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Correlates of prevalent sexually transmitted infections among participants screened for an HIV incidence cohort study in Kisumu, Kenya

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Abstract

Background—We determined the prevalence of four sexually transmitted infections and the demographic and behavioural correlates associated with having one or more sexually transmitted infections among participants in an HIV incidence cohort study in Kisumu, western Kenya.

Methods—Participants were enrolled from a convenience sample and underwent aetiologic sexually transmitted infection investigation. Demographic and behavioural information were collected and basic clinical evaluation performed. Multiple regression analysis was done to determine variables associated with having one or more sexually transmitted infections.

Results—We screened 846, 18- to 34-year-olds. One-third had at least one sexually transmitted infection with specific prevalence being, syphilis; 1.6%, gonorrhoea; 2.4%, herpes simplex virus type-2; 29.1%, chlamydia; 2.8%, and HIV; 14.8%. Odds of having any sexually transmitted infection were higher among participants who were women, were aged 20–24 or 30–34 years compared to 18–19 years, had secondary or lower education compared to tertiary education, were divorced, widowed or separated compared to singles, reported having unprotected sex compared to those who did not, reported previous sexually transmitted infection treatment, and tested HIV-positive.

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Conflict of interest

The authors declare no conflict of interest.

Conclusion—Multiple strategies are needed to address the overall high prevalence of sexually transmitted infections as well as the gender disparity found in this Kenyan population. Structural interventions may be beneficial in addressing educational and socio-economic barriers, and increasing the uptake of health-promoting practices.

Keywords

Kenya; sexually transmitted infection; prevalence; correlates; Kisumu

Introduction

Sexually transmitted infections (STIs) are an important cause of morbidity, especially among African women, whose access to timely diagnosis and treatment is often deficient.[1–4] Adverse sequelae include poor birth outcomes, neonatal and infant infections, ectopic pregnancy, anogenital cancer, infertility, pelvic inflammatory disease, and death.[5–8] In addition, many STIs, in particular herpes simplex virus type 2 (HSV-2), facilitate transmission of human immunodeficiency virus (HIV).[9–15]

There are multiple correlates for the acquisition of different STIs, including demographic, behavioural, and biological considerations. With the exception of HSV-2, lower age has been shown to be a risk factor for the acquisition of STIs; younger people are at higher risk of acquiring STIs than are adults.[16–18] Gender and education have been found to be significant factors in STI acquisition. Kenyan women have a higher prevalence of HSV-2 than do men,[19] and a study in Tanzania found that educated women are less likely to be infected with syphilis compared to their uneducated counterparts.[20] Number of sexual partners has also been found to be a risk factor, with sexual concurrency[21] and sexual networks[22] analyses showing that an increasing number of sexual partners is associated with an increased risk of STI acquisition. HIV infection increases the chances of acquiring various STIs and vice versa. A study in Ethiopia found that HIV co-infection predisposes women to getting more ulcerative STIs, especially HSV-2, as well as to failing STI treatment.[27]

In January 2007, Kenya Medical Research Centre (KEMRI)/Centers for Disease Control and prevention (CDC) initiated an HIV incidence cohort study to prepare for future community-based HIV vaccine or other prevention trials among young adults in Kisumu. The purpose of this analysis was to use data from the screening visit for this cohort to determine: (1) overall prevalence of four STIs: syphilis, gonorrhoea, HSV-2, and chlamydia and (2) demographic and behavioural correlates of prevalent STIs.

Methods

Study population

Between January 2007 and March 2009, 1277 participants underwent pre-screening for the Kisumu Incidence Cohort Study (KICoS), an observational prospective cohort study to estimate the incidence of HIV seroconversion and to identify determinants of successful recruitment and retention.[28] Healthy adults who were 18–34 years of age, residents of

Kisumu, sexually active at least once in the past three months, HIV-negative, and not pregnant were eligible to be screened for study participation. Among the 867 who met eligibility for study consideration, 846 completed study screening. Reasons for not being eligible for study consideration or having not completed screening have been presented in the literature.[28]

Information regarding study recruitment has been published elsewhere.[28] In brief, community engagement, which included setting up a Community Advisory Board and fostering collaboration with community leaders and stakeholders (e.g. chiefs, religious leaders, teachers, persons living with HIV, representatives of community-based organisations and special interest groups), occurred prior to initiating study recruitment in the Kisumu city and bordering districts within 150 kilometres of Kisumu city. Using convenience sampling, two methods were used to recruit study participants: venue-based recruitment and advertisement through study brochures. Recruitment venues included market centres, truck stops, beaches, churches, special interest groups, educational institutions, and HIV voluntary counselling and testing centres. Demographic and behavioural information from screened participants was collected using both staff-administered computer-assisted personal interview (CAPI) and participant self-administered audio computer-assisted self-interview (ACASI). In addition, participants underwent a medical examination which included genital examination for STIs and laboratory testing for gonorrhoea, chlamydia, syphilis, and HSV-2 regardless of symptoms or signs. In addition, rapid HIV test with pre- and post-test counselling was conducted. An appointment was scheduled two weeks thereafter to deliver laboratory results and make available final determination of study eligibility and, if eligible, complete enrolment.

