

High prevalence of HIV infection among rural tea plantation residents in Kericho, Kenya

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SUMMARY

Human immunodeficiency virus type 1 (HIV-1) epidemiology among residents of a rural agricultural plantation in Kericho, Kenya was studied. HIV-1 prevalence was 14·3%, and was higher among women (19·1%) than men (11·3%). Risk factors associated with HIV-1 for men were age (≥ 25 years), marital history (one or more marriages), age difference from current spouse (≥ 5 years), Luo ethnicity, sexually transmitted infection (STI) symptoms in the past 6 months, circumcision (protective), and sexual activity (≥ 7 years). Among women, risk factors associated with HIV-1 were age (25–29 years, ≥ 35 years), marital history (one or more marriages), age difference from current spouse (≥ 10 years), Luo ethnicity, STI symptoms in the past 6 months, and a STI history in the past 5 years. Most participants (96%) expressed a willingness to participate in a future HIV vaccine study. These findings will facilitate targeted intervention and prevention measures for HIV-1 infection in Kericho.

INTRODUCTION

By the end of 2006, nearly 40 million people were living with HIV/AIDS worldwide and 25 million had died since HIV infection was first recognized [1]. Sub-Saharan Africa has been disproportionately affected by this pandemic. In the 42 countries comprising this

region, more than 25 million people (63% of the global total) were living with HIV [2]. The pandemic concentrated in women and the socially and economically productive groups aged 15–45 years [2].

It has long been recognized that HIV/AIDS prevention is instrumental to controlling the global epidemic. Prevention programmes may include: HIV/AIDS education programmes, abstinence promotion, condom promotion, blood bank screening, access to sterile injecting paraphernalia, voluntary testing and counselling, access to antiretroviral drugs and use of microbicides [3].

In Uganda and Kenya, HIV-1 prevalence declined primarily through prevention programmes implementing changes in sexual behaviour, such as

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increased condom use, reduction in the number of sexual partners, and delayed sexual debut [4–6]. In Kenya, the prevalence of HIV-1 infection appears to have declined throughout the 1990s [6]. The nationwide Kenyan Demographic and Health Survey (KDHS) conducted in 2003 reported over 6·7% of the Kenyan adult population (15–49 years) was infected with HIV-1, with an increase in differences between urban areas (10%) and rural areas (5·6%) [7].

The aim of this study was to determine the prevalence of and risk factors for HIV-1 infection among rural plantation residents in Kericho, Kenya to assist in both prevention programmes and the development of a site for HIV-1 vaccine research.

METHODS

The study site is located on a tea plantation neighbouring Kericho, Kenya, ~260 km northwest of Nairobi [8]. Over 50 000 residents live in 29 housing clusters (estates) over the 104 km² plantation. Residents of six estates were invited to participate in the study during community meetings where information on HIV/AIDS and the research objectives were presented. The six estates are located within a few kilometres of each other and were selected based on their proximity to the Walter Reed Project (WRP) office and to Kericho town.

Participants were recruited from June to December 2003. Inclusion criteria for both men and women were: age between 18 and 55 years, the capability of providing informed consent, and plans to live in the community for at least 3 years. All study activities were conducted in mobile tents. Volunteers were informed of study goals and procedures, including the confidentiality of HIV test results and were administered a 10-question comprehension test, for which a passing score was a requirement for enrolment. After written informed consent was obtained, participants underwent phlebotomy, medical history/physical examination, and a risk assessment interview. A standardized questionnaire developed with Kenyan staff was administered in face-to-face confidential interviews by trained personnel in either English or Kiswahili. Socio-demographic and epidemiological data were collected. Participants were asked to return in 2 weeks to receive HIV results and post-test counselling.

Medical study staff performed medical histories and physical examinations. All Kericho residents and

their dependant children were eligible to receive free medical examinations, treatment, and HIV counselling regardless of their participation in the study. Treatment algorithms were followed according to the National Standards of Care (Kenya Ministry of Health) [9]. Pregnant HIV-1-infected women were offered nevirapine to prevent transmission of HIV-1 to their infant.

