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# Correlates of prevalent HIV infection among adults and adolescents in the Kisumu incidence cohort study, Kisumu, Kenya

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## Abstract

We estimated HIV prevalence and identified correlates of HIV infection among 1106 men and women aged 16–34 years residing in Kisumu, Kenya. Demographic, sexual, and other behavioural data were collected using audio computer-assisted self-interview in conjunction with a medical examination, real-time parallel rapid HIV testing, and laboratory testing for pregnancy, gonorrhoea, chlamydia, syphilis, and herpes simplex virus type 2. Multivariate logistic regression was used to identify variables associated with prevalent HIV infection by gender. Overall HIV prevalence was 12.1%. HIV prevalence among women (17.1%) was approximately two and one half times the prevalence among men (6.6%). Odds of HIV infection in men increased with age (aOR associated with one year increase in age =1.21, CI =1.07–1.35) and were greater among those who were uncircumcised (aOR =4.42, CI =1.41–13.89) and those who had an herpes simplex virus type 2 positive (aOR =3.13, CI =1.12–8.73) test result. Odds of prevalent HIV infection among women also increased with age (aOR associated with one year increase in age =1.16, CI =1.04–1.29). Women who tested herpes simplex virus type 2 positive had more than three times the odds (aOR =3.85, CI =1.38–10.46) of prevalent HIV infection compared with those who tested herpes simplex virus type 2 negative. Tailored sexual health interventions and programs may help mitigate HIV age and gender disparities.



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**Declaration of Conflicting Interests**

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Research ethics**

The investigation followed the guidelines of the US Department of Health and Human Services, Centers for Disease Control and Prevention (IRB #00000185), and the Kenya Medical Research Institute (IRB #00008118) regarding protection of human subjects. Institutional review boards associated with each reviewed and approved the research protocol, informed consent process, study procedures, and data collection instruments.

**Keywords**

HIV prevalence; herpes simplex virus type 2 infection; gender disparities; Kenya

## Introduction

To more effectively control HIV epidemics, correlates of HIV infection need to be better understood, and prevention strategies adapted to account for risk patterns linked to particular settings or situations. Several factors have been associated with HIV infection in sub-Saharan Africa, including extramarital sex,[1,2] multiple sexual partners,[3–6] inconsistent or lack of condom use,[7–10] the absence of male circumcision,[11–13] and most recently, hormonal contraceptive use.[14–16] Physiological factors, such as having a sexually transmitted infection (STI), particularly ulcerative genital diseases such as herpes simplex virus type 2 (HSV-2), have also been found to increase infectiousness and susceptibility to HIV infection via a variety of biological mechanisms.[17]

Nyanza Province in western Kenya has the highest HIV prevalence of any province in Kenya. While HIV prevalence among adults aged 15–64 years decreased nationally from 7.2% in 2007 to 5.6% in 2012, prevalence in Nyanza Province slightly increased from 14.9 to 15.1% during this period.[18] Similar to other African countries, women in Kenya are disproportionately affected by HIV. The 2012 Kenya AIDS Indicator Survey[18] showed that among 15- to 64-year-olds, a higher proportion of women (6.9%) were infected with HIV than men (4.4%). A 2003 cross-sectional survey among 13–34-year-olds in rural Asembo, Nyanza Province, found an HIV prevalence of 3.5% among women 15–19 years of age compared to a prevalence of 1% among their male counterparts.[6] Similarly, a gender disparity in prevalence was found among 20–24-year-olds (7.4% among women and 1.9% among men).[6]

Given known challenges of undertaking HIV prevention research in resource-poor settings[19,20] and for specific populations such as adolescents,[21,22] the availability of HIV prevalence and incidence estimates are important in designing and implementing HIV research or programmatic activities. The high prevalence of HIV in Nyanza Province makes it an ideal location to conduct research, including clinical trials, and to evaluate HIV biomedical interventions/strategies. Using data from the Kisumu Incidence Cohort Study (KICoS), one of the few detailed HIV risk factor incidence cohort studies in Kenya since the inception of the U.S. President's Emergency Plan for AIDS Relief, we assessed the prevalence of HIV among young adults aged 16–34 for study eligibility and identified factors associated with HIV infection. The purpose of the analysis is to determine HIV prevalence and identify correlates of HIV infection among men and women residing in Kisumu.

## Methods

### Study population and procedures

We conducted an observational, prospective study among HIV-seronegative young adults, 16–34 years of age, recruited from a non-probability convenience sample in Kisumu, Kenya. Study visits for enrolees occurred at three-month intervals for 12 months. The purpose of the cohort study was to estimate the incidence of HIV and to determine successful recruitment and retention strategies to prepare for future community-based efficacy trials of biomedical interventions to prevent HIV.[23] Here, we focus on the baseline data collected from persons who were screened for study participation. Details of KiCoS have been published elsewhere.[23,24]

In brief, recruitment for KICoS screening was completed in a variety of venues (e.g. markets, health clinics, community forums, special interest group meetings, and other public venues in Kisumu) using convenience sampling. A two-part screening process conducted at the study clinic was used to determine study eligibility. Those who completed only the first screening process were referred to as pre-screeners. Those who completed both parts, and the focus of this analysis, were referred to as screeners.

The initial screening involved a brief computer-based interviewer-administered assessment. If the person presenting for pre-screening was younger than 18 years of age and not a mature minor, parental/ guardian consent and minor assent were required before pre-screening was undertaken. Per Kenya National HIV voluntary counselling and testing guidelines, persons under 18 years of age, who are pregnant, married, or a parent, and who are able to provide informed consent for themselves are considered mature minors.[25] Mature minors, however, were encouraged to speak with and involve their parents/ guardians. Verbal agreement to take part in the brief pre-screening assessment was obtained from person 18 years of age and older after providing an overview of the study purpose and a general explanation of what the pre-screening procedures involved.

No personally identifiable information was collected during the pre-screening process. With the exception of self-reported age being between 16 and 34 years, a yes response was required for all the following questions in order for pre-screeners to proceed with the screening assessment and procedures: fluent in English, Kiswahili, or Dholuo; lived within the study catchment area (within 5 km of Kisumu town); intended to remain in the study catchment area over the next 12 months; had sex at least once in the past three months; never had been told that he/she was infected with HIV by a doctor, nurse, or VCT counsellor; was not taking part in another HIV prevention study; was willing to return for study visits every three months for the next 12 months; was willing to undergo HIV and other medical testing, including a physical exam; and was willing to provide detailed locator information if determined to be eligible for enrolment. Women also had to self-report that they were neither currently pregnant nor planning on becoming pregnant in the next 12 months.