Ethical approval

This study was approved by the KEMRI Scientific Steering Committee and Ethical Review Committee and the CDC Institutional Review Board. All persons interested in study participation provided written informed consent in one of the three languages of their preference (English, Dholuo, or Swahili) to screen for eligibility study enrolment. All persons who took part in the eligibility screening received a standard transport reimbursement of KES 300 (USD 3.50). In addition, they received counselling and treatment for STIs and other common ailments as well as provision of condoms (men and women).

Data analysis

Only participants who completed all screening procedures (n=846) were included in this analysis. Exact binomial confidence intervals were calculated for the prevalence of specific STIs. Initially, a log-binomial model was fit for correlates of STIs but did not converge. Therefore, three logistic regression models were fit for the outcome: acute STIs (chlamydia and gonorrhoea) model, chronic STIs (syphilis and HSV-2) model, and a combined model for both acute and chronic STIs. Unadjusted odds ratios were computed using bivariate analysis while adjusted odds ratios were computed using multiple regression analysis. The multiple regression model included all variables with $p<.25$ or those suspected to be important in the bivariate model. Data analysis was done using SAS for Windows version 9.2 (SAS, Cary, North Carolina, USA).

Measures

The dependent variable was defined as testing positive for syphilis, gonorrhoea, chlamydia, and/or HSV-2 during the screening visit of the study. Independent variables included gender, circumcision status (for men), age, highest level of education, employment status, marital status, ever inherited (referring to the Luo cultural practice of a widow being inherited by the men next of kin of the deceased husband or another man),[29] alcohol use in the past 3 months, age at sexual debut, lifetime number of sex partners, anal sex in the past 3 months, time since last sex, unprotected sex at last sex with main partner, ever treated for an STI, and HIV-seropositive.

Laboratory analysis

Serum syphilis testing was performed using BD MicroVue™ RPR (Rapid Plasma Reagin) Card test (BD & Company, Baltimore, USA) and all reactive tests confirmed by Serodia® TP-PA Syphilis Test (Fujirebio Inc., Tokyo, Japan). Serum HSV-2 serology was tested using KALON® HSV-2 IgG enzyme-linked immunoassay (ELISA) (Kalon Biologicals Ltd., Surrey, UK) and infection with *Chlamydia trachomatis* or *Neisseriae gonorrhoeae* (self-administered vaginal swabs for women and urine for men) was evaluated by qualitative polymerase chain reaction, using COBAS® AMPLICOR CT/NG (Roche Diagnostics, Mannheim, Germany). Real-time parallel rapid HIV testing on whole blood was conducted using UniGold 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 tie-breaker.

Results

Demographic characteristics

Among the 846 persons who completed all screening procedures, women and circumcised men accounted for 424 (50.4%) and 167 (19.8%) of the participants, respectively. The median age of participants was 22.0 years (range 18–34 years) with 62.6% being 20–24 years of age. The majority (81.4%) were Christian, and more than half (61.2%) of the participants had never been married. Of the 93.5% who had attended school, 69.8% had more than primary education. Those who were students at the time of screening accounted for 19.1% of the participants (Table 1).

STI prevalence

Overall, 272 (32.2%) (95% CI 29.0, 35.4) participants had at least one STI, with women accounting for 75.7% of those infected. Specifically, the prevalence was 1.6% (95% CI 0.8, 2.8) for syphilis (men 0.7% and women 2.6%), 2.4% (95% CI 1.4, 3.6) for gonorrhoea (men 0% and women 4.7%), 29.1% (95% CI 26.0, 32.3) for HSV-2 (men 13.3% and women 44.8%), and 2.8% (95% CI 1.8, 4.2) for chlamydia (men 2.8% and women 2.8%). Prevalence of co-infection with more than one STI was 3.7% (95% CI 2.5, 5.2; men 1.2% and women 6.1%), 3.5% for those with two STIs (men 1.2% and women 5.9%) and 0.1% for those with three STIs (men 0.1% and women 0.2%). HSV-2 was present in all co-infections. Overall HIV prevalence was 14.8% (95% CI 12.2, 17.1) (men 7.8% and women

21.2%) with 10.0% (95% CI 8.1, 12.3) (men 3.1% and women 16.9%) of those screened having both HIV and another STI (Table 2).

