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A nested case-control study of sexual practices and risk factors for prevalent HIV-1 infection among young men in Kisumu, Kenya

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Abstract

Objectives—To investigate sexual practices and risk factors for prevalent HIV infection among young men in Kisumu, Kenya.

Goal—The goal of this study was to identify behaviors associated with HIV in Kisumu to maximize the effectiveness of future prevention programs.

Study Design—Lifetime sexual histories were collected from a nested sample of 1337 uncircumcised participants within the context of a randomized controlled trial of male circumcision to reduce HIV incidence.

Results—Sixty-five men (5%) tested positive for HIV. Multiple logistic regression revealed the following independent predictors of HIV: older age, less education being married, being Catholic, >4 lifetime sex partners, prior treatment for an STI, sex during partner's menstruation, ever practicing bloodletting, and receipt of a medical injection in the last 6 months. Prior HIV testing and post coital cleansing were protective.

Conclusions—This analysis confirms the importance of established risk factors for HIV and identifies practices that warrant further investigation.

Keywords

HIV; risk factors; sexual behavior; Africa

Introduction

By the end of 2005, The Joint United Program on HIV/AIDS estimated that approximately 38.6 million people (33.4–46.0) were living with HIV and over 60% of them resided in sub-Saharan Africa.¹ While evidence suggests HIV incidence is declining in some parts of sub-Saharan Africa^{1, 2}, it is estimated that 2.7 million people became infected with HIV in 2005,¹ reaffirming the need to refine and implement improved prevention strategies. Thus, to evaluate risk factors for prevalent HIV-1 infection, we analyzed cross-sectional data from a nested sample of 1337 uncircumcised men aged 18–24 years participating in the context of a

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randomized controlled trial (RCT) of male circumcision (MC) to reduce HIV-1 incidence in Kisumu, Kenya.

Materials and Methods

To investigate the safety and effectiveness of MC to reduce HIV-1 incidence, we are conducting a RCT of MC in Kisumu, the Provincial Capital of Nyanza Province in Western Kenya. In 2003, the overall prevalence of HIV infection among adults in Kenya was estimated to be 6.7%^{3, 4} and the majority of HIV infections are thought to be acquired through heterosexual intercourse.¹ To investigate sexual practices and risk factors for HIV, we recruited men who were screened in the RCT between March 2004 and September 2005. These included consenting seropositive and seronegative men who had experienced sex within the last 12 months, were uncircumcised, aged 18-24 years, and resident in Kisumu District. Interviews were conducted by men fluent in the three most common languages spoken in Kisumu (English, DhoLuo, and Kiswahili) and interviewers were blind to the HIV status of participants. This study received ethical approval from the institutional review boards at the University of Illinois at Chicago, the University of Nairobi, and the University of Manitoba.

To obtain comprehensive lifetime sexual histories, information about every sexual relationship since sexual debut was collected for up to 12 partners. Concurrent partnerships were determined by extrapolation from the dates obtained in the interview when the start and end dates of any two partners overlapped. All participants provided permission to obtain their HIV test results from the trial using their unique study identifier. Men were tested for HIV-1 using two parallel rapid tests: UniGold (Trinity Biotech, Ireland) and Determine (Abbott Laboratories, Inc., Abbott Park, Ill.). Men with concordant positive results were informed of their HIV status and were referred to a post-test support group, which provides counselling, treatment of opportunistic infections, income-generating activities, and referral to a collaborating clinic that provides comprehensive HIV/AIDS care, including the provision of anti-retroviral therapy if indicated. Specimens from men with discordant rapid test results underwent further testing by double ELISA.

Associations between prevalent HIV infection and self-reported demographic characteristics and behaviors were evaluated singly and through multiple logistic regression analysis. Because of the small number of HIV positive men, Fisher's Exact Tests were used to test associations between dichotomous variables. Associations between HIV infection and continuous variables were evaluated by independent t-tests or by the Wilcoxin Sum Rank test (depending on their distributions). A final model was built by adding demographic characteristics and behavioral risk factors that were significant at $p < 0.10$ in bivariate analyses one at a time, and calculating log likelihood ratio tests to identify variables that significantly added to the model. Multiplicative effect modifiers and potential confounding factors were also assessed. The Hosmer Lemeshow test was used to assess the goodness-of-fit of the final model and regression diagnostics were used to identify discriminative capacity and potential covariate patterns that were poorly fitted or highly influential.⁵ All statistical analyses were conducted in SAS Version 8.2 (SAS Institute Inc., Cary, North Carolina, USA).