Persons eligible to proceed with screening completed written informed-consent procedures before further data collection was undertaken. The informed consent process involved a

detailed explanation of the purpose of the study, an account of potential risks and benefits, and a description of the screening and follow-up procedures, including the sensitive nature of some questions about sexual behaviour, and repeated rapid HIV testing with pre- and post-test counselling. In addition, personal and detailed contact information was collected. Screeners were informed during and following the informed consent process that data collection would encompass an audio computer-assisted self-interview (ACASI), a medical examination, rapid HIV testing, and laboratory testing for pregnancy and HSV-2. Both a staff member and a self-directed ACASI tutorial were provided. Screeners could repeat the ACASI tutorial as many times as needed and request staff assistance at any time. To facilitate computer use, the ACASI was completed using a touch screen; mouse and keyboard use were not available.

The ACASI included an array of demographic (e.g. sex, age, education, marital status, employment status, and occupation) and behavioural questions (e.g. number of lifetime sexual partners; STI treatment ever as well as in the past three months; history of oral, anal, and/or forced/unwanted sex; number of partners; condom use for vaginal or anal sex; birth control use; and sex during special occasions, all during the past three months). In Western Kenya, sexual intercourse is part of a traditional practice/sacred ritual that is associated with cultural activities such as planting, harvesting, weddings, and funerals.[26,27] Among the Luo, the ethnic predominate group in this region, an inextricable relationship exists between sex, wealth, and productiveness of the land.[26,27] HIV testing was conducted through parallel rapid testing using Uni-Gold HIV-1/2 (Trinity Biotech, Wicklow, Ireland) and Determine HIV-1/2 (Abbott Labs, Tokyo, Japan) with Bioline (Meridian Life Science Company, Cincinnati, Ohio) used as a tiebreaker.

Persons who tested HIV positive were provided with referrals for HIV care and treatment services. In addition, CD4 T-lymphocyte testing was performed and results given to the participants. Participants were asked to share their results with the referral clinic of their choice to ensure they received appropriate clinical care. All persons who completed both the pre-screening and screening received a bar of soap and transport reimbursement of 300–500 Kenya Shillings (equivalent to $3.50–$5.90) depending on the distance between the clinic and their residence.

## Ethics statement

The KICoS protocol, study procedures, data collection instruments, and informed consent documents were approved by the Research and Public Health Collaboration of the Kenya Medical Research Institute Scientific Steering and National Ethics Review Committees, and the U.S. Centers for Disease Control and Prevention Institutional Review Board. As previously stated, all eligible pre-screeners provided written informed consent prior to undergoing the second part of the screening. Parental consent and minor assent were used for all minors <18 years of age except mature minors (i.e. minors who were pregnant, married, or had children), who provided consent for themselves.

### Measures

We used HIV infection at screening as the dependent variable in our analyses. Independent variables included: demographic characteristics (sex, age, marital status, ethnic group, religion, highest level of education completed, employment status, and occupation), sexual history (lifetime number of sexual partners, sex during special occasions, anal sex, oral sex, forced/unwanted sex, and STI treatment history), sexual behaviour in the past three months (number of sexual partners with whom vaginal or anal sex occurred, vaginal or anal sex with a main partner, condom use for vaginal or anal sex, and birth control methods), and medical data (pregnancy test results, male circumcision status, HIV test results, and HSV-2 results). Any instance of vaginal or anal sex without a condom in the past 12 months with one or more partners was used to create a composite unprotected sex variable.

### Data analysis

To describe screener characteristics, we computed the frequencies for demographic variables, circumcision for men, and pregnancy test status for women. Prevalence of HIV and HSV-2 were also calculated. Bivariate analyses were carried out to assess associations between HIV status and the independent variables. Age was treated as a continuous variable. Two continuous variables, the number of lifetime sexual partners and number of vaginal or anal sexual partners in the past three months, were categorised due to the highly skewed distribution. All participants reported being sexual active in the past three months in the pre-screening computer-assisted personal interview (CAPI), but some indicated either that they had not had any sexual partners or they refused to provide a response in the screening ACASI. In both questionnaires, sexual intercourse was defined as vaginal or anal sex. Gender-specific variables, such as pregnancy status and hormonal contraceptive use for women, and circumcision status for men, were also included.

Multivariate logistic regression models were run separately for men and women to allow for different variables in the final model, which included variables with a p-value <0.25 in bivariate analyses. Adjusted odds ratios (aORs) and 95% confidence intervals (CIs) were calculated. Analyses were performed using statistical analysis software (SAS) for Windows version 9.2 (SAS Institute, Cary, North Carolina, USA).

## Results

Between March 2007 and March 2010 study recruitment and screening were conducted. Of 1724 persons pre-screened, 64% (n =1106, and included 534 men and 572 women) completed the full screening process (Table 1). Among the 618 persons not meeting one or more of the eligibility criteria to proceed to the full study screening (data not shown), 465 (75%) reported that they were not sexually active (i.e. had not had vaginal or anal sex) in the past three months, 90 (15%) planned to move outside of the study catchment area within the next 12 months, 69 (22%) were not willing to test for HIV, 40 (6%) reported ages outside of the target age range (75% were too young), 32 (5%) were participating in other HIV intervention trials, 18 (3%) were women who were pregnant or intending on getting pregnant within the next 12 months, and 16 (3%) had previously been told that they were

HIV infected. Residency outside of the study catchment area was only reported by three of the pre-screeners.

Among those completing screening, the median age was 21 years; the majority reported being single/never married (68.0%), having an education beyond primary school (60.7%), and not being employed (60.6%).

Overall HIV prevalence was 12.1% (n =134); prevalence of HIV infection for women was two and a half times the prevalence for men (17.1% versus 6.6%, respectively). Median number of lifetime sexual partners was three (men: 5, range 1–88; women: 3, range 1–82). Unprotected sex in the past three months was reported by 83.4% of participants.

