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Identification of Novel Risks for Non-Ulcerative Sexually Transmitted Infections Among Young Men in Kisumu, Kenya

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Abstract

Objectives—STI prevention interventions often aim to reduce HIV incidence. Understanding STI risks may lead to more effective HIV prevention.

Goal—To identify STI risks among men aged 18–24 in Kisumu, Kenya.

Study Design—We analyzed baseline data from a randomized trial of male circumcision. Participants were interviewed for socio-demographic and behavioral risks. *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) were diagnosed by polymerase chain reaction assay and *Trichomonas vaginalis* (TV) by culture. The outcome for logistic regression analysis was infection with NG, CT, or TV.

Results—Among 2,743 men, 214 (7.8%; 95% CI: 6.8 – 8.8%) were infected with any STI. In multivariable analysis, statistically significant risks for infection were: living one's whole life in Kisumu (OR=1.50; 95% CI: 1.12 – 2.01), preferring “dry” sex (OR=1.47; 95% CI: 1.05 – 2.07), HSV-2 seropositivity (OR=1.37; 95% CI: 1.01 – 1.86), and inability to ejaculate during sex (OR=2.04; 95% CI: 1.15 – 3.62). Risk decreased with increasing age and education, and cleaning one's penis < 1 hour after sex (OR=0.51; 95% CI: 0.33 – 0.80).

Conclusion—Understanding how post-coital cleaning, “dry” sex, and sexual dysfunction relate to STI acquisition may improve STI and HIV prevention.

Short Summary—We identify novel risks for non-ulcerative STI among young men in Kisumu, Kenya. Understanding how post-coital cleaning, preferring “dry” sex, and sexual dysfunction relate to STI acquisition may lead to improved STI and HIV prevention.

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Likelihood ratio testing demonstrated that condom use at last sex explained more of the variance than did frequency of condom use.

Background

There are an estimated 16 million cases of *Chlamydia trachomatis* (CT), 17 million cases of *Neisseria gonorrhoeae* (NG), 32 million cases of *Trichomonas vaginalis* (TV), and over 3 million HIV cases incident annually in Sub-Saharan Africa [1–2]. In addition to reducing directly associated morbidity, STI control is also recognized as a potential means for limiting HIV acquisition [3–6]. While a community-level STI intervention trial in Tanzania found a 40% reduction in HIV incidence, but inconclusive reductions in STI incidence [3], two other community intervention trials in Uganda and one sex-worker intervention trial in Kenya found reductions in STI incidence but not HIV incidence [4–6]. The reasons for these different findings are multiple and complex, including stage of epidemic, HIV prevalence, confounding with genital herpes infection, other ulcerative and non-ulcerative STIs, and population differences in sexual behaviors [7–12]. In modeling the effect of STI treatment on HIV incidence, Korenromp et al. found that reductions in sex with female sex workers and number of sex partners had a significant impact on effectiveness; by reducing the prevalence of STI through behavior change, the effect of STI treatment on HIV incidence is also reduced [13]. Knowledge of STI behavioral risks can maximize intervention effectiveness by identifying specific modifiable behaviors, as well as persons who may benefit most from education, counseling, screening, and treatment.

We sought to identify demographic and behavioral factors associated with non-ulcerative STI among young men enrolled in a randomized trial assessing the effect of circumcision on HIV incidence in Kisumu, Kenya. Analysis of the baseline data – prior to the intervention and ongoing counseling, testing and treatment associated with trial participation – allowed for assessment of risks for non-ulcerative STI in young, sexually active men.

Methods

Study Design and Participants

This is a cross-sectional analysis of baseline data, collected between February 2002 and September 2005. The cohort consisted of men aged 18–24 enrolled in a randomized controlled trial of male circumcision to reduce HIV acquisition in Kisumu, Kenya [14]. Study participants were recruited from sexually transmitted disease clinics, workplaces, social events, and youth organizations. Potential participants were given a copy of the consent form to read and study. If they agreed, they were given an appointment to return for randomization and possible circumcision within one week of the screening visit. At the second visit, the counselor assessed the potential participant's level of understanding the study, answered any questions, and obtained consent.

For inclusion in the study, men had to be uncircumcised, HIV negative, sexually active in the last 12 months, aged 18–24 years, have a hemoglobin ≥ 9.0 mmol/L, and be resident in Kisumu District with no plans to move away for the duration of follow-up (two years). Men were excluded if their foreskin covered less than half the glans, if they had hemophilia or another bleeding disorder, a medical condition contraindicating surgery, or an absolute indication for circumcision. If there were no temporary or permanent excluding conditions, the participant was asked to give informed consent for enrolment in the study. If there was a temporary, medically curable condition present making it advisable to defer potential surgery (e.g. malaria, severe lower respiratory infection), then the participant was treated and asked to return for randomization after recovery.