All serum samples were initially processed in the on-site laboratory tent. Then, at the WRP laboratory in Kericho, serum specimens were tested for HIV-1 antibodies by screening ELISA and confirmatory Western blot assay.

χ^2 or Fisher's exact test was applied to compare differences in proportions. To evaluate the association of risk factors for HIV-1, odds ratios (OR) were estimated using random-effects logistic regression [10], where estate was defined as the group variable. Potential confounding was evaluated for age, ethnic group, educational level, marital history, and by selecting variables that resulted in a change of $\geq 10\%$ in the odds ratio. All statistical analyses were two-sided and a *P* value $< 0\cdot05$ was considered significant. Statistical analyses were performed using STATA version 8.0 (Stata Corporation, College Station, TX, USA).

RESULTS

Characteristics of study participants

A total of 2801 participants were enrolled. Sixty-one percent (1720) of participants were men and 53% of participants were aged < 30 years (Table 1). More than 95% had completed at least a primary education. Nineteen percent of men and 7% of women had been married two or more times. Men were more likely to be employed compared to women (85% vs. 51%). Participants reported affiliation with more than 25 different ethnic groups (tribes). The most common tribes were Kalenjin, Kisii, Luo, and Luhya. Between the six estates, variability was observed in the proportion of female participants (28–53%), participants aged < 30 years (47–66%), and participants who had never been married (16–28%).

HIV-1 prevalence

At enrolment, 401 participants were HIV-1 positive. The overall HIV-1 prevalence was 14·3% (95% CI 13·0–15·7) and was significantly higher among women than men (19·1% vs. 11·3%, *P* $< 0\cdot001$). Between the

Table 1. Demographic characteristics of 2801 participants from Kericho, Kenya

| Feature | No. of participants enrolled | | Men | | Women | |
|---------------------------|------------------------------|-------|-------------------|-------|-------------------|-------|
| | <i>N</i> | % | No. | % | No. | % |
| All participants | 2801 | 100.0 | 1720 | 100.0 | 1081 | 100.0 |
| Age group (years) | | | | | | |
| 18–24 | 776 | 27.7 | 418 | 24.3 | 358 | 33.1* |
| 25–29 | 708 | 25.3 | 436 | 25.3 | 272 | 25.2 |
| 30–34 | 514 | 18.3 | 321 | 18.7 | 193 | 17.8 |
| ≥35 | 803 | 28.7 | 545 | 31.7 | 258 | 23.9 |
| Mean (s.d., range) | 30.5 (8.5, 18–57) | | 31.3 (8.8, 18–57) | | 29.1 (8.0, 18–54) | |
| Level of education | | | | | | |
| None | 88 | 3.2 | 34 | 2.0 | 54 | 5.1* |
| Primary | 1513 | 54.7 | 859 | 50.6 | 654 | 61.4 |
| ≥High school | 1164 | 42.1 | 806 | 47.4 | 358 | 33.5 |
| Marital history | | | | | | |
| Never married | 563 | 20.0 | 386 | 22.5 | 174 | 16.1* |
| Once married | 1829 | 65.4 | 1002 | 58.4 | 827 | 76.6 |
| Two or more times married | 407 | 14.6 | 328 | 19.1 | 79 | 7.3 |
| Currently employed | | | | | | |
| Yes | 2012 | 71.8 | 1463 | 85.1 | 549 | 50.8* |
| No | 789 | 28.2 | 257 | 14.9 | 532 | 49.2 |
| Ethnic group (tribe) | | | | | | |
| Kalenjin | 775 | 27.7 | 528 | 30.7 | 247 | 22.8* |
| Kisii | 669 | 23.9 | 421 | 24.5 | 248 | 22.9 |
| Luhya | 501 | 17.9 | 274 | 15.9 | 227 | 21.1 |
| Luo | 611 | 21.7 | 355 | 20.6 | 256 | 23.7 |
| Other | 245 | 8.8 | 142 | 8.3 | 103 | 9.5 |

s.d., Standard deviation.