### Factors associated with HIV infection: bivariate analyses

For men, the odds of prevalent HIV infection increased with every one year increase in age (OR =1.20, CI =1.11–1.29) and for those who had never attended school (OR =9.25, CI =2.67–32.08) compared to those who completed post-secondary school (Table 2). Men who had received STI treatment in the past three months (OR =7.00, CI =2.51–19.53) or prior history of STI treatment (OR =4.03, CI =1.78–9.12) had higher odds of prevalent HIV infection compared to those with no history of an STI treatment. Men who had an HSV-2 positive (OR =6.82, CI =3.04–15.29) or indeterminate (OR =5.23, CI =2.02–13.55) test result compared to a negative result were more likely to be HIV-positive. Men who were uncircumcised (OR =4.29, CI =1.49–12.35) had greater odds of being HIV-positive.

For women, the odds of prevalent HIV infection increased with every one year increase in age (OR =1.17, CI =1.11–1.23) and were higher for those married or living as married (OR =2.76, CI =1.70–4.48) and separated, divorced, or widowed (OR =6.03, CI =2.92–12.45) compared to those who were single or never married. The odds of prevalent HIV infection were greater among those who had never attended school (OR =4.21, CI =1.53–11.61) or only completed primary school (OR =2.26, CI =1.19–4.28) versus those who completed post-secondary school, and who were currently working (OR =1.92, CI =1.24–2.99) compared to those who were not. The odds of prevalent HIV infection were also higher among women with 3–4 lifetime partners (OR =2.53, CI =1.25–5.12) and those with ≥5 lifetime partners (OR =3.81, CI =1.88–7.74) as compared to those who reported 1–2 partners. Those who had received STI treatment more than three months ago (OR =4.03, CI =1.78–9.11) or within the past three months (OR =7.00, CI =2.51–19.53) had a higher prevalence of HIV compared to those with no history of an STI treatment, those who had an HSV-2 positive (OR =12.92, CI =6.94–24.06) or indeterminate (OR =7.04, CI =2.78–17.82) test result compared to a negative result, those who had a laboratory confirmed pregnancy test result (OR =2.06, CI =0.88–4.82), and those who had used birth control pills in the past three months (OR =1.96, CI =1.01–3.82) or had used injections to delay or avoid pregnancy in the past three months (OR =2.02, CI =1.05–3.90).

### Factors associated with HIV infection: multivariate analyses

In multivariate analyses among men (Table 3), the odds of prevalent HIV infection increased with each one year increase in age (aOR =1.21, CI =1.07–1.35), and among those who had an HSV-2 positive (aOR =3.13, CI =1.12, 8.73) test result compared to men who

had a negative result. Men who were uncircumcised (aOR =4.42, CI =1.41, 13.89) had greater odds of being HIV-positive.

In multivariate analyses among women, the odds of prevalent HIV infection increased with each one year increase in age (aOR =1.16, CI =1.04–1.29), and among those who had an HSV-2 positive (aOR =3.85, CI =1.38, 10.71) test result compared to those with a negative result.

## Discussion

A number of other studies throughout Kenya[28,29] as well as in other African countries have shown a similar gender disparity in HIV prevalence.[13,30,31] The prevalence of HIV infection among women (17.1%) in our sample was about two and one half times as high as among men (6.6%). Risk factors for men and women in our study were not identical, but did overlap. In multivariate models, both increasing age and being HSV-2 positive were associated with prevalent HIV infection in men and women; the former was not unexpected as the chance of acquiring infection increases with repeated exposures. Although the maximum age in our study was 34 years, our results were similar to those described in other studies.[6,32]

Men who tested HSV-2 positive had nearly three times the odds and women more than four times the odds of prevalent HIV infection than those who tested HSV-2 negative. Among persons with a positive HSV-2 serology, nearly a third were HIV-positive, although the relative timing of co-infection cannot be determined through our screening data. This finding concurs with several earlier reports linking HSV-2 with an increased risk of HIV acquisition[6,11,13,17,33–38] suggesting that ulcerative lesions may provide portals of entry for HIV.[39,40] A meta-analysis of longitudinal studies also found that HSV-2 infection was associated with a three-fold risk for HIV acquisition among men and women.[36] Behavioural interventions aimed at preventing HIV infection may benefit from also addressing HSV-2 prevention.

Not being circumcised was also associated with prevalent HIV infection in men and this has been reported in ecological studies as well as clinical trials.[11–13,41,42] Following the announcements of the positive results of male circumcision on HIV infection, voluntary medical male circumcision initiatives have been initiated throughout sub-Saharan Africa. A study in Kisumu, however, found that uncircumcised men who expressed a positive attitude about circumcision were more likely to report high-risk sexual behaviours.[10] Thus, targeted educational messages for both men and women on the benefits of male circumcision may be important. Participation in routine counselling and testing may help to further emphasise the need to use condoms and reduce high-risk behaviours.

Two gender-specific variables were significant in our bivariate analysis and are worth noting in spite of not reaching statistical significance in multivariate analyses. For women, use of birth control pills and use of injections to delay pregnancy were associated with higher prevalence of HIV infection. These results are consistent with cross-sectional studies that found an association between hormonal contraception use and HIV prevalence, likely

reflecting higher sexual activity among persons using contraception.[14–16] Additional research in this area is warranted given the disproportionate rates of HIV infection among women in this geographical region.

Another variable worth noting is education, which was also significant in bivariate analysis but not in the multivariable analysis. Men and women who never attended school had higher odds of prevalent HIV infection than those with post-secondary school education. Many studies from different parts of Africa have now reported on the inverse relationship between level of education and HIV infection (Zambia,[43] Uganda,[44] South Africa,[45] Zimbabwe,[46] Tanzania[47]). General education has been shown to be a 'social vaccine' against HIV infection in that it can contribute to delays in sexual debut and adoption of other safer sexual behaviour.[11,43,48,49]

Our analyses have several limitations. The data presented are cross-sectional; thus, temporal causality cannot be inferred. Moreover, HIV prevalence and correlates found to be associated with at-risk behaviours may differ from those associated with HIV incidence, including the duration of infection. The use of a non-probability convenience sample may limit the generalisability of our findings. Recruitment focused on sexually active young adults, 16–34 years of age, in the general population as opposed to high-risk groups (e.g. sex workers, men who have sex with men, and HIV-negative persons in serodiscordant relationships) in Kisumu, where HIV prevalence might be expected to be higher. Other studies have found higher reporting of sensitive behaviour with ACASI in comparison to face-to-face interviewer-administered surveys.[50–54] Nevertheless, self-reported sexual behaviour data may contain inaccuracies, including recall biases, social desirability, or reluctance to truthfully answer sensitive personal questions, resulting in either over reporting of behaviours (e.g. condom use) or under reporting (e.g. number of lifetime partners). In addition, use of an ACASI data collection tool with a sample, in which about a third of persons had no formal education, may have led to increased participant auditory fatigue. Inconsistencies between CAPI and ACASI methods suggest that there may be additional value in undertaking a multi-step screening process to ensure that persons ultimately enrolled suitably meet the study eligibility criteria.