Testing for HIV infection was conducted using a parallel double rapid test protocol, using Determine® HIV 1/2 (Abbott Diagnostic Division, Hoofddorp, The Netherlands), and the Uni-Gold Recombigen™ HIV Test (Trinity Biotech, Wicklow, Ireland). Men with concordant

positive results were informed of their HIV status and followed-up at the study clinic or at the New Nyanza Provincial Hospital. They were referred to the clinic's resource center and other organizations for people living with HIV. Men who were concordant negative were eligible for the study.

This study was approved by the Institutional Review Boards of the University of Illinois at Chicago, the Kenyatta National Hospital, RTI International, and University of Manitoba.

Data Collection

All consenting participants underwent standardized medical examination and history, and personal interview to obtain socio-demographic and health information and to assess behavioral risk factors. The questionnaire was translated from English to Kiswahili and Dho Luo, each by two persons independently. A third, independent, non-study staff person read the translation and suggested revisions, if there were discrepancies. Interviews were conducted by trained, experienced, local language-speaking counsellors in the participant's language of choice, English, Dho Luo, or Kiswahili. Demographic variables included age, home district, years living in Kisumu, occupation, employment status, income, educational attainment, marital status, who the participant lived with, religion, and importance of religion. Sexual behaviors assessed included age at first sex, condom use, sex with another man, preference for "wet" or "dry" sex with a woman, and sexual practices in the past 6 months: sex during a woman's menstruation, gifts to a woman for sex, and paying money to a woman for sex. Other sexual practices assessed were the frequency of oral sex and anal insertive sex with a woman, and sex with a woman the same day as meeting. Number of sex partners was assessed for the past 30 days, 6 months, 12 months, and the participant's lifetime. Three questions assessed the frequency of penile trauma during sexual intercourse: soreness; cuts, abrasions, or scratches; and bleeding. Participants were asked how many hours it was until they cleaned their penis after the last time they had sex, and also what they cleaned their penis with. Six questions assessed specific sexual dysfunction occurring for 2 or more weeks during the past 6 months [15]: lack of interest in sex, inability to come to ejaculate, ejaculating too quickly, pain during intercourse, lack of pleasure in sex, and difficulty achieving or maintaining an erection.

Sexually Transmitted Infection Testing

Participants were asked to provide urine specimens which were tested for *Neisseria gonorrhoeae* (NG) and *Chlamydia trachomatis* (CT) by polymerase chain reaction (PCR) assay (AMPLICOR® CT/NG Test, Roche Diagnostics, Montreal, Canada), and for *Trichomonas vaginalis* (TV) by culture (InPouch™ TV test, Biomed Diagnostics, Oregon, United States). Men with urethral discharge had a urethral swab taken for PCR testing for NG and CT and culture for NG and TV. Serum specimens were tested for syphilis antibody and herpes simplex virus type 2 (HSV-2) antibody (Kalon HSV-2 IgG ELISA, Kalon Biological Limited, Aldershot, United Kingdom). Positive Rapid Plasma Reagin (RPR) (Macro-Vue™, Becton Dickinson, New Jersey, United States) tests were confirmed by *Treponema pallidum* hemagglutination (TPHA) assay (Randox Laboratories Ltd., Ardmore, United Kingdom). If genital ulcers were present, specimens were obtained for *Haemophilis ducreyi* culture using chocolate agar supplemented with 0.2% activated charcoal, 3 mg/L vancomycin, and 1% IsoVitalex. Urine, urethral swabs, and blood specimens were sent to the University of Nairobi Department of Medical Microbiology for testing. All tests were conducted according to manufacturers' instructions.

Data Analysis

Non-ulcerative STI was defined as a positive test result for NG or CT by urine PCR or urethral swab culture (NG) or PCR (NG, CT), or a positive test for TV by urine or urethral swab culture. To be included in analysis, participants had to be tested for all three infections. The outcome

for analysis was infection with a non-ulcerative STI, dichotomized as positive for any infection versus negative for all three. Explanatory variables included demographics, sexual behaviors, post-coital cleaning, penile trauma, preference for wet or dry sex, and sexual dysfunction. In exploratory analysis, differences between explanatory variables and the outcome were assessed by the chi-square test for categorical variables. Variables significant at the $p < 0.20$ level in exploratory analysis were examined by univariate logistic regression with likelihood ratio testing compared to the null model. Variables significant at the $p < 0.20$ level by likelihood ratio testing were entered into multivariable logistic regression using stepwise procedure with forwards selection for entry and likelihood ratio testing for backwards elimination [16]. Those variables with a likelihood ratio p -value < 0.05 were maintained in the multivariable model. Wald test p -values are presented for the final multivariable model. The area under the receiver operative characteristic (ROC) curve was calculated as a summary measure of the discriminating ability of the final model. Data were analyzed using STATA/SE 9.2 for Windows (Stata Corp., College Station, TX).