Denominator totals vary due to missing data.

* $P < 0.05$ by χ^2 or Fisher's exact test.

six estates, the HIV-1 prevalence ranged from 9.6% to 19.9%.

Gender-stratified HIV-1 prevalence estimates are presented in Table 2. Among men, HIV-1 prevalence significantly increased with age (2.9–17.1%) and was higher among those who were aged ≥30 years, with primary or no education, who had ever been married, who were ≥5 years older than their current spouse, who were employed, and who were of Luo ethnicity. HIV-1 prevalence was also higher among men who reported sexually transmitted infection (STI) symptoms in the past 6 months, who were uncircumcised, whose sexual partners were either their regular partner/spouse or their regular partner and others, who had been sexually active for ≥7 years, and who had ever had sex with a female sex worker (FSW). Among women, HIV-1 prevalence was higher among those who were aged ≥25 years, who had ever been married, who were ≥10 years younger than their

current spouse, who were employed, who were of Luo ethnicity, who reported STI symptoms in the past 6 months, and who had been sexually active for ≥7 years.

Additionally, when we compared the two estates with highest HIV-1 prevalence (16.8% and 19.9%) with the four remaining estates (9.6–13.4%), no difference in terms of risk factors were found. However, a higher proportion of participants with the following characteristics were observed among the two estates with higher HIV-1 prevalence: women, Luo ethnicity, marital status (one or more marriages), and uncircumcised men (data not shown).

Gender-specific risk factors for HIV-1

Risk factor analyses for men and women are presented in Table 3. Among men, adjusted risk factors significantly associated with HIV-1 were older age

Table 2. HIV-1 prevalence by gender among 2801 participants from Kericho, Kenya

| Feature | Men | | Women | |
|--|---------|--------------|---------|------------|
| | Prev. % | (x/n) | Prev. % | (x/n) |
| All participants | 11.3 | (195/1720) | 19.1 | (206/1081) |
| Age group (years) | | | | |
| 18–24 | 2.9 | (12/418)** | 14.5 | (52/358)** |
| 25–29 | 8.7 | (38/436) | 21.3 | (58/272) |
| 30–34 | 16.2 | (52/321) | 18.7 | (36/193) |
| ≥35 | 17.1 | (93/545) | 23.3 | (60/258) |
| Level of education | | | | |
| None | 17.6 | (6/34) | 16.7 | (9/54) |
| Primary | 12.9 | (111/859) | 20.3 | (133/654) |
| ≥High school | 9.4 | (76/806)* | 17.6 | (63/358) |
| Marital history | | | | |
| Never married | 3.6 | (14/386)** | 10.3 | (18/174)* |
| Once married | 11.6 | (116/1002) | 20.3 | (168/827) |
| Two or more times married | 19.8 | (65/328) | 25.3 | (20/79) |
| Age difference from current spouse (years) | | | | |
| ≤4 | 8.2 | (37/449)** | 18.3 | (55/301)** |
| 5–9 | 13.3 | (71/533) | 15.0 | (44/294) |
| ≥10 | 20.8 | (64/308) | 28.9 | (54/187) |
| Currently employed | | | | |
| No | 7.4 | (19/257) | 16.0 | (85/532) |
| Yes | 12.0 | (176/1463)* | 22.0 | (121/549)* |
| Ethnic group (tribe) | | | | |
| Kalenjin | 5.5 | (29/528)** | 14.6 | (36/247)** |
| Kisii | 6.4 | (27/421) | 14.1 | (35/248) |
| Luhya | 9.5 | (26/274) | 19.4 | (44/227) |
| Luo | 28.5 | (101/355) | 31.6 | (81/256) |
| Other | 8.5 | (12/142) | 9.7 | (10/103) |
| STI symptoms in the past 6 months | | | | |
| No | 9.7 | (147/1516)** | 17.4 | (158/907)* |
| Yes | 23.5 | (46/196) | 30.4 | (48/158) |
| Use of condoms | | | | |
| Never | 12.1 | (156/1294) | 19.4 | (171/881) |
| Sometimes | 10.3 | (27/263) | 20.0 | (25/125) |
| Always | 6.8 | (8/118) | 20.0 | (10/50) |
| Self-reported circumcision | | | | |
| No | 24.9 | (99/398)** | 20.1 | (136/675) |
| Yes | 7.3 | (96/1321) | 16.9 | (68/403) |
| Age at first sexual intercourse (years) | | | | |
| ≤14 | 8.8 | (30/341) | 20.2 | (35/173) |
| 15–18 | 12.8 | (117/914) | 19.9 | (132/663) |
| ≥19 | 10.0 | (41/410) | 15.8 | (33/209) |
| Sexual contacts with | | | | |
| Regular partner/spouse only | 12.1 | (158/1305)* | 19.2 | (167/871) |
| Other people | 5.7 | (10/175) | 20.4 | (22/108) |
| Regular partner/spouse and other people | 13.5 | (22/163) | 20.0 | (10/50) |
| Years of sexual activity | | | | |
| ≤6 | 2.0 | (6/304)** | 13.4 | (41/305)* |
| 7–18 | 11.8 | (103/873) | 21.4 | (110/514) |
| ≥19 | 16.2 | (79/488) | 21.7 | (49/226) |
| Sex with FSW | | | | |
| Never | 10.6 | (155/1463)* | — | — |
| Ever | 16.7 | (39/233) | — | — |

