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Herpes Simplex Virus Type 2 Infection Among Young Uncircumcised Men in Kisumu, Kenya

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Abstract

Objectives—This analysis sought to identify factors associated with herpes simplex virus type 2 (HSV-2) infection among men aged 18–24 in Kisumu, Kenya.

Methods—We analyzed baseline data from a randomized trial of male circumcision. Participants were interviewed for socio-demographic and behavioral risks. The outcome was HSV-2 by antibody status. Risk factors were considered singly and in combination through logistic regression models.

Results—Among 2,771 uncircumcised men, 766 (27.6%; 95% confidence interval [CI]: 26.0 – 29.3%) tested antibody positive for HSV-2. The median age at first sex was 16 years, and the median number of lifetime sexual partners was 4. HSV-2 seroprevalence increased from 19% among 18 year-olds to 43% among 24 year-olds ($p < 0.001$). In multivariable analysis, statistically

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Supriya D. Mehta: Dr. Mehta developed and conducted statistical analysis, and wrote the first draft of manuscript.

Stephen Moses: Dr. Moses originated the objective of the study, study design and selection of study measurements; assisted with interpretation of analysis and study results, and critical review and revision of the manuscript.

Kawango Agot: Dr. Agot directed and ensured integrity of data collection efforts and study protocol implementation at clinics, assisted with study design and selection of study measurements, and critical review and revision of manuscript.

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significant risks for infection were: increasing age (adjusted odds ratio [AOR] ranged from 1.22–2.58), being married or having a live-in female partner (AOR=1.80; 95% CI: 1.28 – 2.53), preferring “dry” sex (AOR=1.39; 95% CI: 1.14–1.69), reported penile cuts or abrasions during sex (AOR=1.58; 95% CI: 1.32 – 1.91), increasing lifetime sex partners (multiple response categories; AORs ranging 1.65–1.97), and non-student occupation (multiple response categories; AORs ranging 1.44–1.93). Risk decreased with reported condom used at last sex (AOR=0.82; 95% CI: 0.68–0.99).

Conclusion—Primary prevention efforts should be initiated at an early age. The same behavioral interventions used currently for HIV prevention – abstinence, reducing number of sex partners, and increasing condom use – should be effective for HSV-2 prevention.

Keywords

HSV-2; behavioral risk; epidemiology; Kenya; male circumcision

Background

It is estimated that up to 50% of young men in sub-Saharan Africa are infected with genital herpes, caused primarily by herpes simplex virus type 2 [HSV-2] [1–2]. HSV-2 has been associated with a several fold increase in the risk of HIV acquisition and transmission [1, 3–4]. HIV viral shedding is increased in the HSV-2/HIV- infected person [4–6], which in turn increases HIV transmission risk [7]. Susceptibility to HIV in the HSV-2 positive/HIV-negative person is increased through compromised mucosal integrity and recruitment of HIV susceptible cells to the genital tract [4]. The proportion of HIV cases attributable to HSV-2 infection has been estimated at 12–65% in Mwanza, Tanzania [8–9]), and 23% in Rakai, Uganda [8]. Preventing HSV-2 acquisition may significantly reduce HIV incidence.

In a randomized controlled trial assessing the effect of circumcision on HIV incidence in Kisumu, Kenya, men who were HSV-2 seropositive at baseline were 1.91 times more likely than HSV-2 seronegative men to become HIV-infected during the 24-month follow-up [10]. We sought to identify demographic and behavioral factors associated with HSV-2 among young men enrolled.

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 years enrolled in a randomized controlled trial of male circumcision to reduce HIV acquisition in Kisumu, Kenya [10]. Details of recruitment and consent have been reported [10].

For inclusion men had to be uncircumcised, HIV negative, sexually active in the last 12 months, aged 18–24 years, resident in Kisumu District with no plans to move away during follow-up (two years), and have a hemoglobin ≥ 9.0 g/dL. Men were excluded if their foreskin covered less than half the glans, if they had a bleeding disorder, a medical condition contraindicating surgery, or an absolute indication for surgery. Testing for HIV infection was conducted using a parallel double rapid test protocol. Men who were concordant negative were eligible for the study.