Given the wide CIs shown in our regression results, our sample size was too small and thus limited inferences can be made from our data. Any conclusions drawn from this data would require replication with a larger sample. It is also important to note that we had a number of sexual behaviour variables that were likely correlated, so would not be significant in multivariate analyses. This may have been one reason that other studies found an association between HIV prevalence and variables such as the number of lifetime sexual partners, marital status, and past treatment for an STI,[6] which did not show statistical significance in our analyses. The predominantly urban (versus rural) population and our small sample size may have also contributed to the lack of statistical significance.

In conclusion, continued attention to examining HIV risk factors is needed in this setting, especially among adolescents. Disparities in gender and age among 16–34-year-olds suggest that tailored sexual health interventions and programs may help mitigate risk for STIs, including HIV, and other negative sexual outcomes, such as unintended pregnancy.

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## References

1. Fox, A. Marital sexual behavior and HIV risk across 16 African countries. Proceedings of the 141st APHA Annual Meeting and Expo; Boston, MA. 2–6 November 2013; Abstract # 289699, https://apha.confex.com/apha/141am/webprogram/Paper289699.html
2. Reniers G, Watkins S. Polygyny and the spread of HIV in Sub Saharan Africa: a case of benign concurrency. AIDS. 2010; 24:299. [PubMed: 19890204]
3. Kaiser R, Bunnell R, Hightower A, et al. Factors associated with HIV infection in married or cohabitating couples in Kenya: results from a nationally representative study. PLoS One. 2011; 6:e17842. [PubMed: 21423615]
4. Pettifor A, MacPhail C, Corneli A, et al. Continued high risk sexual behavior following diagnosis with acute HIV infection in South Africa and Malawi: implications for prevention. AIDS Behav. 2011; 15:1243–1250. [PubMed: 20978833]
5. Mah TL, Halperin DT. Concurrent sexual partnerships and the HIV epidemics in Africa: evidence to move forward. AIDS Behav. 2010; 14:11–16. [PubMed: 18648926]
6. Amornkul PN, Vandenhoudt H, Nasokho P, et al. HIV prevalence and associated risk factors among individualsaged 13–34 years in Rural Western Kenya. PLoS One. 2009; 4:e6470. [PubMed: 19649242]
7. Hearst N, Ruark A, Hudes ES, et al. Demographic and health surveys indicate limited impact of condoms and HIV testing in four African countries. Afr J AIDS Res. 2013; 12:9–15. [PubMed: 25871306]
8. Davidoff-Gore A, Luke N, Wawire S. Dimensions of poverty and inconsistent condom use among youth in urban Kenya. AIDS Care. 2011; 23:1282–1290. [PubMed: 21562992]
9. Bachanas P, Medley A, Pals S, et al. Disclosure, knowledge of partner status, and condom use among HIV-positive patients attending clinical care in Tanzania, Kenya, and Namibia. AIDS Patient Care STDs. 2013; 27:425–435. [PubMed: 23829332]
10. Westercamp N, Mattson CL, Madonia M, et al. Determinants of consistent condom use vary by partner type among young men in Kisumu, Kenya: a multi-level data analysis. AIDS Behav. 2010; 14:949–959. [PubMed: 18791819]
11. Gray R, Azire J, Serwadda D, et al. Male circumcision and the risk of sexually transmitted infections and HIV in Rakai, Uganda. AIDS. 2004; 18:2428–2430. [PubMed: 15622320]
12. Bailey RC, Moses S, Parker CB, et al. Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. Lancet. 2007; 369:643–656. [PubMed: 17321310]
13. Auvert B, Taljaard D, Lagarde E, et al. Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 Trial. PLoS Med. 2005; 2:e298. [PubMed: 16231970]
14. Baeten JM, Benki S, Chohan V, et al. Hormonal contraceptive use, herpes simplex virus infection, and risk of HIV-1 acquisition among Kenyan women. AIDS. 2007; 21:1771–1777. [PubMed: 17690576]
15. Baeten JM, Lavreys L, Overbaugh J. The influence of hormonal contraceptive use on HIV-1 transmission and disease progression. Clin Inf Dis. 2007; 45:360–369.