Multiple logistic regression analysis

The odds of having acute chlamydia or gonorrhoea were higher among women participants compared to circumcised men (Table 3). The odds of having chronic syphilis or HSV-2 (Table 4) were higher among participants who were women compared to circumcised men; were 20–24 or 30–34 years of age compared to 18–19 years; had secondary or lower education compared to college or university education: were divorced, widowed, or separated or were married or living as married compared to being single; reported having unprotected sex at last sex with main partner compared to those who did not; reported previous treatment for STIs compared to those who did not: reported previous STI treatment compared to those who did not; and tested HIV-positive compared to those negative. Conversely, the odds of having a chronic syphilis or HSV-2 were lower among participants who reported recreational drug use compared to those who did not and those who reported engaging in anal sex compared to those who did not.

When all the STIs were combined together (Table 5), the odds of having one or more STI were higher among participants who: were women compared to circumcised men; were 20–24 or 30–34 years of age compared to 18–19 years; had secondary or lower education compared to college or university education; were divorced, widowed, or separated compared to being single; reported having unprotected sex at last sex with main partner compared to those who did not; reported previous treatment for STIs compared to those who did; and tested HIV-positive compared to those negative. On the other hand, the odds of having STIs were lower among participants who reported engaging in anal sex compared to those who did not.

Discussion

Our data show that more than a third of screened participants for an HIV incidence cohort study in periurban Kisumu, western Kenya, had at least one STI (syphilis, gonorrhoea, HSV-2, and/or chlamydia). These results are consistent with what was seen in two studies previously done in the study area.[19,30] Several factors were associated with having an STI, including female gender, low education level, unprotected sex with a main partner, being divorced/widowed/separated or married, and being HIV-infected.

Women accounted for most (75.7%) STI infections, which is consistent with findings from other studies conducted in the same general geographical location, including the four cities study,[30] the Asembo baseline cross-sectional HIV survey,[31] and the Kenya Demographic and Health and Kenya AIDS Indicator Surveys.[19,32] The 10-fold prevalence of HSV-2 infection compared to other STIs is consistent with the known epidemiology in many regions of the world.

Overall, the odds of having one or more STI were six times as great for women as circumcised men. The odds were 1.2 times as great for uncircumcised men as for circumcised men even though this was not significant; suggesting, as has been reported in

other studies,[20,33] that circumcision is protective for STIs in men. Even when the STIs were segregated by acuteness, the odds were still greater in women with women having four times and five times greater odds than their circumcised male counterparts. Not unexpectedly, unprotected sex with a main partner was also associated with having an STI.[25,26,34] This, however, was not true with having an acute STI. Other studies have shown that women in this and other societies are often in a subordinate position and may lack the power to make decisions about condom use,[35–40] and that despite the provision of condoms and risk-reduction counselling, unprotected sex out of marriages continues.[41,42]

Our analysis also documents that having low education and being divorced, widowed, or separated are important correlates for having a chronic STI. Studies have shown that having increased education is associated with more knowledge, safer sexual behaviours, and lower HIV infection rates to the extent that education has been called the "social vaccine."[41] Our data suggests that marital status was associated with higher odds of having an STI for divorced/widowed or separated individuals, most of whom were women. This may be related to previous reports that divorce for women is a risk factor for being involved in commercial sex work and the starting of other relationships.[42–44] Divorced, widowed, or separated women may have pressing financial obligations, including dependent children, and few skills to earn money, thus they resort to some type of transactional sex, including sex work.

We found that HIV-positive individuals had more than four times the odds of having a chronic STI. Several other studies have also shown that a relationship exists between HIV infection and STIs.[23,27,34,45] A study in Ethiopia found that HIV co-infection predisposes women to developing more frequent ulcerative STIs, especially HSV-2, as well as to failing STI treatment. [27] These findings were also seen in another study in Tanzania that enrolled high-risk women which are consistent with what was seen in this study.[34] Behavioural interventions to prevent HIV have been shown to also work to prevent most STIs.[13,46–49] Biomedical interventions to prevent HIV such as tenofovir vaginal gel microbicide have been shown to have the potential to also prevent HSV-2 infection and, thus, may be especially helpful in impacting the HIV epidemic in sub Saharan Africa.[50–52]

Even though several studies have shown anal sex to be a risk factor for prevalent and incident STIs,[53–58] we found the odds of having chronic STIs lower among participants who reported anal sex compared to those who did not. This may be due to the fact that we did not screen for any rectal STIs. We also found the odds of having STIs to be lower in those using recreational drugs contrary to what most studies have reported.[59–61] Reported recreational drug use was rare in our study population, which might reflect the lower availability of recreational drugs in inland western Kenya than at the coast and urban slums in Nairobi,[62–64] and we therefore feel that this finding in our analysis might reflect a spurious association due to low numbers.

