3) | 0.93 (0.28–3.08) | 0.91 (0.27–3.05) |
| 3 | 36 | 7 (16.3) | 1.98 (0.58–6.75) | 1.93 (0.56–6.62) |
| 4+ | 5 | 5 (50.0) | 10.20 (2.18–49.71) | 10.42 (2.18–49.71) |
| | | | (<i>p</i> trend = 0.006) | (<i>p</i> trend = 0.006) |
| Male partner's number of co-wives (ever) | | | | |
| 0 | 14 | 0 (0.0) | — | — |
| 1 | 33 | 2 (5.7) | 1 | 1 |
| 2 | 90 | 12 (11.8) | 2.20 (0.47–10.36) | 2.24 (0.47–10.62) |
| 3 | 32 | 10 (23.8) | 5.16 (1.05–25.39) | 5.35 (1.07–26.74) |
| | | | (<i>p</i> trend = 0.006) | (<i>p</i> trend = 0.006) |

¹Adjusted for age.

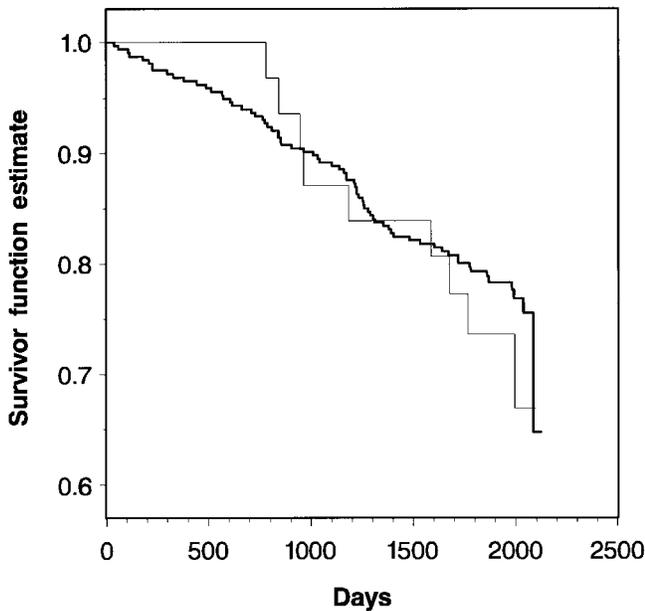


FIGURE 2 – Kaplan-Meier plot of the population-based survival by HTLV-1 status (thick line; seronegative; thin line; seropositive). Guinea-Bissau, West Africa, period 1989–1996.

meantime they had inherited land. On the basis of our long experience with demographic conditions in Guinea-Bissau, such figures are to be expected for this age group, so that there is no reason to suspect that the population eligible for study was not representative. Among eligible persons, only 6% did not participate for reasons that in theory could lead to selection bias, namely, 1% who were too sick to participate, 4% who refused without any reason, and 1% for whom no reason for non-participation was given. In view of these small numbers, we feel confident that selection bias had no significant influence on our results.

Our population-based study of persons above 50 years of age documented an overall seroprevalence of 4.6% among men and

12.4% among women, figures close to those obtained from the Caribbean area but lower than those reported from the southwestern islands of Japan (Murphy *et al.*, 1991; Kajiyama *et al.*, 1986). Because most studies from other areas of Africa have focused on younger age groups, our figures are not directly comparable with these studies. However, the prevalence figures observed in Guinea-Bissau are among the highest reported from the African continent (IARC, 1996). Africa is often considered to be the largest reservoir for HTLV-1 infection, but this assumption is primarily based on widespread low endemicity in many countries, whereas reports of large clusters with high HTLV-1 seroprevalence have been few (IARC, 1996). Microgeographical variation in seroprevalence rates is, however, not uncommon (Biggar *et al.*, 1993; Jeannel *et al.*, 1995), and has been ascribed to behavioral differences in the different populations. We note with interest that within our study population major differences in seroprevalence existed depending on place of birth and ethnic affiliation.

The observed seroprevalence in this older population did not change with advancing age, but remained almost 3-fold higher in females than in males. The significantly higher seroprevalence among older women has been observed in studies from Japan and the Caribbean (Murphy *et al.*, 1991; Kajiyama *et al.*, 1986). In reports from the Caribbean, and from Okinawa in Japan, the female predominance starts already in the 20- to 29-year age group, whereas in mainland Japan (Miyazaki) it is only in much older age groups that this predominance appears (Murphy *et al.*, 1991; Kajiyama *et al.*, 1986; Stuver *et al.*, 1993). Much interest has been devoted this female-to-male ratio in the Caribbean and Japan in particular, since prevalence figures continue to increase rapidly in older age groups and beyond those representing the most sexually active age groups. The absence of a continuous increase in seroprevalence with increasing age above 50 years in the Guinean population is different from the findings of these studies, and more in line with an expectation of a less promiscuous sexual lifestyle, in particular, fewer new partners, at older age.