16. Heffron R, Donnell D, Rees H, et al. Use of hormonal contraceptives and risk of HIV-1 transmission: a prospective cohort study. Lancet. 2012; 12:19–26. [PubMed: 21975269]
17. Reynolds SJ, Quinn TC. Developments in STD/HIV interactions: the intertwining epidemics of HIV and HSV-2. Infect Dis Clin N Am. 2005; 19:415–425.
18. National AIDS and STI Control Programme, Ministry of Health, Kenya. AIDS indicator survey 2012: preliminary report. Nairobi, Kenya: Sep. 2013
19. Goldie SJ, Yazdanpanah Y, Losina E, et al. Cost-effectiveness of HIV treatment in resource-poor settings in the case of Cote d'Ivoire. N Engl J Med. 2006; 355:1141–1153. [PubMed: 16971720]
20. Thomas TK, Masaba R, Borkowf CB, et al. Triple-antiretroviral prophylaxis to prevent mother-to-child HIV transmission through breastfeeding in the Kisumu Breastfeeding Study, Kenya: a clinical trial. PLoS Med. 2011; 8:e1001015. [PubMed: 21468300]
21. Adler DH. Inclusion of South African adolescents in HIV vaccine trials. J AIDS HIV Res. 2012; 4:30–35. [PubMed: 24729929]
22. Jaspan HB, Cunningham CK, Tucker TJ, et al. Inclusion of adolescents in preventive HIV vaccine trials: public health policy and research design at a crossroads. J Acquir Immune Defic Syndr. 2008; 47:86–92. [PubMed: 17984759]
23. Chege W, Pals SL, McLellan-Lemal E, et al. Baseline findings of an HIV incidence cohort study to prepare for future HIV prevention clinical trials in Kisumu, Kenya. J Infect Dev Ctries. 2012; 6:870–880. [PubMed: 23276741]
24. Mdodo R, Gust D, Otieno FO, et al. Investigation of HIV incidence rates in a high-risk, high-prevalence Kenyan population potential lessons for intervention trials and programmatic strategies. J Int Assoc Provid AIDS Care. 2013 Epub ahead of print. 2325957413511667.
25. World Health Organization. HIV and adolescents: Guidance for HIV testing and counselling and care for adolescents living with HIV: recommendations for a public health approach and considerations for policy-makers and managers. Geneva: World Health Organization; 2013. http://www.ncbi.nlm.nih.gov/books/NBK217962/ [accessed 26 September 2014]
26. Ayikukwei R, Ngare D, Sidle J, et al. HIV/AIDS and cultural practices in western Kenya: the impact of sexual cleansing rituals on sexual behaviours. Cult Health Sex. 2008; 10:587–599. [PubMed: 18649197]
27. Ayikukwei RM, Ngare D, Sidle JE, et al. Social and cultural significance of the sexual cleansing ritual and its impact on HIV prevention strategies in western Kenya. Sex Culture. 2007; 11:32–50.
28. Johnson K, Way A. Risk factors for HIV infection in a national adult population: evidence from the 2003 Kenya Demographic and Health Survey. J Acquir Immune Defic Syndr. 2006; 42:627–636. [PubMed: 16868500]
29. Joesoef MR, Cheluget B, Marum LH, et al. Differential of HIV prevalence in women and men who attended sexually transmitted disease clinics at HIV sentinel surveillance sites in Kenya, 1990–2001. Int J STD AIDS. 2003; 14:193–196. [PubMed: 12665443]
30. Buve A, Carael M, Hayes RJ, et al. Multicentre study on factors determining differences in rate of spread of HIV in sub-Saharan Africa: methods and prevalence of HIV infection. AIDS. 2001; 15:S5–S14. [PubMed: 11686465]
31. UNAIDS. AIDS epidemic update: December. Geneva: UNAIDS; 2009.
32. Oluoch T, Mohammed I, Bunnell R, et al. Correlates of HIV infection among sexually active adults in Kenya: a national population-based survey. Open AIDS J. 2011; 5:125. [PubMed: 22253668]
33. Newell J, Senkoro K, Mosha F, et al. A population-based study of syphilis and sexually transmitted disease syndromes in north-western Tanzania. 2. Risk factors and health seeking behaviour. Genitourin Med. 1993; 69:421–426. [PubMed: 8282292]
34. Drumright LN, Gorbach PM, Holmes KK. Do people really know their sex partners?: Concurrency, knowledge of partner behavior, and sexually transmitted infections within partnerships. Sex Transm Dis. 2004; 31:437–442. [PubMed: 15215701]
35. Freeman EE, Weiss HA, Glynn JR, et al. Herpes simplex virus 2 infection increases HIV acquisition in men and women: systematic review and meta-analysis of longitudinal studies. AIDS. 2006; 20:73–83. [PubMed: 16327322]

36. Kamali A, Quigley M, Nakiyingi J, et al. Syndromic management of sexually-transmitted infections and behaviour change interventions on transmission of HIV-1 in rural Uganda: a community randomised trial. Lancet. 2003; 361:645–652. [PubMed: 12606175]
37. Rodriguez, MdMP.; Obasi, A.; Mosha, F., et al. Herpes simplex virus type 2 infection increases HIV incidence: a prospective study in rural Tanzania. AIDS. 2002; 16:451–462. [PubMed: 11834958]
38. Celum C, Wald A, Hughes J, et al. Effect of aciclovir on HIV-1 acquisition in herpes simplex virus 2 seropositive women and men who have sex with men: a randomised, double-blind, placebo-controlled trial. Lancet. 2008; 371:2109–2119. [PubMed: 18572080]
39. Ping LH, Cohen MS, Hoffman I, et al. Effects of genital tract inflammation on human immunodeficiency virus type 1 V3 populations in blood and semen. J Virol. 2000; 74:8946–8952. [PubMed: 10982338]
40. Dyer JR, Kazembe P, Vernazza PL, et al. High levels of human immunodeficiency virus type 1 in blood and semen of seropositive men in sub-Saharan Africa. J Infect Dis. 1998; 177:1742–1746. [PubMed: 9607862]
41. Weiss HA, Dickson KE, Agot K, et al. Male circumcision for HIV prevention: current research and programmatic issues. AIDS. 2010; 24:S61–S9. [PubMed: 21042054]
42. Moses S, Bradley JE, Nagelkerke NJ, et al. Geographical patterns of male circumcision practices in Africa: association with HIV seroprevalence. Int J Epidemiol. 1990; 19:693–697. [PubMed: 2262266]
43. Michelo C, Sandoy IF, Fylkesnes K. Marked HIV prevalence declines in higher educated young people: evidence from population-based surveys (1995–2003) in Zambia. AIDS. 2006; 20:1031–1038. [PubMed: 16603856]
44. Kilian AH, Gregson S, Ndyanabangi S, et al. Reductions in risk behaviour provide the most consistent explanation for declining HIV-1 prevalence in Uganda. AIDS. 1999; 13:391–398. [PubMed: 10199230]
45. Johnson LF, Dorrington RE, Bradshaw D, et al. The effect of educational attainment and other factors on HIV risk in South African women: results from antenatal surveillance, 2000–2005. AIDS. 2009; 23:1583–1588. [PubMed: 19521233]
46. Gregson S, Garnett GP, Nyamukapa CA, et al. HIV decline associated with behavior change in eastern Zimbabwe. Science. 2006; 311:664–666. [PubMed: 16456081]
47. Mmbaga EJ, Leyna GH, Mnyika KS, et al. Education attainment and the risk of HIV-1 infections in rural Kilimanjaro Region of Tanzania, 1991–2005: a reversed association. Sex Transm Dis. 2007; 34:947–953. [PubMed: 18077844]
48. Coombe C, Kelly MJ. Education as a vehicle for combating HIV/AIDS. Prospects. 2001; 31:435–445.
49. Lugoe WL, Klepp KI, Skutle A. Sexual debut and predictors of condom use among secondary school students in Arusha, Tanzania. AIDS Care. 1996; 8:443–452. [PubMed: 8863915]
50. Mensch BS, Hewett PC, Erulkar AS. The reporting of sensitive behavior by adolescents: a methodological experiment in Kenya. Demography. 2003; 40:247–268. [PubMed: 12846131]
51. Hewett PC, Mensch BS, Erulkar AS. Consistency in the reporting of sexual behaviour by adolescent girls in Kenya: a comparison of interviewing methods. Sex Transm Infect. 2004; 80:ii43–ii8. [PubMed: 15572639]
52. Turner CF, Ku L, Rogers SM, et al. Adolescent sexual behavior, drug use, and violence: increased reporting with computer survey technology. Science. 1998; 280:867–873. [PubMed: 9572724]
53. Tourangeau R, Smith TW. Asking sensitive questions the impact of data collection mode, question format, and question context. Public Opin Quart. 1996; 60:275–304.
54. van der Elst EM, Okuku HS, Nakamya P, et al. Is audio computer-assisted self-interview (ACASI) useful in risk behaviour assessment of female and male sex workers, Mombasa, Kenya? PLoS One. 2009; 4:e5340. [PubMed: 19412535]