HIV-1, Human immunodeficiency virus type 1; STI, sexually transmitted infections; FSW, female sex worker; Prev., prevalence.

Denominator totals vary due to missing data.

* $P < 0.05$, ** $P < 0.001$ by χ^2 or Fisher's exact test.

Table 3. Gender-specific risk factor analysis for HIV-1 infection among 2801 participants from Kericho, Kenya

| Feature | Men | | | | Women | | | |
|--|------|----------------|-------------|----------------------|-------|---------------|-------------|----------------------|
| | OR | (95% CI) | aOR | (95% CI) | OR | (95% CI) | aOR | (95% CI) |
| Age group (years) | | | | | | | | |
| 18–24 | Ref. | | Ref. | | Ref. | | Ref. | |
| 25–29 | 3.23 | (1.66–6.27)** | 2.83 | (1.41–5.68)* | 1.60 | (1.06–2.41)* | 1.53 | (1.00–2.34)* |
| 30–34 | 6.40 | (3.35–12.24)** | 4.96 | (2.46–9.99)** | 1.35 | (0.85–2.15) | 1.25 | (0.77–2.02) |
| ≥35 | 6.84 | (3.69–12.70)** | 4.68 | (2.35–9.33)** | 1.78 | (1.18–2.69)* | 1.68 | (1.09–2.57)* |
| Level of education | | | | | | | | |
| ≥High school | Ref. | | Ref. | | Ref. | | Ref. | |
| Primary | 1.36 | (0.99–1.87) | 1.01 | (0.73–1.40) | 1.20 | (0.86–1.67) | 1.01 | (0.72–1.44) |
| None | 1.96 | (0.78–4.93) | 0.96 | (0.37–2.50) | 0.94 | (0.44–2.01) | 0.54 | (0.24–1.21) |
| Marital history | | | | | | | | |
| Never married | Ref. | | Ref. | | Ref. | | Ref. | |
| Once married | 3.42 | (1.94–6.04)** | 2.39 | (1.29–4.43)* | 2.21 | (1.32–3.70)* | 1.95 | (1.14–3.33)* |
| Two or more times married | 6.41 | (3.51–11.71)** | 3.38 | (1.71–6.67)** | 2.94 | (1.45–5.94)* | 2.40 | (1.13–5.12)* |
| Age difference from current spouse (years) | | | | | | | | |
| ≤4 | Ref. | | Ref. | | Ref. | | Ref. | |
| 5–9 | 1.71 | (1.13–2.60)* | 1.58 | (1.02–2.43)* | 0.79 | (0.51–1.22) | 0.79 | (0.51–1.23) |
| ≥10 | 2.92 | (1.89–4.51)** | 2.04 | (1.23–3.38)* | 1.82 | (1.18–2.79)* | 1.77 | (1.14–2.73)* |
| Ethnic group | | | | | | | | |
| Kalenjin | Ref. | | Ref. | | Ref. | | Ref. | |
| Kisii | 1.18 | (0.69–2.03) | 0.99 | (0.57–1.72) | 0.96 | (0.58–1.59) | 0.87 | (0.52–1.47) |