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

Data Collection

All consenting participants underwent standardized medical examination and history, and personal interview to obtain socio-demographic and behavioral risk information. Interviews were conducted by trained, experienced, local language-speaking counsellors in the participant's language of choice: English, Dho Luo, or Kiswahili. Data on sexual behaviors included: age at first sex, condom use, specific sexual practices, and the number of recent and lifetime sex partners. Three questions assessed the occurrence of penile trauma during sexual intercourse. Five questions assessed specific sexual dysfunctions occurring for 2 or more weeks during the past 6 months [11].

Sexually Transmitted Infection Testing

Methods for STI testing are detailed elsewhere [10, 13]. Briefly, men were tested for *Neisseria gonorrhoeae* (Ng) and *Chlamydia trachomatis* (Ct) by polymerase chain reaction (PCR)-based methods and for *Trichomonas vaginalis* (Tv) by culture. Serum specimens were tested for HSV-2 antibody (Kalon HSV-2 IgG ELISA, Kalon Biological Limited, Aldershot, United Kingdom). Syphilis infections were diagnosed by serum antibody testing. *Haemophilus ducreyi* testing by PCR and culture was conducted if genital ulcers were present. Testing was conducted at the study clinic and the University of Nairobi Department of Medical Microbiology research laboratory.

Data Analysis

The outcome for analysis was HSV-2 serostatus, dichotomized as positive or negative. Explanatory variables were demographics, sexual behaviors, post-coital genital cleaning, coital injury, preference for wet or dry sex, and sexual dysfunction. Differences between explanatory variables and the outcome were assessed by chi-square test for categorical variables. Variables significant at the $p < 0.20$ level in exploratory analysis were examined by univariate logistic regression. Variables significant at the $p < 0.20$ level by likelihood ratio testing were entered into a multivariable logistic regression model using forwards stepwise entry [12]. Those variables with a p -value < 0.05 were maintained in the multivariable model. Data were analyzed using Stata/SE 9.2 for Windows (Stata Corp., College Station, TX).

Results

Between February 2002 and September 2005, 2,784 men screened for the main trial consented to participation and were randomized. Results of screening and reasons for exclusion and non-participation have been previously described [10, 13].

Of the 2,776 participants eligible for analysis, 2,771 had HSV-2 testing and were included in this analysis. Among the 2,771 men, 766 tested positive (27.6%; 95% confidence interval [C.I.]: 26.0 – 29.3%). On physical exam, there were 28 men with genital ulcer and 47 (1.7%) men reported painful genital ulcer in the past 6 months. Twenty-eight (1.01%; 95% CI: 0.07 – 1.46%) men had active syphilis (RPR positive and TPHA positive), 2 of whom reported painful genital ulcer in the past 6 months, and none had genital ulcer on exam. Eighty-one men (2.94%; 95% CI: 2.3 – 3.6%) had evidence of prior exposure to syphilis (RPR negative and TPHA positive), four of whom reported painful genital ulcer in the past 6 months, and one had genital ulcer on exam. None of the men tested positive for *H. ducreyi*. By physical exam there were 12 men with urethral discharge, and 109 (3.9%) men reported urethral discharge in the past 6 months. There were 213 (7.8%; 95% CI: 6.8 – 8.8%) men who tested positive at the baseline visit for non-ulcerative STIs (Ng, Ct, or Tv), 27 (13%) of whom had urethral discharge on exam or by report, compared to 3.5% of men who tested negative for non-ulcerative STI ($p < 0.001$).

Interviews were conducted in English (62%), Dho Luo (36%), and Kiswahili (2%). Participants' median reported age was 20. The median number of lifetime sex partners was 4 and the median number of years sexually active was 5. Anal insertive sex with a woman was infrequent, reported by 4.0% of men. Sex with a man was reported by 6 participants. Participant socio-demographic and behavioral characteristics are shown in Table 1.

Exploratory Analysis: Factors Associated with HSV-2

The prevalence of infection increased from 19% among 18 year-olds to 43% among 24 year-olds ($p < 0.001$; Figure 1). HSV-2 seropositivity was more prevalent among men reporting coital injuries, preference for dry sex, erectile dysfunction or pain during sex, greater number of sexual partners, and numerous sexual behaviors (Table 2). HSV-2 seropositivity increased with older age, living with their wife or female partner, and employment and income. The prevalence of infection decreased with increasing education, condom use at last sexual intercourse, greater frequency of condom use in the past 6 months, and cleaning one's penis < 1 hour after sex (Table 2). Age at first sex, alcohol use at the last sex, and living one's whole life in Kisumu were not associated with infection.