## Table 1

Demographic and behavioural characteristics of persons screened, Kisumu Incidence Cohort Study, Kenya, 2007–2010.[a]

| Characteristic | Total n/N (%) 1106 (100) | Women n/N (%) 572 (51.7) | Men n/N (%) 534 (48.3) |
|---|---|---|---|
| Age group (years) | | | |
| 16–17 | 260/1106 (23.5) | 148/572 (25.9) | 112/534 (21.0) |
| 18–24 | 635/1106 (57.4) | 322/572 (56.3) | 313/534 (58.6) |
| 25–29 | 149/1106 (13.5) | 73/572 (12.8) | 76/534 (14.2) |
| 30–34 | 62/1106 (5.6) | 29/572 (5.1) | 33/534 (6.2) |
| Marital Status | | | |
| Single/never married | 747/1099 (68.0) | 348/569 (61.2) | 399/530 (75.3) |
| Married/living as married | 305/1099 (27.8) | 182/569 (32.0) | 123/530 (23.2) |
| Separated/divorced/widowed | 47/1099 (4.3) | 39/569 (6.9) | 8/530 (1.5) |
| Ethnic group or tribe | | | |
| Luo | 964/1105 (87.2) | 489/571 (85.6) | 475/534 (89.0) |
| Luhya | 83/1105 (7.5) | 48/571 (8.4) | 35/534 (6.6) |
| Kisii | 33/1105 (3.0) | 16/571 (2.8) | 17/534 (3.2) |
| Kikuyu/Maasai/Other | 25/1105 (2.3) | 18/571 (3.2) | 7/534 (1.3) |
| Religion | | | |
| Roman Catholic | 488/1103 (44.2) | 278/570 (48.8) | 210/533 (39.4) |
| Protestant or other Christian | 404/1103 (36.6) | 183/570 (32.1) | 221/533 (41.5) |
| Muslim/Nomiya/Other | 174/1103 (15.8) | 87/570 (15.3) | 87/533 (16.3) |
| No religion | 37/1103 (3.4) | 22/570 (3.9) | 15/533 (2.8) |
| Highest education level | | | |
| Never attended school | 46/1099 (4.2) | 24/570 (4.2) | 22/529 (4.2) |
| Primary school | 386/1099 (35.1) | 227/570 (39.8) | 159/529 (30.1) |
| Secondary school | 381/1099 (34.7) | 187/570 (32.8) | 194/529 (36.7) |
| Post-secondary school[b] | 286/1099 (26.0) | 132/570 (23.2) | 154/529 (29.1) |
| Currently working | | | |
| Yes | 434/1100 (39.5) | 202/569 (35.5) | 232/531 (43.7) |
| No | 666/1100 (60.6) | 367/569 (64.5) | 299/531 (56.3) |
| Lifetime number of sexual partners[c] | | | |
| 1–2 partner | 188/1052 (17.9) | 142/539 (26.4) | 46/513 (9.0) |
| 3–4 partners | 377/1052 (35.8) | 228/539 (42.3) | 149/513 (29.0) |
| ≥5 partners | 487/1052 (46.3) | 169/539 (31.4) | 318/513 (62.0) |
| Number of sexual partners in the last three months[d] | | | |
| 0 partners | 70/1078 | 35/552 (6.3) | 35/526 (6.7) |
| 1 partner | 404/1078 (37.5) | 289/552 (52.4) | 115/526 (21.9) |
| 2–3 partners | 368/1078 (34.1) | 156/552 (28.3) | 212/526 (40.3) |
| ≥4 partners | 236/1078 (21.9) | 72/552 (13.0) | 164/526 (3.12) |
| Any unprotected vaginal or anal sex in the last three months | | | |

| Characteristic | Total n/N (%) 1106 (100) | Women n/N (%) 572 (51.7) | Men n/N (%) 534 (48.3) |
|---|---|---|---|
| Yes | 789/946 (83.4) | 387/476 (81.3) | 402/470 (85.5) |
| No | 157/946 (16.6) | 89/476 (18.7) | 68/470 (14.5) |
| Circumcision as confirmed by physical examination (men only) | | | |
| Uncircumcised | – | | 327/527 (62.1) |
| Circumcised | – | | 200/527 (38.0) |
| Pregnant as confirmed by lab test (women only) | | | |
| Pregnant | – | 28/569 (5.0) | – |
| Not pregnant | – | 541/569 (95.1) | – |
| Used any method to avoid or delay pregnancy in the last three months | | | |
| Yes | 455/1065 (42.7) | 258/567 (45.5) | 197/498 (39.6) |
| No | 610/1065 (57.3) | 309/567 (54.5) | 301/498 (60.4) |
| Self/partner used birth control pills to delay or avoid pregnancy in the last three months[e] | | | |
| Yes | 210/438 (48.0) | 143/256 (55.9) | 67/182 (36.8) |
| No | 228/438 (52.1) | 113/256 (44.1) | 115/182 (63.2) |
| Self/partner used contraceptive injections to delay or avoid pregnancy in the last three months[e] | | | |
| Yes | 165/425 (38.8) | 137/255 (53.7) | 28/170 (16.5) |
| No | 260/425 (61.2) | 118/255 (46.3) | 142/170 (83.5) |

[a] Sample sizes fluctuate for some variables due to missing data. Some percentages do not sum to 100 due to rounding.