Results

Between February 2002 and September 2005, 6,686 men were screened, and 6,159 (92%) met initial inclusion criteria. Of these men, 5,622 (91%) tested negative for HIV (8% tested positive, and 1% tested indeterminate). Twenty percent of these men did not meet the other study eligibility criteria and were excluded. Of the remaining 4,489 subjects eligible for the trial, 2,784 (62%) consented to participation and were randomized. Reasons for exclusion and non-participation are listed in Table 1. Among the 2,784 men enrolled, 8 men were excluded from this analysis: 5 did not complete the baseline interview, 2 were aged 17, and 1 was aged 25.

Of the 2,776 participants eligible for analysis, 2,743 (98.8%) had testing for all three infections and were included in this analysis (Table 2). Among the 2,743 participants, there were 188 (6.9%) participants with one infection, 25 (0.9%) with two infections, and one with all three infections, for a total of 214 (7.8%; 95% confidence interval [C.I.]: 6.8 – 8.8%) infections. Of the dual infections, 11 were NG and CT co-infections, 9 were CT and TV co-infections, and 5 were NG and TV co-infections. Approximately 28% of men tested positive for HSV-2. Twenty-seven (1.0%) men had active syphilis (RPR $\geq 1:1$ and TPHA positive) and none tested positive for *H. ducreyi*.

Interviews were conducted in English (62%), Dho Luo (36%), and Kiswahili (2%). Participants' median age was 20, and almost half (49%) reported Kisumu as their home district. Other frequently named home districts were neighboring: Siaya (15.8%), Nyando (9.2%), Bondo (7.8%), and Rachuonyo (7.5%). Additional participant socio-demographic and behavioral characteristics are shown in Table 2.

The median age of first sex was 16 years. While 86% of men were sexually active in the past 6 months, 44% reported no sex partners in the past 30 days. Condoms were used "always" by 22% and "never" by 26% of respondents; 48% reported using a condom the last time they had sex. Approximately one-fifth of men reported cleaning their penis within one hour of having sex; 1,614 (59%) men said they cleaned their penis with a dry cloth using no water or soap, while 601 (22%) used soap and water, and 131 (4.8%) used water alone. Fifteen percent of men reported giving money or gifts to a woman to have sex in the past 6 months. Almost half of participants said they preferred "dry" sex. Anal insertive sex with a woman was infrequent, reported by 4.0% of men. Sex with a man was reported by 6 participants.

Exploratory Analysis: Factors Associated with Non-Ulcerative STI

The prevalence of infection varied by several socio-demographic characteristics (Table 3), and was increased among those who were: aged 18–19, married or had a live-in partner, or salaried,

less educated, farmers/fishermen, or lived their whole lives in Kisumu. There was also an increased prevalence of infection among HSV-2 seropositive men and those who reported: increasing sex partners in the past 30 days¹, having sex with a woman the day they met, preference for “dry” sex, inability to ejaculate or ejaculating too quickly during sex, and cuts or abrasions on their penis during sex. The prevalence of infection was lower among men who reported condom use at their last sexual intercourse² and cleaning their penis < 1 hour after sex. How the men reported cleaning their penis (dry cloth, soap and water, water only) was not associated with prevalence of infection. Number of lifetime sex partners or sex partners in the past 12 months, age at first sex, years being sexually active, and income were not associated with infection, either as continuous or categorical variables. Syphilis infection was not associated with non-ulcerative STI.

In bivariate analyses, the association between religious importance and infection disappeared when controlling for education. The protective association between traveling to Nairobi and infection became non-significant when controlling for either education, using a condom at last sex, preference for wet or dry sex, or HSV-2 status. The association of penile cuts or abrasions during sex with STI was attenuated when adjusting for numerous individual variables.