Several limitations should be considered in the interpretation of our findings. First, our participants may not be representative of the Kisumu population as they were volunteers for a research study and were recruited through convenience sampling. However, the screening HIV prevalence we found is nearly identical to local population estimates from national

surveillance data,[19] suggesting that perhaps the study participants may be representative of the local community regardless of the convenience sampling and potential bias of desiring to participate in a research study. Second, there may be response bias as with any self-reported behavioural/risk data collection, although we believe use of ACASI facilitated more truthful responding[65,66] than face-to-face interviews would have. Thirdly, our diagnosis of chlamydia/gonorrhoea was an assay for active disease, but for HSV-2 and syphilis was serology, which may have missed recent acquisition and which also classifies people as positive even if their infection was remote and is inactive. We also did not test for any rectal STIs and so could not correlate this to anal sex. Lastly, because this was a cross-sectional study evaluating prevalence of STI and HIV within a prospective study, we cannot determine timing or causality. The strength of our analysis, however, is that we were able to collect and correlate both behavioural and biological correlates of prevalent STI.

In conclusion, similar to HIV infection in Kenya, STI prevalence is high in this part of Kenya, with women more likely to be infected than men in our research setting. Multiple strategies are needed to address the overall high prevalence of STIs as well as the gender disparity. In addition to increasing screening and access to health care,[67] and developing women-controlled biomedical interventions like vaginal microbides, [68] non-medical methods should be employed to reduce the gender disparity in HIV and STIs. Because HIV can be considered an STI (although it was considered separately in this analysis), the structural methods which may have an impact are virtually the same as for HIV, and would include focusing on education, about which the WHO has stated that, "…a good basic education ranks among the most effective-and cost-effective-means of HIV prevention."[69] In conjunction with education, reducing early marriage is another important strategy, as the husbands of married adolescents and young adult women are more likely to be HIV-positive compared to the male partners of single woman.[31,70] Finally, empowerment of adolescent girls and women through structural and economic interventions has been effectively used to improve their health.[3,71] By using multiple strategies (biomedical, socio-economic, and cultural), STI and HIV prevalence in Kenya could be reduced.

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Table 1

Demographic characteristics of participants completing KICoS screening in Kisumu, Kenya (2007–2008).

Characteristic (n = 846)	n/N	Percentage
Gender/male circumcision status[a]		
Women	424/842	50.4
Uncircumcised men	251/842	29.8
Circumcised men	167/842	19.8
Age, years		
18–19	105/846	12.4
20–24	530/846	62.6
25–29	149/846	17.6
30–34	62/846	7.3
Religion		
Roman catholic	318/845	37.6
Protestant or other Christian	370/845	43.8
Muslim	27/845	3.2
Nomiya[b]	45/845	5.3
Other	60/845	7.1
No religion	25/845	3.0
Marital status		
Never married	515/842	61.2
Married or living as married	286/842	34.0
Divorced/separated/widowed[c]	41/842	4.9
Level of education		
Primary or below[c]	254/842	30.2
Secondary	311/842	36.9
Technical	63/842	7.5
College or university	214/842	25.4
Currently employed		
No	440/844	52.0
Yes	404/844	47.8
Occupation		
Farmer	28/841	3.3
Salaried worker	22/841	2.6
Casual worker	117/841	13.9
Self-employed	146/841	17.4
Homemaker	62/841	7.4
Students not otherwise employed	161/841	19.1
Not employed	279/841	33.2
Other	26/841	3.1

Note: Sample sizes fluctuate slightly for some variables due to missing data. Some percentages do not sum to 100 due to rounding.

[a] Four men refused to respond to question about circumcision status.

[b] Religion of the Luo, the predominant ethnic group in the area.

[c] Responses solicited separately then combined for analysis.

Table 2

Prevalence of specific sexually transmitted infections (STIs) among participants completing KICoS screening in Kisumu, Kenya, by age and gender (2007–2008).