The seroprevalence of HSV-2 was increased among men with active syphilis infection (46%; odds ratio [OR]=2.35; 95% CI: 1.11 – 4.97) and men with a history of syphilis infection (42%; OR=1.96; 95% CI: 1.25 – 3.08). HSV-2 seroprevalence was 35% among men with Ng, Ct, or Tv infection compared to 27% among men without any of those infections (OR=1.47; 95% CI: 1.10 – 1.97).

Multivariable Logistic Regression Analysis: Factors Associated with HSV-2

The likelihood of being HSV-2 seropositive increased with age (Table 3). Other risk factors for HSV-2 were being married or living with a female partner (AOR=1.80; 95% CI: 1.28 – 2.53), preference for dry sex (AOR=1.39; 95% CI: 1.14 – 1.70), reporting penile cuts, scratches or abrasions during sex (AOR=1.58; 95% CI: 1.32 – 1.91), having a non-student occupation, and more than one lifetime sex partner. Those who reported using a condom the last time they had sex were less likely to be HSV-2 seropositive (AOR=0.82; 95% CI: 0.68 – 0.99). Frequency of condom use in the past 6 months, assessed in a separate model due to collinearity with condom use at last sex, was not associated with HSV-2 status in a multivariable model. Syphilis and non-ulcerative STI were not analyzed as risks for HSV-2 in multivariable analysis because of the small number of men with these infections relative to the number who were HSV-2 seropositive. No statistically significant two-way interaction terms were identified. The Hosmer-Lemeshow goodness-of-fit test yielded a p -value of 0.45, indicating adequate model fit.

Discussion

Almost 28% of uncircumcised men aged 18–24 residing in Kisumu, Kenya, were HSV-2 seropositive. The high prevalence and increasing prevalence with age, number of lifetime sex partners, non-student occupation, and being married or having a live-in partner were also associated with HSV-2 infection in a study reported by Weiss et al. examining HSV-2 in four African cities, including Kisumu [1]. In our study, the prevalence of infection increased from 15% among men with one lifetime sex partner, to 26% among men with two lifetime sex partners. However, a strong dose-response effect was not observed beyond this, similar to the findings by Weiss et al. [1]. This is likely due to the high prevalence of HSV-2 among young women in Kisumu (51% among women aged 15–24) [1]. Condom use at last sex, an assessment of a single event, was associated with lower risk of HSV-2 infection, and is a condom use measure in the Demographic and Health Survey conducted in several sub-Saharan African countries [14], including Kenya, as well as in U.S. national surveys [15].

Results of some studies suggest dry sex is associated with an increased risk of STI [16] and HIV [17–19] in women in Africa, potentially due to the associated abrasions and ulcers [16]. Our study is the first we are aware of to demonstrate an increased risk of HSV-2 with dry sex preference among men. While an association was found for *preference* for dry sex, actual practices of dry sex were not assessed. In our study, preferring dry sex was associated with older age, being married or having a live-in partner, lower education, increasing number of sex partners, and sexual dysfunction. Further research is necessary to characterize the practice of dry sex geographically and culturally, and to determine whether this precedes STIs.

Less than 2% of men reported having a painful genital ulcer in the past 6 months. We did not collect data on the occurrence or frequency of previous HSV-2 outbreaks. HSV-2 seropositive men were less likely to report condom use the last time they had sex, increasing risk for transmission to their partner. As HSV-2 viral shedding peaks within 24 hours after symptoms [20], individuals could be given specific counseling for symptom recognition, and avoiding sex or using condoms before and after a symptomatic period [21–22]. Recent studies have found that single-day oral antiviral therapy (famciclovir) initiated within one hour of prodromal symptoms decreased duration and intensity of genital herpes outbreaks [20, 23]. Current studies are assessing the feasibility of HSV-2 suppressive therapy in preventing HIV transmission and acquisition [24].

Almost half of all men reported that their penis had ever been cut, scratched, or abraded during sex, and this was a statistically significant risk for HSV-2 in multivariable analysis. The high prevalence of coital injury reported may be a misclassification of HSV-2 symptoms [25]. However, while there was a higher prevalence of penile cuts or abrasions reported among HSV-2 seropositive men (58%), the prevalence of cuts or abrasions among HSV-2 negative men was still 44%. Conversely, through compromised mucosal integrity, HSV-2 infection may increase men's risk for penile cuts, abrasions, or scratches, although we are unaware of any evidence for this. Urogenital coital injury has been associated with vigorous coitus, unorthodox sexual positions, and young age [26–27]. Penile cuts, scratches, and abrasions may be more common in uncircumcised men [28]. Additional study is needed to determine the cause of penile cuts and abrasions during sex, and how this relates to HSV-2 risk.