Logistic Regression Analysis: Factors Associated with Non-Ulcerative STI

Results of multivariable logistic regression are shown in Table 4. Variables that were entered in multivariable analysis that were not retained in the final model were: condom used at last sex, religious importance, sex in the past 6 months, occupation, ejaculating too quickly, ever having sex with a woman on the day met, marital status and income source. Living one's whole life in Kisumu remained a risk factor (OR=1.50; 95% CI: 1.12 – 2.01), as did preference for dry sex (OR=1.47; 95% CI: 1.05 – 2.07), inability to ejaculate for 2 or more weeks in the past 6 months (OR=2.04; 95% CI: 1.15 – 3.62), and HSV-2 seropositivity (OR=1.37; 95% CI: 1.01 – 1.86). Risk decreased with increasing age and education. Those who reported cleaning their penis within one hour after sex were also less likely to have a non-ulcerative STI diagnosed (OR=0.51; 95% CI: 0.33 – 0.80). There were no statistically significant two-way interaction terms identified. Hosmer-Lemeshow goodness-of-fit test produced a p-value of 0.79, indicating adequate fit of the model. The area under the ROC was 0.67, indicating fair discriminative capacity, although a predicted probability a cut-off value of 5.6% was necessary to identify 80% of infected participants, which produced a specificity of 42.3% and a positive predictive value of 10.5%.

Discussion

We found a 7.8% prevalence of non-ulcerative STI (NG, CT, and TV) among men aged 18–24 residing in Kisumu, Kenya, higher than previously reported among young men in Kisumu [17]. In keeping with findings from other studies [18–20], we found lower risk of infection with condom use and increasing age and education. We found increased risk with Kisumu home district and genital herpes infection. In addition, we found other associations that have been infrequently documented in the literature: an increased risk of STI with preference for dry sex and inability to ejaculate during sex, and decreased risk among those who reported immediate post-coital cleaning of their penis.

Although all participants resided in Kisumu District, those who lived their whole life in Kisumu had increased risk for infection. A study comparing residents of rural districts Siaya and Bondo to those of Kisumu, a city of over 500,000 people, found that, controlling for numerous socio-

¹The prevalence of infection also increased with increasing number of sex partners in the past 6 months (p=0.088). However, likelihood ratio testing demonstrated number of sex partners in the past 30 days explained more variance (p=0.026).

²Infection status was also associated with frequency of condom use (never, inconsistent, always).

demographics, sexual risk behaviors did not differ between urban and rural men [21]. We found that in bivariate analyses men who lived in Kisumu their whole lives were more likely to be aged 18–19, less likely to clean their penis immediately after sex, and had lower educational attainment. Thus there may be some residual confounding associated with this variable, leading to the observed association. However, it is likely that living one's whole life in Kisumu is a marker for unmeasured exposures. The risk associated with living one's whole life in Kisumu may reflect cultural or regional differences in behavior among districts of origins. It is possible that living one's whole life in Kisumu reflects involvement with sexual networks with greater density, behavioral risk, or STI prevalence.

Among a cohort of 147 female sex workers in Meru, Kenya, 36% reported practicing dry sex [22]. Dry sex was associated with inconsistent condom use, genital sores, and previous STI. The authors note that the prevalence of dry sex and how it is practiced varies by region in Africa. In our study, when men were asked what the woman did to make her vagina dry for sex, 70% said she dried or wiped her vagina with a cloth, 23% did not know what the woman did, and 7% gave other answers. Unlike in some communities in southern Africa [23], our results do not indicate that women in Kisumu use agents to dry their vagina. Other details concerning the practice of dry sex were not assessed, such as the proportion of intercourse that is "dry", how often dry sex is performed (e.g., number of times per day or week), the partner type with which it is practiced, or whether it is performed as a singular event or as part of multiple sexual intercourse events. Additional bivariate analyses identified less frequent preference for dry sex among men reporting penile soreness during sex, or higher income or education. Preference for dry sex was more prevalent among men with multiple recent sex partners, HSV-2 seropositivity, age 20–24, and inability to ejaculate during sex. Thus the preference for dry sex appears to parallel risks for non-ulcerative STI. The potential for compromised epidermal and mucosal integrity that may occur through dry sex, in both the index and partner, may explain the increased STI risk associated with preference for this practice. Further research is necessary to define the practice of dry sex, and whether this is directly associated with increased risk for STI.

In a national household survey conducted in Britain, using similar definitions of sexual dysfunction reported in our study, 35% of men aged 18–44 reported any sexual dysfunction for at least one month in the past year [24]. Adjusting for age and marital status, men with sexual dysfunction were twice as likely as those without to report STI diagnosis in the past 5 years [25]. A household probability sample of men aged 18–59 in the United States also assessed prevalence of sexual dysfunction using similar definitions as ours [15]. Adjusting for numerous socio-demographic variables, men with premature ejaculation or erectile dysfunction (analyzed as separate outcomes) were more likely to report urinary tract symptoms, poorer health, emotional problems or stress, and being sexually touched before puberty, though history of STI was not associated with sexual dysfunction. The association between STI and sexual dysfunction found in our study is difficult to interpret as we do not know at what age the sexual dysfunction began in these men, or if there were STIs previous to the currently assessed sexual dysfunction or STI. It is possible that the diagnosed STI is causing sexual dysfunction [26], or it is possible that men with sexual dysfunction have different sexual behavioral risks that increase their risk for STI. Longitudinal data on sexual dysfunction, sexual behavior and the incidence of STI is lacking, and is necessary to determine whether there is a causal association between sexual dysfunction and STI.