We found compelling evidence that early age at sexual debut and a high number of lifetime sexual partners are risk factors for HTLV-1 seropositivity in older women, but not in older men. A possible explanation for this discrepancy could be that sexual transmission from males-to-females has been found to be more efficient than the reverse, most probably because transmission is

facilitated via HTLV-1-infected mononuclear cells in the semen (Stuver *et al.*, 1993; Nakashima *et al.*, 1995; Murphy *et al.*, 1989). It has been suggested that genital sores increase transmissibility (Murphy *et al.*, 1989). We did not find that a history of genital ulcers and other sexually transmitted diseases was associated with higher HTLV-1 seropositivity, but these events may have been under-reported.

Stuver *et al.* (1993) have documented a 12-fold higher rate of seroconversion in wives than in husbands in older HTLV-1-serodiscordant Japanese couples, and hypothesized that the higher prevalence in older women might be explained by the post-menopausal thinning of the vaginal epithelium and loss of barrier integrity. The menopause occurs at an earlier age in most developing countries, and among women in Guinea-Bissau it is considered to occur in the mid-40s. A study that examined risk factors for HIV-2 transmission from the same area of Guinea-Bissau found a particularly high incidence of HIV-2 in women above the age of 44 years (Poulsen *et al.*, 1997).

An explanation sometimes advanced is that these women are sexually exposed to older men, who have more viremia and hence are more infectious with age. Whereas there appears to be a documented association between viral load and risk of HTLV-1 transmission (Kaplan *et al.*, 1996) there is no obvious reason why this hypothetical progressive increase in infectiousness among men, which would put older married women at ever-increasing risk, should terminate at age 50. However, sexual activity may be decreased in these older age groups, reducing exposure.

Another variable associated with HTLV-1 positivity was a monkey bite. Several experiments have demonstrated that HTLV-1 can be transmitted to and infect several species of monkeys by i.v. or i.p. inoculation of autologous or heterologous HTLV-1-transformed cell lines (IARC, 1996). Moreover, phylogenetic analyses indicate that the simian T-cell lymphoma/leukemia virus type 1 (STLV-1) is 3.5 to 7% divergent from the prototype-related HTLV-1, but also that cross-species transmission of HTLV-1 and STLV-1 continued to occur long after their ancestral strain separated (Saksena *et al.*, 1994). In Guinea-Bissau, primate-man interactions are fairly close, since monkeys are frequently kept as pets and also used as a source of meat. The association with monkey bite was seen both in men and in women and remained strong in the multivariate analysis. Although this finding is curious, we cannot rule out that it may be linked to another, unmeasured, confounding variable or to misclassification of co-variables; or it

may be due to chance. Although cross-species infections are possible, most areas in which HTLV-1 is endemic have no exposure to monkeys.

Blood exposure and ornamental scarification both suggest transmission percutaneously, a route established by other studies (Blattner, 1994; Manns *et al.*, 1992). However, only a minority of HTLV-1-positive persons had such exposure, which is why other types of exposure must play a more important role.

HTLV-2 is a closely related retrovirus and has little or no pathogenicity. If HTLV-2 were endemic in a West African population, prevalence would most likely be highest among the oldest persons. This study is the largest survey for HTLV viruses done on older Africans, but none of our subjects was infected with HTLV-2.

Survival

Since the discovery of HTLV-1 in 1978, the list of associated diseases has been steadily growing. Many of the associated diseases may not necessarily be life-threatening (Blattner, 1994). The diversity of the spectrum of diseases has led to the suggestion that chronic HTLV-1 infection may alter general morbidity in carriers through increasing immune dysfunction (Stuver *et al.*, 1996). Because the more severe manifestations appear after decades of infection and primarily after the age of 50 years, we studied the impact of HTLV-1 infection on overall survival. There appears to be no available population-based data on overall survival of HTLV-1 in an African population, and very few elsewhere (IARC, 1996). In the present study, we found no indication that HTLV-1 had an adverse effect on survival. However, the limited number of HTLV-1-positive study subjects available for follow-up should be considered when interpreting the result. On the other hand, we note that the completeness of our follow-up was high and that the confidence intervals accompanying the survival estimate were narrow. Whereas this result in itself may be reassuring, the population of Guinea-Bissau has a very high seroprevalence of HIV-2 and is facing a growing HIV-1 epidemic. There have been suggestions that these infections, concomitant with HTLV-1 infection, may accelerate AIDS or lead to more profound immunological alterations (Bartholomew *et al.*, 1987; Page *et al.*, 1990; Pepin *et al.*, 1991). However, the question is still controversial (Hershow *et al.*, 1996) and more studies will be needed to adequately address this particular question on viral interactions.

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