	Men					Women					
Age (Years)	**18–19 (n = 49)**	**20–24 (n = 254)**	**25–29 (n = 76)**	**30–34 (n = 33)**	**Total (n = 422)**	**18–19 (n = 56)**	**20–24 (n = 266)**	**25–29 (n = 73)**	**30–34 (n = 29)**	**Total (n = 424)**	**Overall prevalence [95% exact CI]**
Chlamydia	4.1%	3.4%	0.0%	3.0%	2.8%	1.8%	3.4%	2.7%	0.0%	2.8%	2.8% [1.8%–4.2%]
Gonorrhoea	0.0%	0.0%	0.0%	0.0%	0.0%	5.4%	4.1%	5.5%	6.9%	4.7%	2.4% [1.4%–3.6%]
Syphilis	0.0%	0.4%	1.3%	3.0%	0.7%	3.6%	1.9%	2.7%	6.9%	2.6%	1.6% [0.8%–2.8%]
HSV-2[a]	6.1%	10.6%	14.5%	42.4%	13.3%	25.0%	42.9%	56.2%	72.4%	44.8%	29.1% [26.0%–32.3%]
HSV-2[b]	6.3%	11.2%	17.7%	48.3%	14.4%	27.5%	46.5%	60.3%	77.8%	48.4%	31.5% [28.2%–34.9%]
HIV					7.8%					21.2%	14.8% [12.2%–17.1%]
HIV/STI coinfection[c]					3.1%					16.9%	10.0% [8.1%–12.3%]

[a] Indeterminates counted as negatives.

[b] Indeterminates dropped from analysis.

[c] Infection with HIV in addition to any other STI.

Table 3

Correlates of acute *Chlamydia Trachomatis* (CT) and *Neisseriae gonorrhoeae* (NG) among participants completing KICoS screening in Kisumu, Kenya (2007–2008).

	Have CT/NG	Bivariate		Multiple Regression	
Variable	**n/N (%)**	**OR [95% CI]**	***p* Value**	**AOR [95% CI]**	***p* Value**
Gender/men circumcision status			0.0243		0.0442
Circumcised men	4/167 (2.4)	*ref.*		*ref.*	
Uncircumcised men	8/251 (3.2)	1.34 [0.40–4.53]	0.6361	1.73 [0.44–6.85]	0.4341
Women	30/424 (7.1)	3.10 [1.08–8.95]	0.0362	3.78 [1.07–13.36]	0.0392
Age, years			0.9358		
18–19	6/105 (5.7)	*ref.*			
20–24	27/530 (5.1)	0.89 [0.36–2.20]	0.7938		
25–29	6/149 (4.0)	0.69 [0.22–2.21]	0.5346		
30–34	3/62 (4.8)	0.84 [0.20–3.48]	0.8089		
Highest level of education			0.0418		0.2058
College/University	6/214 (2.8)	*ref.*		*ref.*	
Technical	3/63 (4.8)	1.73 [0.42–7.14]	0.4463	2.45 [0.55–10.94]	0.2393
Secondary	12/311 (3.9)	1.39 [0.51–3.77]	0.5158	1.60 [0.53–4.84]	0.4035
Primary and below	21/254 (8.3)	3.12 [1.24–7.89]	0.0159	3.00 [0.99–9.12]	0.0532
Currently employed					
No	25/440 (5.7)	*ref.*			
Yes	17/404 (4.2)	0.73 (0.39–1.37)			
Marital status			0.0241		0.0919
Never married	23/515 (4.5)	*ref.*		*ref.*	
Married/Living as married	13/286 (4.6)	1.02 [0.51–2.04]	0.9585	0.51 [0.23–1.15]	0.1038
Divorced/Widowed/Separated	6/41 (14.6)	3.67 [1.40–9.59]	0.0081	1.55 [0.53–4.55]	0.4254
Ever inherited or been inherited					
No	40/797 (5.0)	*ref.*			
Yes	1/34 (2.9)	0.57 [0.08–4.30]	0.5886		
Alcohol use in the past 3 months[b]					
No	21/482 (4.4)	*ref.*			