Results

Between March 2004 and September 2005, 1348 of the 2059 eligible men enrolled in the study, yielding an overall response rate of 65%. Eleven men were excluded from the analysis: 6 did not complete the interview; 3 were later determined to be ineligible, 1 was missing data on HIV status, and 1 was judged to be giving false answers. Thus, 1337 men were included in the final sample. For a complete description of the sample, see Table 1.

The median number of lifetime sex partners was 5 (IQR 3-9). Only 66 men (5%) reported one lifetime sex partner. Eleven hundred and sixty-three men (87%) reported 12 partners or less and thus, provided information on all of their lifetime partners. The median age of reported sexual debut was 15 (IQR 13-17). Receiving oral sex, performing oral sex and engaging in insertive anal intercourse were reported infrequently (7%, 5%, and 1%, respectively). Only four men reported sex with another man and three reported receptive anal intercourse. Most men (93%) reported unprotected sex with one or more of the partners: 206 (17%) reported unprotected sex with one partner, 239 (19%) reported unprotected sex with two partners and 792 (59%) reported unprotected sex with three or more partners. Further, 210 men (16%) reported never using condoms with any of the partners discussed in their sexual histories. Eight hundred and forty-two men (63%) had at least one concurrent sexual partnership (e.g. two overlapping partners) in their lifetime sexual history. Of these, 249 (30%) had only one instance of overlapping partners, 166 (19%) had two instances, and 416 (49%) had 3 or more instances where two partnerships overlapped.

Bivariate Analyses

Of the 1337 men who enrolled, 65 (5%) were HIV antibody positive (see Table 1.) As hypothesized, HIV infection was associated with number of lifetime partners. The median number of partners for HIV negative men was 5.0, compared to 8.0 for HIV positive men (Wilcoxon Rank Sum test = 4.6, $p < 0.01$). Moreover, it is notable that none of the 66 men who reported just one lifetime sex partner tested positive for HIV.

Lack of consistent condom use, as defined by not always using a condom during penetrative sex with a partner, was also associated with increased odds of infection. In fact, all of the HIV positive men reported unprotected sex with more than one partner. The median number of unprotected partners for HIV negative men was 3, compared to 5 for HIV positive men (Wilcoxon Rank Sum test = 4.5, $p < 0.01$). HIV infection was also associated with concurrent partnerships. In general, as the number of concurrent partnerships increased, so did HIV seroprevalence. The median number of concurrent partnerships for HIV negative men was 1 versus 2 for HIV positive men (Wilcoxon Rank Sum test = 2.6, $p < 0.01$).

Men who experienced possible exposure to blood through either iatrogenic or traditional practices were also more likely to be HIV positive. Those who reported an injection in the last 6 months were almost 3 times more likely to be HIV positive, those who ever practiced bloodletting (saro) were 2 times more likely to be infected, and those who reported tattoos were 2 times as likely to be HIV positive. There was no association between HIV infection and ever donating blood or ever receiving a blood transfusion.

Finally, we also identified practices that were associated with reduced likelihood of HIV infection. Men who reported previous HIV testing and men who reported washing their genitals immediately after their last vaginal intercourse (i.e. post coital washing) were also less likely to be diagnosed with HIV.

Multivariable Analyses

The final logistic model is presented in Table 2. According to the Hosmer and Lemeshow Goodness-of-Fit Test, the model adequately fit the data ($p=0.82$) and regression diagnostics indicated that the discriminative capacity of the model was good (area under ROC curve = 0.87). In addition to demographic characteristics previously found to be related to HIV infection in Kenya, men who identified themselves as Catholic as compared to all others were almost twice as likely to be HIV positive. Although Catholics were no less likely to use condoms (OR 0.9 95% CI 0.7-1.3) or report greater number of lifetime partners (OR 1.1 95% CI 0.9-1.4), they were more likely to report 2 or more concurrent partners (OR 1.4, 95% CI

1.1-1.7). In addition to number of sex partners and previous STI, men who ever had sex with a woman while she was menstruating were twice as likely to be HIV positive. Men who practiced bloodletting or received an injection in the last 6 months were also more likely to be HIV positive. Behaviors that were less likely to be reported by men who were HIV positive were prior HIV testing and post coital cleansing. No multiplicative effect modifiers were identified in this analysis.