Limitations

This analysis is based on data collected from subjects who were recruited, screened and enrolled to a clinical trial. The participants may not be representative of the eligible population and may have a selective behavioral risk profile with respect to HSV-2 infection. This trial excluded men who were HIV-positive at baseline. It is likely that these men would have had higher risk profiles, had higher prevalence of HSV-2, and reported more genital ulcerations [1]. There may have been misreporting of risks due to social desirability or difficulty recalling events.

Conclusions

This analysis identified modifiable behaviors – preference for dry sex, inconsistent condom use, and multiple sex partners – for HSV-2 prevention. Primary HSV-2 prevention efforts should be initiated at an early age prior to first sex. Further study should evaluate the effectiveness of education and behavioral interventions among men already infected in preventing HSV-2 transmission to their partners. The same behavioral interventions used currently for HIV prevention – abstinence, reducing number of sex partners, and increasing condom use – should be effective for HSV-2 prevention.

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Figure 1.
Seroprevalence of HSV-2 by Reported Age, with 95% Confidence Intervals.

Table 1

Socio-Demographic Characteristics and Behavioral Risks of Participants.

	Number (%)
Reported Age in Years	
18–19	849 (30.6)
20–21	1,081 (39.0)
22–24	841 (30.4)
Lived Whole Life in Kisumu	
No	1,659 (59.9)
Yes	1,112 (40.1)
Religion	
Anglican	397 (14.4)
Catholic	831 (30.1)
Muslim	22 (0.8)
Pentacostal	362 (13.1)
Nomiya	53 (1.9)
7 th Day Adventist	323 (11.7)
Other Protestant	259 (9.4)
Other	515 (18.7)
Religious Importance	
Very	1,355 (49.5)
Quite, Somewhat, Not at all	1,381 (50.5)
Income Source	
Salaried	319 (11.5)
Self-employed	952 (34.4)
No income	1,498 (54.1)
Amount of Income In Past Month	
None	268 (10.0)
< 2000 Shillings	1,192 (44.6)
≥ 2000 Shillings	1,213 (45.4)
Who Do You Live With	
Alone	414 (14.9)
Wife/female live-in partner	135 (4.9)
Family	2,045 (73.8)
Friends	109 (3.9)
Other	68 (2.5)
Marital Status	
Live in partner or married	185 (6.7)

	Number (%)
Not married/no live in partner	2,580 (93.3)
Education Level	
None, Primary 1–8	944 (34.1)
Secondary 1–3	487 (17.6)
Secondary 4, post secondary	1,340 (48.4)
Occupation	
Student	627 (22.6)
Farmer/Fisherman	197 (7.1)
Unskilled worker	1,449 (52.3)
Semi-skilled	181 (6.5)
Skilled worker	253 (9.1)
Professional/Managerial	64 (2.3)
Drank any alcohol in the past week	
No	2,326 (83.9)
Yes	444 (16.1)
Age at First sex	
Less than 14 years	532 (19.8)
14–15 years	773 (28.7)
16–17 years	766 (28.4)
Greater than 17 years	622 (23.1)
Number of Years Sexually Active	
≤ 5 Years	1,521 (56.9)
> 5 Years	1,152 (43.1)
Number of Sex Partners in the Past 6 months	
None	384 (13.9)
One or more	2,385 (86.1)
Number of Sex Partners in the Past 30 Days	
None	1,221 (44.1)
One	1,099 (39.7)
Two or more	451 (16.3)
Number of Life Time Sex Partners	
1	216 (8.4)
2	351 (13.6)
3–5	1,114 (43.1)
6–10	615 (23.8)
11+	289 (11.2)
Condom Used at Last Sex	