	Have CT/NG	Bivariate		Multiple Regression	
Variable	**n/N (%)**	**OR [95% CI]**	***p* Value**	**AOR [95% CI]**	***p* Value**
Yes	21/363 (5.8)	1.35 [0.73–2.51]	0.3458		
Recreational drug use in the past 3 months[b]					
No	36/706 (5.1)	*ref.*			
Yes	6/137 (4.4)	0.85 [0.35–2.06]	0.7235		
Age of sexual debut, years			0.0724		0.3070
22–34	4/26 (15.4)	*ref.*			
16–21	18/458 (3.9)	0.23 [0.07–0.72]	0.0121	0.32 [0.08–1.28]	0.1079
8–15	20/314 (3.4)	0.37 [0.12–1.19]	0.0960	0.53 [0.13–2.13]	0.3687
<7	0/17 (0.0)	*undefined*	0.9842	*undefined*	0.9826
Number of lifetime sex partners			0.6866		
0–1	3/111 (2.7)	*ref.*			
2–5	23/429 (5.4)	2.04 [0.60–6.92]	0.2529		
6–10	9/156 (5.8)	2.20 [0.58–8.33]	0.2442		
>10	6/112 (5.4)	2.04 [0.50–8.36]	0.3230		
Engaged in anal sex in the past 3 months					
No	31/684 (4.5)	*ref.*			
Yes	10/152 (6.6)	1.48 [0.71–3.10]	0.2933		
Time since last sex			0.0072		0.1477
Never	2/15 (13.3)	*ref.*		*ref.*	
Within three months	27/676 (4.0)	0.27 [0.06–1.26]	0.0955	0.42 [0.08–2.19]	0.3039
Four to six months	4/58 (6.9)	0.48 [0.08–2.92]	0.4267	0.63 [0.10–4.10]	0.6250
More than six months	8/57 (14.0)	1.06 [0.20–5.61]	0.9443	1.18 [0.21–6.82]	0.8510
Unprotected sex at last sex with main partner in the past 3 months[c]					
No	9/265 (3.4)	*ref.*		*ref.*	
Yes	32/564 (5.7)	1.71 [0.81–3.64]	0.1629	1.59 [0.72–3.55]	0.2533
Ever treated for STI					
No	34/706 (4.8)	*ref.*			
Yes	8/131 (6.1)	1.29 [0.58–2.84]	0.5348		
HIV-positive					
No	35/723 (4.8)	*ref.*			

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Variable	Have CT/NG n/N (%)	Bivariate OR [95% CI]	*p* Value	Multiple Regression AOR [95% CI]	*p* Value
Yes	7/123 (5.7)	1.19 [0.52–2.73]	0.6885		

OR: odds ratio; AOR: adjusted odds ratio; CI: confidence interval; ref: reference group

[a] Multiple regression model includes all variables with p <.25 in bivariate model.

[b] Any use reported; not necessarily abuse or misuse.

[c] Also includes participants who reported unprotected sex with a non-main or primary partner.

Note: Sample sizes fluctuate slightly for some variables due to missing data. Some percentages do not sum to 100 due to rounding.

Table 4

Correlates of prevalent chronic syphilis and HSV-2 infections among participants completing KICoS screening in Kisumu, Kenya (2007–2008).

	HSV-2/Syphilis	Bivariate		Multiple regression[a]	
Variable	**n/N (%)**	**OR [95% CI]**	***p* Value**	**AOR [95% CI]**	***p* Value**
Gender/men circumcision status			<0.0001		<0.0001
Women	192/424 (45.3)	5.75 [3.50–9.44]	<0.0001	4.99 [2.51–9.91]	<0.0001
Uncircumcised men	36/251 (14.3)	1.16 [0.65–2.07]	0.6065	0.75 [0.36–1.56]	0.4437
Circumcised men	21/167 (12.6)	*ref.*		*ref.*	
Age, years			<0.0001		0.0528
18–19	19/105 (18.1)	*ref.*		*ref.*	
20–24	143/530 (27.0)	1.67 [0.98–2.85]	0.0584	2.19 [1.09–4.42]	0.0282
25–29	52/149 (34.9)	2.43 [1.33–4.42]	0.0038	2.00 [0.89–4.52]	0.0941
30–34	35/62 (56.5)	5.87 [2.90–11.89]	<0.0001	3.79 [1.42–10.15]	0.0080
Highest level of education			<0.0001		0.0028
Primary and below	118/254 (46.5)	5.12 [3.25–8.06]	<0.0001	2.71 [1.43–5.14]	0.0022
Secondary	92/311 (29.6)	2.48 [1.58–3.90]	<0.0001	2.19 [1.24–3.87]	0.0070
Technical	7/63 (11.1)	0.74 [0.31–1.77]	0.4956	0.70 [0.24–2.10]	0.5273
College or university	31/214 (14.5)	*ref.*		*ref.*	
Currently employed					
No	113/404 (25.7)	*ref.*	0.0139	*ref.*	0.2524
Yes	135/440 (33.4)	1.45 [1.08–1.96]		1.28 [0.84–1.96]	
Marital status			<0.0001		0.0090
Never married	87/515 (16.9)	*ref.*		*ref.*	
Married or living as married	131/286 (45.8)	4.16 [3.00–5.77]	<0.0001	1.87 [1.12–3.11]	0.0163
Divorced/separated/widowed	28/41 (68.3)	10.60 [5.28–21.27]	<0.0001	3.57 [1.30–9.84]	0.0137
Ever inherited or been inherited					
No	221/797 (27.7)	*ref.*		*ref.*	
Yes	22/34 (64.7)	4.78 [2.33–9.82]	<0.0001	1.77 [0.64–4.88]	0.2707
Alcohol use in the past 3 months[b]					
No	175/482 (36.3)	*ref.*		*ref.*	
Yes	73/363 (20.1)	0.44 [0.32–0.61]	<0.0001	0.76 [0.47–1.21]	0.2477