| Luhya | 1.81 | (1.04–3.15)* | 1.54 | (0.87–2.70) | 1.41 | (0.87–2.28) | 1.31 | (0.80–2.14) |
| Luo | 6.76 | (4.34–10.53)* | 5.65 | (3.60–8.87)** | 2.71 | (1.75–4.22)** | 2.50 | (1.59–3.94)** |
| Other | 1.58 | (0.78–3.18) | 1.36 | (0.67–2.79) | 0.63 | (0.30–1.32) | 0.63 | (0.30–1.34) |
| STI symptoms in the past 6 months | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 2.85 | (1.96–4.15)** | 2.42 | (1.63–3.58)** | 2.07 | (1.41–3.02)** | 2.00 | (1.36–2.95)** |
| STI history in the past 5 years | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 1.95 | (1.16–3.28)* | 1.60 | (0.93–2.80) | 1.87 | (1.02–3.42)* | 1.96 | (1.07–3.60)* |
| Self-reported circumcision | | | | | | | | |
| No | Ref. | | Ref. | | Ref. | | Ref. | |
| Yes | 0.24 | (0.17–0.32)** | 0.34 | (0.22–0.52)** | 0.80 | (0.58–1.11) | 0.97 | (0.67–1.40) |
| Sexual contacts with | | | | | | | | |
| Regular partner/spouse only | Ref. | | Ref. | | Ref. | | Ref. | |
| Other people | 0.44 | (0.23–0.86)* | 0.97 | (0.48–1.98) | 1.08 | (0.66–1.77) | 1.55 | (0.89–2.70) |
| Regular partner/spouse and other people | 1.12 | (0.69–1.81) | 1.16 | (0.71–1.89) | 1.05 | (0.52–2.15) | 1.09 | (0.53–2.24) |
| Years of sexual activity | | | | | | | | |
| ≤6 | Ref. | | Ref. | | Ref. | | Ref. | |
| 7–18 | 6.43 | (2.79–14.85)** | 4.54 | (1.90–10.85)* | 1.75 | (1.19–2.59)* | 1.50 | (0.93–2.43) |
| ≥19 | 9.28 | (3.98–21.6)** | 3.36 | (1.16–9.67)* | 1.78 | (1.13–2.81)* | 1.43 | (0.60–3.42) |

HIV-1, Human immunodeficiency virus type 1; STI, sexually transmitted infections; OR, odds ratio; CI, confidence interval; aOR, adjusted odds ratio; Ref., reference category for odds calculations.

Significant adjusted associations for HIV infection are denoted by boldface.

* $P < 0.05$, ** $P < 0.001$.

[25–29 years, adjusted odds ratio (aOR) 2.83; 30–34 years, aOR 4.96; ≥35 years, aOR 4.68], having been married (one marriage, aOR 2.39; ≥2 marriages,

aOR 3.38), being older than current spouse (5–9 years, aOR 1.58; ≥10 years, aOR 2.04), affiliation with the Luo ethnic group (aOR 5.65), STI symptoms