[b] Post-secondary education includes technical/vocational training or study at a college or university.

[c] Person with whom the participant had vaginal or anal sex; 54 participants refused to report number of lifetime sexual partners in the ACASI.

[d] Person with whom the participant had vaginal or anal sex; 28 participants refused to report number of sexual partners in the past three months in the ACASI.

[e] Asked of participants who reported using a method to avoid or delay pregnancy in the past three months in the ACASI; participant could select more than one method.

**Table 2**

Correlates of HIV infection among men, Kisumu Incidence Cohort Study, Kenya, 2007–2010.

| | HIV Prevalence at Screening | | Bivariate | | Multiple Regression | |
|---|---|---|---|---|---|---|
| | N | % | OR (95% CI) | p-value | aOR** (95% CI) | p-value |
| Age* | | | 1.20 (1.11, 1.29) | <.0001 | 1.21 (1.07, 1.35) | .0017 |
| Marital status | | | | .0373 | | .2976 |
| Single/never married | 21 | 5.3 | Ref | | Ref | |
| Married/living as married | 12 | 9.8 | 1.95 (0.93, 4.08) | | 0.47 (0.14, 1.57) | |
| Separated/divorced/widowed | 2 | 25.0 | 6.00 (1.14, 31.54) | | 2.08 (0.24, 18.07) | |
| Religion | | | | .5776 | | |
| Roman Catholic | 11 | 5.2 | Ref | | | |
| Protestant or other Christian | 15 | 6.8 | 1.32 (0.59, 2.94) | | | |
| Muslim/Nomiya/Other | 7 | 8.1 | 1.58 (0.59, 4.23) | | | |
| No religion | 2 | 13.3 | 2.78 (0.56, 13.90) | | | |
| Highest education level | | | | .0030 | | .2421 |
| Never attended school | 6 | 27.3 | 9.25 (2.67, 32.08) | | 4.47 (0.95, 21.06) | |
| Primary school | 12 | 7.6 | 2.01 (0.74, 5.51) | | 1.41 (0.42, 4.74) | |
| Secondary school | 11 | 5.7 | 1.48 (0.54, 4.10) | | 1.15 (0.38, 3.50) | |
| Post-secondary school[a] | 6 | 3.9 | Ref | | Ref | |
| Currently working | | | | .8029 | | |
| Yes | 16 | 6.9 | 1.09 (0.55, 2.17) | | | |
| No | 19 | 6.4 | ref | | | |
| Lifetime number of sexual partners[b] | | | | .3646 | | |
| 1–2 | 2 | 4.4 | Ref | | | |
| 3–4 | 7 | 4.7 | 1.09 (0.22, 5.41) | | | |
| 5 or more | 25 | 7.9 | 1.88 (0.43, 8.20) | | | |
| Ever had anal sex | | | | .2108 | | .1577 |
| Yes | 3 | 3.4 | 0.46 (0.14, 1.55) | | 0.37 (0.09, 1.48) | |
| No | 31 | 7.0 | Ref | | Ref | |
| Ever had oral sex | | | | .9831 | | |
| Yes | 9 | 6.6 | 1.01 (0.46, 2.21) | | | |

| | HIV Prevalence at Screening | | Bivariate | | Multiple Regression | |
|---|---|---|---|---|---|---|
| | N | % | OR (95% CI) | p-value | aOR** (95% CI) | p-value |
| No | 26 | 6.6 | Ref | | | |
| Ever been forced into sex | | | | .5502 | | |
| Yes | 6 | 8.2 | 1.32 (0.53, 3.30) | | | |
| No | 29 | 6.4 | Ref | | | |
| Number of sexual partners in the past three months[b] | | | | .9009 | | .4761 |
| 0 | 5 | 14.3 | Ref | | Ref | |
| 1 | 5 | 4.4 | 0.27 (0.07, 1.00) | | 0.31 (0.06, 1.59) | |
| 2–3 | 13 | 6.1 | 0.39 (0.13, 1.18) | | 0.34 (0.08, 1.39) | |
| 4 or more | 12 | 7.3 | 0.47 (0.16, 1.44) | | 0.42 (0.10, 1.74) | |
| Any unprotected vaginal or anal sex in the past three months | | | | .6114 | | |
| Yes | 3 | 4.4 | 1.38 (0.40, 4.70) | | | |
| No | 24 | 6.0 | Ref | | | |
| Sex during special occasions in the past three months | | | | .6831 | | |
| Yes | 10 | 5.5 | 0.85 (0.39, 1.86) | | | |
| No | 20 | 6.4 | Ref | | | |
| STI history | | | | <.0001 | | .0966 |
| Never | 19 | 4.3 | Ref | | Ref | |
| Not recent | 10 | 15.4 | 4.03 (1.78, 9.12) | | 2.09 (0.76, 5.78) | |
| Recent (past three months) | 6 | 24.0 | 7.00 (2.51, 19.53) | | 3.40 (0.99, 11.65) | |
| HSV-2 results | | | | <.0001 | | .0489 |
| Positive | 12 | 20.7 | 6.82 (3.04, 15.29) | | 3.13 (1.12, 8.73) | |
| Indeterminate | 7 | 16.7 | 5.23 (2.02, 13.55) | | 3.04 (0.95, 9.71) | |
| Negative | 16 | 3.7 | Ref | | Ref | |
| Circumcision as confirmed by physical examination (men) | | | | .0070 | | .0109 |
| Uncircumcised | 31 | 8.9 | 4.29 (1.49, 12.35) | | 4.42 (1.41, 13.89) | |
| Circumcised | 4 | 2.2 | Ref | | Ref | |

[a] Post-secondary education includes technical/vocational training, college, or university.

[b] Persons with whom the participant had vaginal or anal sex.

* Continuous variable.

** Odds ratios and confidence intervals adjusted for all variables listed in the column (i.e. all variables with p <.25 in bivariate models).