Variable	HSV-2/Syphilis n/N (%)	Bivariate OR [95% CI]	*p* Value	Multiple regression[a] AOR [95% CI]	*p* Value
Recreational drug use in the past 3 months[b]					
No	232/706 (32.9)	*ref.*		*ref.*	
Yes	16/137 (11.7)	0.27 [0.16–0.47]	<0.0001	0.36 [0.16–0.84]	0.0177
Age of sexual debut, years			0.2031		0.8661
22–34	6/26 (23.1)	*ref.*		*ref.*	22–34
16–21	148/458 (32.3)	1.59 [0.63–4.05]	0.3292	1.68 [0.49–5.80]	0.4082
8–15	81/314 (25.8)	1.16 [0.45–2.99]	0.7605	1.63 [0.46–5.82]	0.4495
< 7	4/17 (23.5)	1.03 [0.24–4.35]	0.9726	1.89 [0.30–11.84]	0.4954
Number of lifetime sex partners			0.0236		0.3161
0–1	35/111 (31.5)	*ref.*		*ref.*	
2–5	144/429 (33.6)	1.10 [0.70–1.72]	0.6848	1.50 [0.83–2.74]	0.1835
6–10	34/156 (21.8)	0.61 [0.35–1.05]	0.0748	1.95 [0.89–4.25]	0.0946
> 10	27/112 (24.1)	0.69 [0.38–1.24]	0.2171	2.07 [0.87–4.93]	0.0996
Engaged in anal sex in the past 3 months					
No	216/684 (31.6)	*ref.*			
Yes	30/152 (19.7)	0.53 [0.35–0.82]	0.0042	0.33 [0.18–0.61]	0.0003
Time since last sex			0.0038		0.8725
Never	5/15 (33.3)	*ref.*		*ref.*	
Within three months	182/676 (26.9)	0.74 [0.25–2.19]	0.5818	1.72 [0.46–6.36]	0.4202
Four to six months	23/58 (39.7)	1.31 [0.40–4.35]	0.6540	1.52 [0.34–6.78]	0.5854
More than six months	27/57 (47.4)	1.80 [0.55–5.93]	0.3341	1.69 [0.40–7.15]	0.4790
Unprotected sex at last sex with main partner in the past 3 months[c]					
No	47/265 (17.7)	*ref.*		*ref.*	
Yes	195/564 (34.6)	2.45 [1.71–3.51]	< 0.0001	1.77 [1.10–2.85]	0.0191
Ever treated for STI					
No	191/706 (27.1)	*ref.*		*ref.*	
Yes	53/131 (40.5)	1.83 [1.25–2.70]	0.0021	2.31 [1.31–4.06]	0.0037
HIV-positive					
No	165/723 (22.8)	*ref.*		*ref.*	
Yes	84/123 (68.3)	7.28 [4.80–11.06]	< 0.0001	4.43 [2.56–7.68]	< 0.0001

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OR: odds ratio; AOR: adjusted odds ratio; CI: confidence interval; ref: reference group.

[a]Multiple regression model includes all variables with $p<.25$ in bivariate model.

[b]Any use reported; not necessarily abuse or misuse.

[c]Also includes participants who reported unprotected sex with a non-main or primary partner.

Note: Sample sizes fluctuate slightly for some variables due to missing data. Some percentages do not sum to 100 due to rounding.

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Table 5

Correlates of acute and chronic sexually transmitted infections (STIs) among participants completing KICoS screening in Kisumu, Kenya (2007–2008).