Table 4. *Participants' beliefs on ways to contract or be protected from HIV/AIDS among 2801 participants from Kericho, Kenya*

| Feature | Men (N=1720) | | Women (N=1081) | |
|---|--------------|------|----------------|-------|
| | No. | % | No. | % |
| Ways to get HIV/AIDS | | | | |
| Sex without condom with HIV-positive person | 1704 | 99.1 | 1074 | 99.4 |
| Sharing razors, scissors with HIV-positive person | 1622 | 94.3 | 1005 | 93.0 |
| Sharing needles with HIV-positive person | 1345 | 78.2 | 838 | 77.5 |
| Blood transfusion from HIV-positive person | 1255 | 73.0 | 796 | 73.6 |
| Baby breastfed by mother who has the virus | 1007 | 58.5 | 690 | 63.8* |
| Ways to protect from HIV/AIDS | | | | |
| Correct condom use | 1637 | 95.2 | 1018 | 94.2 |
| Be faithful to one faithful partner | 1520 | 88.4 | 967 | 89.5 |
| Not sharing razor/scissors | 1201 | 69.8 | 813 | 75.2* |
| Do not have sex or abstain from sex | 1075 | 62.6 | 666 | 61.6 |
| Have sex only with healthy persons | 252 | 14.7 | 192 | 17.8 |

HIV, Human immunodeficiency virus; AIDS, acquired immune deficiency syndrome.

Denominator totals vary due to missing data.

* $P < 0.05$ by χ^2 or Fisher's exact test.

in the past 6 months (aOR 2.42), being uncircumcised (aOR 0.34), and years of sexual activity (7–18 years, aOR 4.54; ≥ 19 years, aOR 3.36).

Among women, adjusted risk factors significantly associated with HIV-1 were age (25–29 years, aOR 1.53; ≥ 34 years, aOR 1.68), having been married (one marriage, aOR 1.95; ≥ 2 marriages, aOR 2.40), being younger than current spouse (≥ 10 years, aOR 1.77), affiliation with the Luo ethnic group (aOR 2.50), STI symptoms in the past 6 months (aOR 2.00), and a STI history in the past 5 years (aOR 1.96).

Participants' beliefs on ways to contract or be protected from HIV/AIDS

The majority of male and female participants reported sexual contact without condoms (99%), sharing needles with HIV-positive persons (78%), or a blood transfusion from HIV-1-positive persons (73%) as ways to get HIV/AIDS (Table 4). Women were more likely than men (64% vs. 59%, $P = 0.008$) to identify that a baby could become infected through breastfeeding. In addition, almost 94% of participants reported sharing razors/scissors with HIV-1-positive persons as a way to get HIV/AIDS. Correct condom use was identified by 95% of men and women as one way to protect from HIV/AIDS. Other ways of protecting from HIV/AIDS were being faithful to one faithful partner (89%), abstaining

from sex (62%), and having sex only with healthy persons (16%).

Additionally, most participants (99%) reported having received information on HIV/AIDS. Radio was the most cited source of information. The WRP staff, health personnel, television, and newspapers/magazines were also cited as other sources of information. Women were more likely than men to receive information from health personnel and family.

Willingness to participate in HIV vaccine studies

Over 98% of men and 96% of women reported they would be willing to participate in a HIV vaccine study. Ninety-six percent of men and women reported that they would probably want or definitely want to receive a HIV vaccine that had been proven safe and efficacious. The percentage willing to participate in HIV vaccine research was similar across the six estates and age groups.

DISCUSSION

We found a high prevalence of HIV-1 among this rural Kenyan population. Among men, higher risk for HIV-1 was found for those in older age groups, having been married at least once, being ≥ 5 years older than their spouse or partner, having had a STI

symptom in the past 6 months, being of Luo ethnicity, and having ≥ 7 years of sexual activity. Circumcision was associated with lower risk of HIV-1 among men. Among women, higher risk for HIV-1 was being in the ≥ 25 –29 years age group, those married once or more, being ≥ 10 years younger than their spouse or partner, and having had a STI symptom in the past 6 months and a history of a STI in the past 5 years.