**Table 3**

Correlates of HIV infection among women, Kisumu Incidence Cohort Study, Kenya, 2007–2010.

| | HIV Prevalence at Screening | | Bivariate | | Multiple Regression | |
|---|---|---|---|---|---|---|
| | N | % | OR** (95% CI) | p-value | aOR** (95% CI) | p-value |
| Age* | | | 1.17 (1.11, 1.23) | <.0001 | 1.16 (1.04, 1.29) | .0085 |
| Marital status | | | | <.0001 | | .9456 |
| Single/never married | 36 | 10.3 | Ref | | Ref | |
| Married/living as married | 44 | 24.2 | 2.76 (1.70, 4.48) | | 1.00 (0.34, 2.97) | |
| Separated/divorced/widowed | 16 | 41.0 | 6.03 (2.92, 12.45) | | 1.26 (0.29, 5.52) | |
| Religion | | | | .8482 | | |
| Roman Catholic | 48 | 17.3 | Ref | | | |
| Protestant or other Christian | 28 | 15.3 | 0.87 (0.52, 1.44) | | | |
| Muslim/Nomiya/Other | 17 | 19.5 | 1.16 (0.63, 2.15) | | | |
| No religion | 4 | 18.2 | 1.07 (0.35, 3.29) | | | |
| Highest education level | | | | .0096 | | .3554 |
| Never attended school | 8 | 33.3 | 4.21 (1.53, 11.61) | | 4.77 (0.49, 46.07) | |
| Primary school | 48 | 21.2 | 2.26 (1.19, 4.28) | | 3.05 (0.84, 11.08) | |
| Secondary school | 27 | 14.4 | 1.42 (0.72, 2.83) | | 2.31 (0.66, 8.08) | |
| Post-secondary school[a] | 14 | 10.6 | Ref | | Ref | |
| Currently working | | | | .0038 | | .6743 |
| Yes | 47 | 23.3 | 1.92 (1.24, 2.99) | | 0.83 (0.35, 1.96) | |
| No | 50 | 13.6 | Ref | | Ref | |
| Lifetime number of sexual partners[b]* | | | | .0010 | | .2903 |
| 1–2 | 11 | 7.8 | Ref | | Ref | |
| 3–4 | 40 | 17.5 | 2.53 (1.25, 5.12) | | 2.52 (0.75, 8.47) | |
| ≥5 | 41 | 24.3 | 3.81 (1.88, 7.74) | | 1.68 (0.46, 6.16) | |
| Ever had anal sex | | | | .0940 | | .5813 |
| Yes | 19 | 12.5 | 0.63 (0.37, 1.08) | | 0.73 (0.24, 2.21) | |
| No | 76 | 18.5 | Ref | | Ref | |
| Ever had oral sex | | | | .5928 | | |
| Yes | 17 | 15.2 | 0.86 (0.48, 1.52) | | | |

| | HIV Prevalence at Screening | | Bivariate | | Multiple Regression | |
|---|---|---|---|---|---|---|
| | N | % | OR** (95% CI) | p-value | aOR** (95% CI) | p-value |
| No | 78 | 17.3 | Ref | | | |
| Ever been forced into sex | | | | .3499 | | |
| Yes | 29 | 19.5 | 1.26 (0.78, 2.04) | | | |
| No | 68 | 16.1 | Ref | | | |
| Number of sexual partners in the past three months[b] | | | | .6828 | | |
| 0 | 6 | 17.1 | Ref | | | |
| 1 | 51 | 15.6 | 0.89 (0.35, 2.27)Ref | | | |
| 2–3 | 28 | 18.0 | 1.06 (0.40, 2.79) | | | |
| 4 or more | 14 | 19.4 | 1.17 (0.41, 3.35) | | | |
| Any unprotected vaginal or anal sex in the past three months | | | | .0725 | | .5167 |
| Yes | 70 | 18.1 | 1.96 (0.94, 4.10) | | 0.70 (0.24, 2.06) | |
| No | 9 | 10.1 | Ref | | Ref | |
| Sex during special occasions in the past three months | | | | .7423 | | |
| Yes | 19 | 17.9 | 1.10 (0.63, 1.92) | | | |
| No | 71 | 16.6 | Ref | | | |
| STI history | | | | <.0001 | | .9115 |
| Not recent | 10 | 15.4 | 4.03 (1.78, 9.11) | | 1.38 (0.32, 5.90) | |
| Recent (past three months) | 6 | 24.0 | 7.00 (2.51, 19.53) | | 1.00 (0.08, 11.81) | |
| Never | 19 | 4.3 | Ref | | Ref | |
| HSV-2 results | | | | <.0001 | | .0114 |
| Positive | 76 | 35.5 | 12.92 (6.94, 24.06) | | 3.85 (1.38, 10.71) | |
| Indeterminate | 9 | 23.1 | 7.04 (2.78, 17.82) | | 0.88 (0.14, 5.59) | |
| Negative | 13 | 4.1 | Ref | | Ref | |
| Pregnant as confirmed by lab test (women) | | | | .0963 | | .9837 |
| Yes | 8 | 28.6 | 2.06 (0.88, 4.82) | | 0.98 (0.09, 10.66) | |
| No | 88 | 16.3 | Ref | | Ref | |
| Used birth control pills to delay or avoid pregnancy in the past three months (women) | | | | .0484 | | .5334 |
| Yes | 33 | 23.1 | 1.96 (1.01, 3.82) | | 1.38 (0.51, 3.74) | |
| No | 15 | 13.3 | Ref | | Ref | |
| Used injections to delay or avoid pregnancy in the past three months (women) | | | | .0355 | | .9940 |

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| | HIV Prevalence at Screening | | Bivariate | | Multiple Regression | |
|---|---|---|---|---|---|---|
| | N | % | OR** (95% CI) | p-value | aOR** (95% CI) | p-value |
| Yes | 33 | 24.1 | 2.02 (1.05, 3.90) | | 1.00 (0.38, 2.67) | |
| No | 16 | 13.6 | Ref | | Ref | |

[a] Post-secondary education includes technical/vocational training, college, or university.

[b] Persons with whom the participant had vaginal or anal sex.

* Continuous variable.

** Odds ratios and confidence intervals adjusted for all variables listed in the column (i.e. all variables with p <.25 in bivariate models).