In our study, men who reported cleaning their penis immediately after sex were less likely to have a non-ulcerative STI diagnosed. A study of 150 male sex partners of women with lower genital tract symptoms in Nairobi, Kenya, found a protective association between a composite measure of hygiene and HIV infection; a large component of the hygiene effect was bathing immediately after sex [27]. The authors hypothesize that immediate post-coital bathing may

reduce the duration and size of the HIV inoculum to which the penile epithelium is exposed. In a study of men attending an STI clinic in South Africa, O'Farrell et al. found that sub-preputial penile wetness, reflecting poor genital hygiene, was associated with lower education, income, and age, and greater number of sex partners [28]. Controlling for age, education, behavioral risks and HSV-2, men with penile wetness were almost 2.5 times more likely to be HIV-positive. The authors suggest four mechanisms through which genital hygiene may affect HIV risk: delayed healing of mucosal tears, increased risk of balanitis and micro-ulceration, enhanced adherence of HIV to target cells, and eliciting an immune response that favors HIV infection. Further prospective studies of genital hygiene practices and the *in vivo* cellular response are needed to delineate the risk for STIs and HIV posed by poor genital hygiene.

Limitations

This study had some limitations. Over one-third of eligible men were not enrolled in the trial, the majority of whom were those who did not return to the clinic. If men who did not return to the clinic were at lower risk for STI, then the associations observed may have been exaggerated. Conversely, men who were at lower risk for STI may have been more likely to participate in this study, as they may have been more interested in their genitourinary health. This analysis excluded men who were HIV-positive at baseline. It is likely that these men would have had higher risk profiles and higher rates of STI. Their inclusion may have generated a different risk profile. This study is subject to the biases inherent in survey studies: under-reporting of risks due social desirability, difficulty recalling events, and interviewer bias. Under-reporting risks and limited recall may have led to attenuated observed associations. Behavioral risks were assessed prior to randomization and prior to the availability of STI results, limiting recall bias. Significant efforts were made to limit interviewer bias through standardization of interview conduct, rigorous training, and intermittent monitoring. Additional data collection may have included previous STI history and date, and whether or not participants knew they had genital herpes, and the frequency of outbreaks. Throughout the discussion we have highlighted additional information that may have further explained some of the associations found here. We analyzed infection with NG, CT, and TV as a single outcome. It is possible that risks for these individual infections differed. However, power to identify risks for NG and CT as individual outcomes would have been limited. Inherent in the cross-sectional design of this analysis, we cannot assume causality from our findings.

Conclusions

While this analysis did not yield a highly predictive algorithm for screening, we identified novel behaviors associated with non-ulcerative STI risk: post-coital cleaning, preference for “dry” sex, and sexual dysfunction. There are significant gaps in our knowledge of how these behaviors relate to STI risk, and potentially to HIV risk. Expanded data collection and longitudinal analysis will be required to determine temporality and causality, and to specify the nature of these associations.

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Table 1**Reasons for Exclusion and Non-Participation.**

Reasons for Exclusion Among 5,622 HIV-Negative, Initially Eligible Men		N (%)
Not sexually active in the last 12 months		671 (11.9%)
Had a medical problem that was unsolved or for which they didn't return		176 (3.1%)
Deemed "unreliable" by counselor		157 (2.8%)
Had a condition preventing sex		63 (1.1%)
Had absolute indication for surgery		58 (1.0%)
Had contraindication for surgery		32 (0.6%)
Had hypospadias		9 (0.2%)
Reasons for Non-Participation Among 4,489 Eligible Patients		
Client did not return/was undecided		1,407 (31.3%)
Client had insufficient understanding of study		201 (4.5%)
Client declined participation		53 (1.2%)
Client wanted only circumcision		44 (1.0%)

Table 2

Socio-Demographic Characteristics and Behavioral Risks of Male Participants Aged 18–24 Years at Enrollment in a Randomized Controlled Trial of Circumcision in Kisumu, Kenya.