In the Rift Valley Province (which extends from Sudan in the North to Tanzania in the South and where Kericho is located), the HIV-1 prevalence reported by the KDHS [7] was 5.3%, and the neighbouring province of Nyanza, ~ 15 km northwest of Kericho, reported the highest HIV-1 prevalence (15.1%) in Kenya [7]. In our study, over 47% of enrolled participants and 60.1% of all HIV-positive participants were originally from Nyanza, which could help to explain the high HIV-1 prevalence observed in Kericho.

The epidemiological features of HIV-1 infection observed in Kericho were similar to previous studies in sub-Saharan Africa [2, 11–13]. In our study population, HIV-1 prevalence was nearly twofold greater among women than among men. One possible explanation for this gender disparity concerns the unequal power dynamics between men and women [11, 14]. Our findings were also consistent with the KDHS, which reported a marked gender disparity with women almost twice as likely to be infected as men, with HIV prevalences of 7.5% and 3.6%, respectively [7]. An age difference of ≥ 10 years from current spouse was also associated with HIV-1 infection among both men and women in our study. These findings were consistent with earlier work [14]. Circumcision was associated with lower risk for HIV-1 infection among men. Circumcision being protective against HIV-1 infection has been also observed in other areas of sub-Saharan Africa [12, 15, 16]. Recently, UNAIDS and the World Health Organization have suggested male circumcision as one preventive measure against acquiring infection in areas with high HIV-1 prevalence [17]. A STI symptom in the past 6 months for both women and men was associated with HIV-1. As is well-known, STI has constituted a complementary risk factor for the spread of HIV-1 infection in sub-Saharan Africa [13]. Interestingly, in contrast to other research [14], sex with a FSW was not associated with HIV-1 among men, adjusting for other variables (data not shown). However, this lack of association could be explained by the fact that men were

more likely to use condoms when having sex with a FSW [18, 19]. This factor was not addressed in our study.

Although most participants knew that sex without condoms with a HIV-1-positive person was one way to contract HIV/AIDS, a significant proportion did not know that sharing needles or receiving a blood transfusion from a HIV-1-infected person could also lead to infection. Interestingly, a high proportion of both men and women thought they could get HIV/AIDS through sharing razors/scissors with a HIV-1-positive person. These findings identify HIV/AIDS education needs in Kericho. Despite the fact that the majority of participants were familiar with sexual risks associated with HIV-1 infection, additional education on HIV-1 transmission and specific behaviours that are not high risk for infection (e.g. casual contact with a HIV-1-infected person) may be warranted. In addition, the high proportion of women who did not know that the virus can be transmitted to a child through breastfeeding illustrates an educational opportunity which could be part of an overall strategy to reduce mother-to-infant HIV transmission.

Volunteers expressed strong willingness to participate in future HIV vaccine research and receive an efficacious vaccine when one is developed. The degree to which the community knows about the disease and the ability of its members to provide informed consent are critical elements for the conduct of HIV research [20, 21], which is one of the goals of the WRP in Kericho. Other critical elements include a strong research infrastructure, effective recruitment and retention strategies, and community commitment and support [22, 23]. The Kericho research infrastructure has been integrated with HIV/AIDS treatment facilities supported by the United States President's Emergency Plan for AIDS Relief [24].

Some limitations of this study should be considered. No information was available on potential participants who did not enrol in the study. Therefore we were unable to determine how representative our study population is of the population of the six estates or of the overall tea plantation population. Several study findings suggest that there may be important cultural factors related to tribal affiliation that could be associated with an increased risk for HIV-1 infection. Our study was not designed to address these specific factors. However, this information will inform future studies in this rural population which seek to examine these factors in greater

detail. Finally, sensitivity to revealing personal information (i.e. sexual behaviour) may have prevented those who did participate in the study from being totally truthful, despite assurances of confidentiality, which may have led to underreporting of some risk behaviours.

In summary, in this rural Kenyan population, a high HIV-1 prevalence was found and this was significantly higher among women than men. The epidemiological and socio-behavioural features of this study, combined with the research infrastructure in Kericho, make this site suitable for continued HIV research.

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DECLARATION OF INTEREST

None.

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