	Have STIs[a]	Bivariate		Multiple regression[b]	
Variable	**n/N (%)**	**OR [95% CI]**	***p* Value**	**AOR [95% CI]**	***p* Value**
Gender/men circumcision status			<0.0001		<0.0001
Women	206/424 (48.6)	5.92 [3.66–9.56]	<0.0001	6.12 [3.20–11.72]	<0.0001
Uncircumcised men	43/251 (17.1)	1.29 [0.75–2.24]	0.3573	1.20 [0.61–2.33]	0.6000
Circumcised men	23/167 (13.8)	*ref.*			
Age, years			<0.0001		0.0431
18–19	23/105 (21.9)	*ref.*			
20–24	160/530 (30.2)	1.54 [0.94–2.54]	0.0886	2.13 [1.12–4.04]	0.0214
25–29	53/149 (35.6)	1.97 [1.11–3.49]	0.0202	1.73 [0.82–3.64]	0.1508
30–34	36/62 (58.1)	4.94 [2.49–9.79]	<0.0001	3.41 [1.34–8.67]	0.0100
Highest level of education			<0.0001		0.0006
College or university	37/214 (17.3)	*ref.*			
Technical	9/63 (14.3)	0.80 [0.36–1.76]	0.5741	1.09 [0.44–2.72]	0.8570
Secondary	96/12 (30.9)	2.14 [1.39–3.28]	0.0005	2.02 [1.19–3.43]	0.0092
Primary and below	129/254 (50.8)	4.94 [3.21–7.60]	<0.0001	3.24 [1.80–5.83]	<0.0001
Currently employed			0.0503		0.4533
No	128/440 (29.1)	*ref.*		*ref.*	
Yes	143/404 (35.4)	1.34 (1.00–1.78			
Marital status			<0.0001		0.0133
Never married	103/515 (20.0)	*ref.*			
Married or living as married	136/286 (47.6)	3.63 [2.64–4.98]	<0.0001	1.58 [0.98–2.57]	0.0635
Divorced/separated/widowed	30/41 (73.2)	10.91 [5.29–22.50]	<0.0001	4.04 [1.43–11.38]	0.0082
Ever inherited or been inherited			<0.0001		0.5410
No	243/797 (30.5)	*ref.*			
Yes	22/34 (64.7)	4.18 [2.04–8.58]		1.34 [0.52–3.47]	
Alcohol use in the past 3 months[c]			<0.0001		0.5477
No	185/482 (38.4)	*ref.*			
Yes	86/363 (23.7)	0.50 [0.37–0.68]		0.87 [0.56–1.36]	

	Have STIs[a]	Bivariate		Multiple regression[b]	
Variable	**n/N (%)**	**OR [95% CI]**	***p* Value**	**AOR [95% CI]**	***p* Value**
Recreational drug use in the past 3 months[c]			<0.0001		0.0616
No	250/706 (35.4)	*ref.*			
Yes	21/137 (15.3)	0.33 [0.20–0.54]		0.51 [0.25–1.03]	
Age of sexual debut, years			0.5835		
22–34	9/26 (34.6)	*ref.*			
16–21	155/458 (33.8)	0.97 [0.42–2.22]	0.9355		
8–15	94/314 (29.9)	0.81 [0.35–1.88]	0.6184		
<7	4/17 (23.5)	0.58 [0.15–2.31]	0.4416		
Number lifetime sex partners			0.0133		0.3047
0–1	37/111 (33.3)	*ref.*			
2–5	158/429 (36.8)	1.17 [0.75–1.81]	0.4945	1.71 [0.96–3.02]	0.0674
6–10	37/156 (23.7)	0.62 [0.36–1.07]	0.0850	1.69 [0.81–3.53]	0.1653
>10	30/112 (26.8)	0.73 [0.41–1.30]	0.2870	1.88 [0.84–4.22]	0.1278
Engaged in anal sex in the past 3 months			0.0089		0.0005
No	233/684 (34.1)	*ref.*			
Yes	35/152 (23.0)	0.58 [0.39–0.87]		0.38 [0.22–0.65]	
Time since last sex			0.0007		0.6119
Never	5/15 (33.3)	*ref.*			
Within three months	198/676 (29.3)	0.83 [0.28–2.46]	0.7342	2.11 [0.57–7.89]	0.2653
Four to six months	264/58 (44.8)	1.63 [0.49–5.35]	0.4245	2.54 [0.58–11.16]	0.2183
More than six months	30/57 (52.6)	2.22 [0.67–7.32]	0.1897	2.54 [0.60–10.71]	0.2058
Unprotected sex at last sex with main partner in the past three months[d]			<0.0001		0.0054
No	52/265 (19.6)	*ref.*			
Yes	212/564 (37.6)	2.47 [1.74–3.49]		1.88 [1.21–2.94]	
Ever treated for STI			0.0021		0.0037
No	210/706 (29.8)	*ref.*			
Yes	57/131 (43.5)	1.82 [1.24–2.66]		2.23 [1.30–3.82]	
HIV-positive			<0.0001		<0.0001
No	187/723 (25.9)	*ref.*			
Yes	85/123 (69.1)	6.41 [4.23–9.73]		3.24 [1.91–5.51]	

OR: odds ratio; AOR: adjusted odds ratio; CI: confidence interval; ref: reference group.

[a] The 4 STIs were syphilis, gonorrhoea, HSV-2 and Chlamydia.

[b] Multiple regression model includes all variables with $p<.25$ in bivariate model

[c] Any use reported; not necessarily abuse or misuse

[d] Also includes participants who reported unprotected sex with a non-main or primary partner Note: Sample sizes fluctuate slightly for some variables due to missing data. Some percentages do not sum to 100 due to rounding.

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