	Number (%)
No	1,436 (51.8)
Yes	1,335 (48.2)
Reported Frequency of Condom Use in the Past 6 Months	
Not sexually active in the past 6 months	373 (13.5)
“Always” used condoms	518 (18.7)
Used condoms inconsistently	1,250 (45.2)
“Never” used condoms	625 (22.6)
Sex with Woman Day You Met	
Never	1,921 (69.4)
Ever	846 (30.6)
Was Drinking Alcohol the Last Time Had Sex	
No	2,481 (89.5)
Yes	290 (10.5)
Gave Gifts or Paid a Woman to Have Sex in the Past 6 Months	
No, or no sex past 6 months	2,364 (85.4)
Yes	405 (14.6)
Oral Sex on a Woman	
Never	2,494 (90.2)
Ever	271 (9.8)
Prefer Wet or Dry Sex	
Wet	1,057 (38.5)
Dry	1,304 (47.4)
No Preference	236 (8.6)
Don't know	151 (5.5)
When Did You Clean Your Penis After Sex	
≥ 1 hr	2,160 (78.5)
< 1 hr	591 (21.5)
Penis Ever Sore During Sex	
No	1,443 (52.3)
Yes	1,314 (47.7)
Penis Ever Cut or Abraded During Sex	
No	1,434 (51.8)
Yes	1,332 (48.2)
Penis Ever Bleeds During Sex	
No	2,304 (83.3)
Yes	463 (16.7)

	Number (%)
Unable to Ejaculate for ≥ 2 Weeks in the Past 6 Months	
No, or no sex past 6 months	2,654 (96.1)
Yes	108 (3.9)
Ejaculated Too Quickly for ≥ 2 Weeks in the Past 6 Months	
No, or no sex past 6 months	2,331 (84.5)
Yes	428 (15.5)
Difficulty Achieving or Maintaining Erection for ≥ 2 Weeks in the Past 6 Months	
No, or no sex past 6 months	2,595 (93.9)
Yes	169 (6.1)
Sex Not Pleasurable for ≥ 2 Weeks in the Past 6 Months	
No, or no sex past 6 months	2,569 (93.1)
Yes	192 (6.9)
Sex Painful for ≥ 2 Weeks in the Past 6 Months	
No, or no sex past 6 months	2,585 (93.5)
Yes	179 (6.5)

Not all categories of variables sum to 2,771 due to missing responses.

Table 2

Distribution of Characteristics by HSV-2 Infection Status, HSV-2 Seroprevalence, and Factors Associated with HSV-2 Seropositivity.

	HSV-2 Seronegative N (%)	HSV-2 Seronegative N (%)	HSV-2 Seroprevalence (95% C.I.)	Univariate Odds Ratio (95% C.I.)
Reported Age in Years				
18	257 (12.8)	60 (7.8)	18.9 (14.8 – 23.7)	*ref
19	392 (19.6)	140 (18.3)	26.3 (22.6 – 30.3)	1.53 (1.09 – 2.15)
20	415 (20.7)	147 (19.2)	26.2 (22.6 – 30.0)	1.52 (1.08 – 2.13)
21	390 (19.5)	129 (16.8)	24.9 (21.2 – 28.8)	1.42 (1.00 – 2.00)
22	251 (12.5)	123 (16.1)	32.9 (28.1 – 37.9)	2.10 (1.47 – 2.99)
23	201 (10.0)	93 (12.1)	31.6 (26.4 – 37.3)	1.98 (1.36 – 2.88)
24	99 (4.9)	74 (9.7)	42.8 (35.3 – 50.5)	3.20 (2.12 – 4.83)
Income In the Past Month				
None	212 (10.9)	56 (7.7)	20.9 (16.2 – 26.3)	*ref
Less than 2000 Kenyan Shillings	889 (45.8)	303 (41.5)	25.4 (23.0 – 28.0)	1.29 (0.94 – 1.78)
2000 or more Kenyan Shillings	842 (43.3)	371 (50.8)	30.6 (28.0 – 33.3)	1.67 (1.21 – 2.29)
Employment				
Salaried	210 (10.5)	109 (14.3)	34.2 (29.0 – 39.7)	*ref
Self-employed	647 (32.3)	305 (39.9)	32.0 (29.1 – 35.1)	0.91 (0.69 – 1.19)
No Income	1,147 (57.2)	351 (45.9)	23.4 (21.3 – 25.7)	0.59 (0.45 – 0.76)
Marital Status				
Live in partner or married	97 (4.9)	88 (11.5)	47.6 (40.2 – 55.0)	*ref
Not married/no live in partner	1,904 (95.1)	667 (88.5)	26.2 (24.5 – 27.9)	0.39 (0.29 – 0.53)
Highest Education Completed				
None, Primary 1–8	645 (32.2)	299 (39.0)	31.7 (28.7 – 34.7)	*ref
Secondary 1–3	351 (17.5)	136 (17.9)	27.9 (24.0 – 32.1)	0.84 (0.66 – 1.07)
Secondary 4, post secondary	1,009 (50.3)	331 (43.2)	24.7 (22.4 – 27.1)	0.71 (0.59 – 0.85)
Occupation				
Student	508 (25.3)	119 (15.5)	19.0 (16.0 – 22.3)	*ref
Farmer/Fisherman	128 (6.4)	69 (9.0)	35.0 (28.4 – 42.1)	2.31 (1.61 – 3.28)
Unskilled worker	1,040 (51.9)	409 (53.4)	28.2 (25.9 – 30.6)	1.68 (1.33 – 2.11)
Semi-skilled	120 (6.0)	61 (8.0)	33.7 (26.9 – 41.1)	2.17 (1.50 – 3.13)
Skilled worker	167 (8.3)	86 (11.2)	34.0 (28.2 – 40.2)	2.20 (1.58 – 3.05)
Professional/Managerial	42 (2.1)	22 (2.9)	34.4 (22.9 – 47.3)	2.24 (1.29 – 3.89)
Religious Importance				
Very Important	1,002 (50.6)	353 (46.8)	26.1 (23.7 – 28.5)	*ref
Quite, Somewhat, Not at All Important	979 (49.4)	402 (53.2)	29.1 (26.7 – 31.6)	1.17 (0.99 – 1.38)