	Number (%)
Sexually Transmitted Infection Test Results	
Negative for all three	2,529 (92.2%)
Positive for any	214 (7.8%)
<i>Chlamydia trachomatis</i>	127 (4.6%)
<i>Neisseria gonorrhoeae</i>	56 (2.0%)
<i>Trichomonas vaginalis</i>	58 (2.1%)
Reported Age at Screening in Years	
18–19	848 (30.9)
20–21	1,067 (38.9)
22–24	828 (30.2)
Lived Whole Life in Kisumu	
No	1,640 (59.8)
Yes	1,103 (40.2)
Religion	
Anglican	395 (14.5)
Catholic	750 (27.4)
Muslim	22 (0.8)
Pentacostal	288 (10.5)
Nomiya	53 (1.9)
7 th Day Adventist	318 (11.6)
Other	908 (33.2)
Religious Importance	
Very	1,338 (49.4)
Quite, Somewhat, Not at all	1,370 (50.6)
Income Source	
Salaried	315 (11.5)
Self-employed	940 (34.3)
No income	1,486 (54.2)
Amount of Income In Past Month	
None	265 (10.0)
< 2000 Kenyan Shillings	1,180 (44.6)
≥ 2000 Kenyan Shillings	1,202 (45.4)
Who Do You Live With	
Alone	407 (14.8)
Wife/female live-in partner	132 (4.8)
Family	2,030 (74.0)
Friends	107 (3.9)
Other	67 (2.4)
Marital Status	
Live in partner or married	182 (6.7)
Not married/no live in partner	2,555 (93.3)
Education Level *	
None, Primary 1–8	934 (34.0)
Secondary 1–3	485 (17.7)
Secondary 4, post secondary	1,324 (48.3)
Occupation	
Student	618 (22.5)
Farmer/Fisherman	194 (7.1)
Unskilled worker	1,439 (52.4)
Semi-skilled	178 (6.5)
Skilled worker	252 (9.2)
Professional/Managerial	62 (2.3)
Drank any alcohol in the past week	
No	2,304 (84.0)
Yes	438 (16.0)
Age at First Sex	
Less than 16 years	1,292 (48.5)
16 years or older	1,373 (51.5)
Number of Sex Partners in the Past 6 months	
None	377 (13.8)

	Number (%)
One	1,215 (44.3)
Two or more	1,149 (41.9)
Number of Sex Partners in the Past 30 Days	
None	1,208 (44.0)
One	1,089 (39.7)
Two or more	446 (16.3)
Frequency of Condom Use For those Sexually Active Past 6 Months	
Never	618 (26.1)
Inconsistent	1,240 (52.3)
Always	514 (21.7)
Condom Used at Last Sex	
No	1,420 (51.8)
Yes	1,323 (48.2)
Sex with Woman Day You Met	
Never	1,904 (69.5)
Ever	835 (30.5)
Was Drinking Alcohol the Last Time Had Sex	
No	2,455 (89.5)
Yes	288 (10.5)
Gave Gifts or Paid a Woman to Have Sex in the Past 6 Months	
No, or no sex past 6 months	2,338 (85.3)
Yes	403 (14.7)
Oral Sex on a Woman	
Never	2,467 (90.1)
Ever	270 (9.9)
Prefer Wet or Dry Sex	
Wet	1,042 (38.3)
Dry	1,289 (47.4)
No Preference	237 (8.7)
Don't know	152 (5.6)
When Did You Clean Your Penis After Sex	
≥ 1 hr	2,143 (78.7)
< 1 hr	580 (21.3)
Penis Gets Scratches, Cuts, or Abrasions During Sex	
Never	1,421 (51.9)
Ever	1,317 (48.1)
Unable to Ejaculate ≥ 2 Weeks Past 6 Months	
No, or no sex past 6 months	2,627 (96.1)
Yes	107 (3.9)
Ejaculated Too Quickly ≥ 2 Weeks Past 6 Months	
No, or no sex past 6 months	2,309 (84.6)
Yes	422 (15.4)
Difficulty Achieving or Maintaining Erection ≥ 2 Weeks Past 6 Months	
No, or no sex past 6 months	2,568 (93.9)
Yes	168 (6.1)
HSV-2 Serostatus	
Negative	1,984 (72.4)
Positive	757 (27.6)
Active: Syphilis RPR titer ≥ 1:1 and TPHA Positive	
No	2,713 (99.0%)
Yes	27 (1.0%)

Not all categories of variables sum to 2,743 due to missing responses.

* Two men reported their educational attainment as "None".

Table 3

Characteristics Associated with Non-Ulcerative Sexually Transmitted Infection Among Male Participants Aged 18–24 Years at Enrollment in a Randomized Controlled Trial of Circumcision in Kisumu, Kenya.