Discussion

In this nested case-control study of young men participating in a RCT of MC in Kisumu, Kenya, we confirmed the importance of previously established risk factors for HIV infection and identified several practices that warrant further study. As consistently noted elsewhere⁶⁻⁹, we found that the number of lifetime sexual partners was of pivotal importance. Greater number of lifetime partners was also associated with more unprotected partners (OR 5.4 95% CI 4.0-7.1) and more concurrent partnerships (OR 7.7 95% CI 6.0-9.9). Similarly, men who used condoms consistently or were faithful to one partner were less likely to be infected. However, as has been found in other studies in Africa¹⁰⁻¹², condom use did not remain significant after adjustment for other risk factors in multivariable models. This lack of association could be due to inaccuracies in self-reported data or possibly because we measured frequency, but not correctness of condom use.

Some have suggested that concurrent partnerships may contribute to the spread of HIV.¹³⁻¹⁶ Although bivariate analyses revealed an association between concurrent partnerships and HIV, this association was not significant after adjustment was made for other variables. Duration of concurrent partnerships may contribute as much or more to the risk of HIV¹⁶ as presence or number of such partnerships, which should be explored in future studies.

Consistent with previous studies, men who reported a history of a sexually transmitted infection had increased odds of being HIV positive.^{6, 17-22} Sex with a woman while she was menstruating was also more common among the HIV positive men. Although some studies early in the epidemic found evidence to suggest that sex during menstruation may increase the risk of HIV^{9, 23, 24} or other STIs²⁵, and this is biologically plausible, we are not aware of any recent studies that have reported an association. Also consistent with previous studies in sub-Saharan Africa, the following demographic characteristics were associated with HIV infection: older age^{3, 26}, less education²⁷, being married^{4, 17, 20}, and religious affiliation.^{28, 29}

Although there is a general consensus that heterosexual transmission accounts for 90% or more of HIV infections in sub-Saharan Africa,¹ some have argued that iatrogenic transmission of HIV, through blood transfusions and medical injections, has been grossly underestimated.³⁰⁻³⁸ Although transfusions were not associated with HIV infection, only 3% of men reported transfusions which did not provide sufficient power to detect an association. Receipt of injections was associated with HIV, even after controlling for treatment of prior STIs. However, because this is a cross-sectional analysis, it is also possible that HIV positive men were more likely to report recent injections to treat HIV/AIDS related illnesses. We also found an association between HIV and the practice of bloodletting (saro), which persisted in multivariable analyses. It is possible that bloodletting may increase the risk of HIV through exposure to another person's blood if a knife or other instrument is used in succession without proper sterilization. However, this practice is not typically performed in succession, but rather on an individual basis, making it unlikely that knives serve as fomites for transmission.³⁹ Further, it is less likely that residual blood would stay infective on a knife for as long as it would on a hollow device such as a needle.³⁹ Some prior studies found types of scarification to be a risk for HIV^{40, 41}, while others have not.^{41, 42}

We also documented practices associated with reduced odds of infection: prior HIV testing and post-coital cleansing. That men who reported prior testing for HIV have reduced odds of infection could be because men who seek HIV testing practice less risky behaviors,^{43, 44} or it could be attributed to the beneficial effects of risk reduction counseling, which is a standard component of voluntary counseling and testing (VCT).^{45,46} Similar to a recent study in Nairobi, men who reported washing their genitals immediately after sex had reduced odds of being infected with HIV.⁴⁷ In multivariable analyses (not shown) post-coital washing was associated with fewer unprotected partners, not drinking alcohol, and not practicing bloodletting, so it is possible that the association between men testing positive for HIV and post coital washing is confounded by other factors. Also, hygiene practices reported by HIV positive men may not reflect their behaviors at the time of HIV acquisition.⁴⁷

Although the overall response rate was 65%, a differential response rate was noted according to HIV serostatus. Of the 1769 eligible HIV seronegative men, 1272 (72%) enrolled; however, of the 290 eligible HIV positive men, only 65 men (22%) enrolled. We hypothesize that fewer HIV positive men chose to participate in this study as they had just been informed of their serostatus and did not want to be interviewed about their sexual behavior; however, it is possible that those who participated engaged in different behavior than those who did not. We compared the demographic characteristics of HIV positive men who enrolled in the study to those who did not enroll and found no significant differences. We did not have behavioral data available for the HIV positive men who chose not to enroll in this study, thus it was not possible to compare sexual practices.