	HSV-2 Seronegative N (%)	HSV-2 Seronegative N (%)	HSV-2 Seroprevalence (95% C.I.)	Univariate Odds Ratio (95% C.I.)
Number of Years Sexually Active				
5 Years or Less	1,132 (58.5)	389 (52.8)	25.6 (23.4 – 27.8)	$\ddagger_{\text{ref}}$
More than 5 Years	804 (41.5)	348 (47.2)	30.2 (27.6 – 33.0)	1.26 (1.06 – 1.49)
Number of Lifetime Sex Partners				
1	184 (9.7)	32 (4.6)	14.8 (10.4 – 20.3)	$^*_{\text{ref}}$
2	261 (13.8)	90 (13.0)	25.6 (21.2 – 30.5)	1.98 (1.27 – 3.10)
3–5	826 (43.7)	288 (41.4)	25.9 (23.3 – 28.5)	2.00 (1.35 – 2.99)
6–10	427 (22.6)	188 (27.1)	30.6 (26.9 – 34.4)	2.53 (1.68 – 3.83)
11+	192 (10.2)	97 (14.0)	33.6 (18.4 – 28.4)	2.90 (1.86 – 4.55)
Condom Used at Last Sex				
No	995 (49.6)	441 (57.6)	30.7 (28.3 – 33.2)	$^*_{\text{ref}}$
Yes	1,010 (50.4)	325 (42.4)	24.3 (22.1 – 26.7)	0.73 (0.61 – 0.86)
Frequency of Condom Use in the Past 6 Months				
No sex in the past 6 months	282 (14.1)	91 (11.9)	24.4 (20.1 – 29.1)	$\ddagger_{\text{ref}}$
“Always” used condoms	388 (19.4)	130 (17.0)	25.1 (21.4 – 29.1)	1.04 (0.76 – 1.41)
Used condoms inconsistently	906 (45.3)	344 (45.0)	27.5 (25.1 – 30.1)	1.18 (0.90 – 1.54)
“Never” used condoms	425 (21.2)	200 (26.1)	32.0 (28.4 – 35.8)	1.46 (1.09 – 1.95)
Sex with Woman Day You Met				
Never	1,420 (71.0)	501 (65.4)	26.1 (24.1 – 28.1)	$^*_{\text{ref}}$
Ever	581 (29.0)	265 (34.6)	31.3 (28.2 – 34.6)	1.29 (1.08 – 1.54)
Prefer Wet or Dry Sex				
Wet	793 (39.9)	264 (34.8)	25.0 (22.4 – 27.7)	$^*_{\text{ref}}$
Dry	890 (44.8)	414 (54.6)	31.8 (29.2 – 34.4)	1.40 (1.17 – 1.68)
No Preference	184 (9.3)	52 (6.9)	22.0 (16.9 – 27.9)	0.85 (0.61 – 1.19)
Don’t know	122 (6.1)	29 (3.8)	19.2 (13.3 – 26.4)	0.71 (0.47 – 1.10)
When Clean Penis After Sex				
≥ 1 hr	1,543 (77.5)	617 (81.3)	28.6 (26.7 – 30.5)	$\ddagger_{\text{ref}}$
< 1 hr	449 (22.5)	142 (18.7)	24.0 (20.6 – 27.7)	0.79 (0.64 – 0.98)
Gave a woman money or gifts for sex past 6 months				
No, or no sex past 6 months	1,725 (86.1)	639 (83.4)	27.0 (25.2 – 28.9)	$\ddagger_{\text{ref}}$
Yes	278 (13.9)	127 (16.6)	31.4 (26.9 – 36.1)	1.23 (0.98 – 1.55)
Difficulty Achieving or Maintaining Erection During Sex for ≥ 2 Weeks in the Past 6 Months				
No, or no sex past 6 months	1,890 (94.5)	705 (92.3)	27.2 (25.5 – 28.9)	$\ddagger_{\text{ref}}$
Yes	110 (5.5)	59 (7.7)	34.9 (27.8 – 42.6)	1.44 (1.04 – 2.00)