	Uninfected N (%)	Infected N (%)	Prevalence (95% C.I.)	Univariate Odds Ratio (95% C.I.)
Age in years [*]				
18–19	762 (30.1)	86 (40.2)	10.1 (8.2 – 12.4)	ref
20–21	997 (39.5)	68 (31.8)	6.4 (5.0 – 8.0)	0.60 (0.43 – 0.84)
22–24	768 (30.4)	60 (28.0)	7.2 (5.6 – 9.2)	0.69 (0.49 – 0.97)
Lived Whole Life in Kisumu [*]				
No	1,540 (60.8)	105 (49.1)	6.4 (5.2 – 7.7)	ref
Yes	994 (39.2)	109 (50.9)	9.9 (8.2 – 11.8)	1.61 (1.22 – 2.13)
Religious Importance [†]				
Very	1,249 (50.1)	89 (41.8)	6.7 (5.4 – 8.1)	ref
Quite, Somewhat, Not at all	1,246 (49.9)	124 (58.3)	9.1 (7.6 – 10.7)	1.40 (1.05 – 1.85)
Income Source [§]				
Salaried	285 (11.3)	30 (14.0)	9.5 (6.5 – 13.3)	ref
Self-employed	857 (33.9)	83 (38.8)	8.8 (7.1 – 10.8)	0.92 (0.59 – 1.43)
No income	1,385 (54.8)	101 (47.2)	6.8 (6.0 – 8.8)	0.69 (0.45 – 1.06)
Who Do You Live With [§]				
Alone	364 (14.4)	43 (20.1)	10.6 (7.8 – 14.0)	ref
Wife/female live-in partner	117 (4.6)	15 (7.0)	11.4 (6.5 – 18.0)	1.09 (0.58 – 2.02)
Family	1,887 (74.6)	143 (66.8)	7.0 (6.0 – 8.2)	0.64 (0.45 – 0.92)
Friends	101 (4.0)	6 (2.8)	5.6 (2.1 – 11.8)	0.50 (0.21 – 1.21)
Other	60 (2.4)	7 (3.3)	10.5 (4.3 – 20.3)	0.99 (0.42 – 2.30)
Marital Status [†]				
Live in partner or married	161 (6.4)	21 (9.9)	11.5 (7.3 – 17.1)	ref
Not married/no live in partner	2,363 (93.6)	192 (90.1)	7.5 (6.5 – 8.6)	0.62 (0.39 – 1.00)
Highest Education Completed [*]				
None, Primary 1–8	828 (32.7)	106 (49.5)	11.4 (9.4 – 13.6)	ref
Secondary 1–3	449 (17.8)	36 (16.8)	7.4 (5.3 – 10.1)	0.63 (0.42 – 0.93)
Secondary 4, post secondary	1,252 (49.5)	72 (33.6)	5.4 (4.3 – 6.8)	0.45 (0.33 – 0.61)
Been to Nairobi in the Past 6 Months [‡]				
No	2,061 (81.5)	186 (86.9)	8.3 (7.2 – 9.5)	ref
Yes	467 (18.5)	28 (13.1)	5.7 (3.8 – 8.1)	0.66 (0.44 – 1.00)
Occupation [†]				
Student	582 (23.0)	36 (16.8)	5.8 (4.1 – 8.0)	ref
Farmer/Fisherman	173 (6.8)	21 (9.8)	10.8 (6.8 – 16.1)	1.96 (1.12 – 3.45)
Unskilled worker	1,319 (52.2)	120 (56.1)	8.3 (7.0 – 9.9)	1.47 (1.00 – 2.16)
Semi-skilled	167 (6.6)	11 (5.1)	6.2 (3.1 – 10.8)	1.06 (0.53 – 2.13)
Skilled worker	228 (9.0)	24 (11.2)	9.5 (6.2 – 13.8)	1.70 (0.99 – 2.92)
Professional/Managerial	60 (2.4)	2 (0.9)	3.2 (0.4 – 11.2)	0.54 (0.13 – 2.29)
Number of Sex Partners Past 30 Days [‡]				
None	1,133 (44.8)	75 (35.1)	6.2 (4.9 – 7.7)	ref
One	988 (39.1)	101 (47.2)	9.3 (7.6 – 11.2)	1.54 (1.13 – 2.11)
Two or more	408 (16.1)	38 (17.8)	8.5 (6.1 – 11.5)	1.41 (0.94 – 2.11)