Despite these limitations, this analysis has important strengths. It is noteworthy that we obtained lifetime sexual histories on 87% of participants and described sexual practices not commonly reported elsewhere. Though this study confirms previously documented risk factors for HIV (e.g. greater number of lifetime partners, older age, less education), it also identifies others that have not been consistently documented in the literature including sex with a woman while she is menstruating, bloodletting, receipt of injections, being Catholic and the protective effect of post coital cleansing. Some of these practices have the potential for modification and if the results are replicated in other studies, they could be incorporated into prevention campaigns.

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Table 1
Demographic & Behavioral Characteristics Associated with Prevalent HIV Infection (n = 1337)

Variable	Total n	(%)	HIV + n	(%)	HIV - n	(%)	Unadjusted OR 95% CI	Age Adjusted OR 95% CI
Age ^{**}								
21-24	706	(52)	48	(8)	583	(92)	3.3, 1.9 to 5.9	n/a
18-20	631	(47)	17	(3)	689	(97)		
Education ^{**}								
<9 years	262	(20)	29	(11)	233	(89)	3.6, 2.2 to 6.0	3.7, 2.2 to 6.1
>= 9 years	1075	(80)	36	(3)	1039	(97)		
Income								
> 2000 ksh/m	543	(41)	36	(7)	507	(93)	1.9, 1.1 to 3.1	1.4, 0.9 to 2.4
<= 2000 ksh/m	793	(59)	29	(4)	764	(96)		
Marital status ^{**} (n = 1336)								
Married or living with partner	106	(8)	21	(20)	85	(80)	6.8, 3.9 to 12.0	5.3, 3.0 to 9.5
Single	1230	(92)	43	(4)	1187	(96)		
Religion [*]								
Catholic	369	(28)	25	(7)	344	(93)	1.7, 1.0 to 2.8	1.6, 0.9 to 2.6
All others	968	(72)	40	(4)	928	(96)		
Age at Sexual Debut								
Less than 17	991	(74)	50	(5)	941	(95)	1.2, 0.7 to 2.3	1.6, 0.8 to 2.9
17 or greater	343	(26)	14	(4)	329	(96)		
Number of lifetime Sex Partners ^{**}								
Five or more	769	(58)	52	(7)	717	(93)	3.1, 1.7 to 5.7	2.6, 1.5 to 4.5
Less than five	568	(42)	13	(2)	555	(98)		
Ever taken alcohol [*]								
Yes	952	(71)	55	(6)	897	(94)	2.3, 1.2 to 4.6	2.0, 1.0 to 3.9
No	385	(29)	10	(3)	375	(7)		
Ever smoked marijuana ^{**}								
Yes	389	(29)	35	(9)	354	(91)	3.0, 1.8 to 5.0	2.6, 1.6 to 4.4
No	948	(71)	30	(3)	918	(97)		
Ever taken mirah [*]								
Yes	352	(26)	24	(7)	328	(93)	1.7, 1.9 to 5.9	1.5, 0.9 to 2.6
No	985	(74)	41	(4)	944	(96)		
Ever had sex during menstruation ^{**}								
Yes	318	(24)	29	(9)	289	(91)	2.7, 1.7 to 4.5	2.6, 1.5 to 4.3
No	1019	(76)	36	(4)	983	(96)		
Number of partners ever had unprotected sex with ^{**}								
More than 1	1031	(77)	62	(6)	969	(94)	6.5, 2.0 to 20	3.7, 1.9 to 7.4
0-1	306	(23)	3	(1)	303	(99)		
Ever had unprotected sex with a regular partner								
Yes	1127	(84)	58	(5)	1069	(95)	1.6, 0.7 to 3.5	1.5, 0.7 to 3.3
No	210	(16)	7	(3)	203	(97)		
Ever had unprotected sex with a casual partner ^{**}								
Yes	890	(67)	54	(6)	836	(94)	2.6, 1.3 to 4.9	2.5, 1.3 to 4.8
No	447	(33)	11	(2)	436	(98)		
Ever had sex with a woman for money or gifts ^{**}								
Yes	484	(36)	37	(8)	447	(92)	2.4, 1.5 to 4.0	2.2, 1.3 to 3.7
No	853	(64)	28	(3)	825	(98)		
Ever had unprotected sex with a sex worker ^{**}								
Yes	71	(5)	10	(14)	61	(86)	3.6, 1.8 to 7.4	3.0, 1.5 to 6.2
No	1266	(95)	55	(4)	1211	(96)		
Had more than 10 sexual encounters with 2 or more partners ^{**}								