	Uninfected N (%)	Infected N (%)	Prevalence (95% C.I.)	Univariate Odds Ratio (95% C.I.)
Condom Used at Last Sex [*]				
No	1,287 (50.9)	133 (62.2)	9.4 (7.9 – 11.0)	ref
Yes	1,242 (49.1)	81 (37.8)	6.1 (4.9 – 7.6)	0.63 (0.47 – 0.84)
Sex with Woman Day You Met [†]				
Never	1,766 (69.9)	138 (64.5)	7.3 (6.1 – 8.5)	ref
Ever	759 (30.1)	76 (35.5)	9.1 (7.2 – 11.3)	1.28 (0.96 – 1.72)
Prefer Wet or Dry Sex [*]				
Wet	983 (39.2)	59 (27.7)	5.7 (4.3 – 7.2)	ref
Dry	1,166 (46.5)	123 (57.8)	9.5 (8.0 – 11.3)	1.76 (1.27 – 2.42)
No Preference	221 (8.8)	16 (7.5)	6.8 (3.9 – 10.7)	1.21 (0.68 – 2.14)
Don't know	137 (5.5)	15 (7.0)	9.9 (5.6 – 15.8)	1.82 (1.01 – 3.31)
When Clean Penis After Sex [*]				
≥ 1 hr	1,956 (77.9)	187 (88.2)	8.7 (7.6 – 10.0)	ref
< 1 hr	555 (22.1)	25 (11.8)	4.3 (2.8 – 6.3)	0.47 (0.31 – 0.72)
Unable to Ejaculate ≥ 2 Weeks Past 6 months [*]				
No, or no sex past 6 months	2,432 (96.4)	195 (92.0)	7.4 (6.4 – 8.5)	ref
Yes	90 (3.6)	17 (8.0)	15.9 (9.5 – 24.2)	2.36 (1.37 – 4.04)
Ejaculated Too Quickly ≥ 2 Weeks Past 6 months [‡]				
No, or no sex past 6 months	2,140 (85.0)	169 (79.3)	7.3 (6.3 – 8.5)	ref
Yes	378 (15.0)	44 (20.7)	10.4 (7.7 – 13.7)	1.47 (1.04 – 2.09)
Penis Gets Scratches, Cuts, or Abrasions During Sex [†]				
Never	1,321 (52.3)	100 (46.7)	7.0 (5.8 – 8.5)	ref
Ever	1,203 (47.7)	114 (53.3)	8.6 (7.2 – 10.3)	1.25 (0.95 – 1.66)
HSV-2 Serostatus [*]				
Negative	1,846 (73.0)	138 (64.8)	7.0 (5.9 – 8.2)	ref
Positive	682 (27.0)	75 (35.2)	9.9 (7.9 – 12.3)	1.47 (1.10 – 1.97)

C.I. = Confidence Interval; confidence intervals for prevalence are binomially obtained. HSV-2 = Herpes Simplex Virus Type 2

Statistical significance of likelihood ratio p-value indicated by:

* p < 0.01;

[‡] 0.01 ≤ p < 0.05;

[†] 0.05 ≤ p < 0.10;

[§] 0.10 ≤ p < 0.20

ref = reference category for analysis

Table 4

Multivariable Logistic Regression Results: Factors Associated with Non-Ulcerative Sexually Transmitted Infection Among Male Participants Aged 18–24 Years at Enrollment in a Randomized Controlled Trial of Circumcision in Kisumu, Kenya, N=2686.

	Adjusted Odds Ratio	95% C.I.	Wald Test P-Value
Age in years			
18–19	ref		
20–21	0.63	0.45 – 0.89	0.008
22–24	0.73	0.51 – 1.06	0.098
Lived Whole Life in Kisumu			
No	ref		
Yes	1.50	1.12 – 2.01	0.006
Highest Education Completed			
None, Primary 1–8	ref		
Secondary 1–3	0.63	0.42 – 0.95	0.027
Secondary 4, post secondary	0.56	0.40 – 0.78	0.001
Prefer Wet or Dry Sex			
Wet	ref		
Dry	1.47	1.05 – 2.07	0.026
No Preference	1.16	0.64 – 2.11	0.614
Don't know	1.64	0.88 – 3.05	0.120
When Did You Clean Your Penis After Sex			
≥ 1 hr	ref		
< 1 hr	0.51	0.33 – 0.80	0.003
Unable to Ejaculate During Sex ≥ 2 Weeks Past 6 Months			
No, or no sex past 6 months	ref		
Yes	2.04	1.15 – 3.62	0.014
HSV-2 Serostatus			
Negative	ref		
Positive	1.37	1.01 – 1.86	0.046

ref = reference category for analysis

C.I. = Confidence Interval

HSV-2 = Herpes Simplex Virus Type 2

The model is adjusted for all variables presented.