Variable	Total n	(%)	HIV + n	(%)	HIV - n	(%)	Unadjusted OR 95% CI	Age Adjusted OR 95% CI
Yes	348	(26)	31	(9)	317	(91)	2.7, 1.7 to 4.5	2.4, 1.4 to 3.9
No	989	(74)	34	(3)	955	(97)		
Had 2 or more concurrent partnerships								
Yes	581	(44)	38	(7)	543	(93)	1.9, 1.1 to 3.1	1.7, 1.0 to 2.9
No	756	(56)	27	(4)	729	(96)		
Reported genital sores in the last 6 months								
Yes	155	(12)	21	(14)	134	(86)	4.1, 2.3 to 7.0	3.6, 2.1 to 6.2
No	1182	(88)	44	(4)	1138	(86)		
Reported genital discharge in the last 6 months								
Yes	62	(5)	11	(18)	51	(82)	4.9, 2.4 to 9.9	4.9, 2.4 to 10.1
No	1275	(95)	54	(4)	1221	(96)		
Ever treated for an STI (n = 1329)								
Yes	283	(21)	36	(13)	247	(88)	5.1, 3.1 to 8.5	4.6, 2.7 to 7.7
No	1046	(79)	29	(3)	1017	(97)		
Ever received an injection in the last 6 months								
Yes	513	(38)	39	(8)	474	(92)	2.5, 1.5 to 4.2	2.6, 1.5 to 4.3
No	824	(62)	26	(3)	798	(97)		
Ever practiced bloodletting** (saro) (n = 1326)								
Yes	412	(31)	30	(7)	382	(93)	2.1, 1.3 to 3.5	2.1, 1.3 to 3.5
No	914	(69)	33	(4)	881	(94)		
Ever been tattooed (n = 1336)								
Yes	86	(6)	8	(9)	78	(91)	2.2, 1.0 to 4.7	2.2, 1.0 to 4.9
No	1250	(94)	56	(5)	1194	(95)		
Ever previously tested for HIV* (n = 1336)								
Yes	422	(32)	12	(3)	410	(97)	0.5, 0.3 to 0.9	0.43, 0.2 to 0.8
No	914	(68)	53	(6)	861	(94)		
Washed genitals immediately after last sexual intercourse								
Yes	381	(29)	6	(2)	375	(98)	0.2, 0.1 to 0.6	0.25, 0.10.6
No	956	(71)	59	(6)	897	(94)		

Fisher's Exact Test Results:

*
p < 0.05,**
p < 0.01

Table 2
Final Model of Factors associated with HIV infection (n = 1316)

Parameter	β	OR	95% CI	Pr > ChiSq
Age				
21-24 versus 18-20	1.01	2.8	1.4-5.3	<0.01
Education				
<=9 years versus >9 years	0.93	2.5	1.4-4.6	<0.01
Marital Status				
Married/cohabitating versus not married	1.10	3.0	1.5-5.9	<0.01
Religion				
Catholic versus all others	0.58	1.8	1.0-3.2	0.05
Number of Lifetime Sex Partners				
More than 5 versus less	0.72	2.1	1.1-4.0	0.03
Ever treated for an STI				
Yes versus no	0.99	2.7	1.5-4.8	<0.01
Ever sex during menstruation				
Yes versus no	0.73	2.1	1.1-3.7	0.02
Ever practice bloodletting (saro)				
Yes versus no	0.69	2.0	1.1-3.5	0.02
Received an injection last 6 months for any reason				
Yes versus no	0.72	2.0	1.1-3.7	0.02
Ever previously tested for HIV				
Yes versus no	-0.67	0.5	0.3-1.0	0.06
Washed genitals immediately after last sex				
Yes versus no	-1.22	0.3	0.1-0.8	0.01