	HSV-2 Seronegative N (%)	HSV-2 Seronegative N (%)	HSV-2 Seroprevalence (95% C.I.)	Univariate Odds Ratio (95% C.I.)
Pain During Sex for ≥ 2 Weeks in the Past 6 months				
No, or no sex past 6 months	1,883 (94.1)	702 (91.9)	27.2 (25.4 – 28.9)	$\ddagger_{\text{ref}}$
Yes	117 (5.9)	62 (8.1)	34.6 (27.7 – 42.1)	1.42 (1.03 – 1.96)
Penis Ever Sore During Sex				
No	1,089 (54.6)	354 (46.3)	24.5 (22.3 – 26.8)	$^*_{\text{ref}}$
Yes	904 (45.4)	410 (53.7)	31.2 (28.7 – 33.8)	1.40 (1.18 – 1.65)
Penis Ever Gets Scratches, Cuts, or Abrasions During Sex				
No	1,116 (55.7)	318 (41.6)	22.2 (20.0 – 24.4)	$^*_{\text{ref}}$
Yes	886 (44.3)	446 (58.4)	33.5 (31.0 – 36.1)	1.77 (1.49 – 2.09)

Statistical significance of logistic regression likelihood ratio p-value indicated by:

* $p < 0.01$;

$\ddagger$ $0.01 \leq p < 0.05$;

$\dagger$ $0.05 \leq p < 0.10$;

$\S$ $0.10 \leq p < 0.20$

ref = reference category for analysis

C.I. = C.I. = confidence interval estimate, assuming a binomial distribution for prevalence and a normal distribution for the log odds

Table 3

Final Results of Stepwise Multivariable Logistic Regression Model for Factors Associated with HSV-2 Seropositivity, N=2,552.

	Adjusted Odds Ratio	95% C.I.	P-Value
Reported Age in Years			
18	ref		
19	1.41	0.98 – 2.04	0.066
20	1.43	0.99 – 2.07	0.053
21	1.22	0.84 – 1.78	0.297
22	1.89	1.28 – 2.78	0.001
23	1.53	1.01 – 2.32	0.047
24	2.58	1.63 – 4.08	<0.001
Occupation			
Student	ref		
Farmer/Fisherman	1.93	1.32 – 2.83	0.001
Unskilled Laborer	1.44	1.12 – 1.84	0.004
Semi-Skilled Laborer	1.61	1.08 – 2.40	0.020
Skilled Laborer	1.66	1.16 – 2.37	0.005
Professional/Managerial	1.63	0.87 – 3.05	0.126
Marital Status			
Not Married or No Live In Partner	ref		
Married or Live In Partner	1.80	1.28 – 2.53	0.001
Number of Lifetime Sex Partners			
1	ref		
2	1.95	1.23 – 3.08	0.004
3–5	1.65	1.09 – 2.49	0.018
6–10	1.84	1.20 – 2.84	0.006
11+	1.97	1.23 – 3.15	0.005
Prefer Wet or Dry Sex			
Wet	ref		
Dry	1.39	1.14 – 1.69	0.001
No Preference	0.97	0.68 – 1.41	0.850
Don't know	0.79	0.48 – 1.28	0.346
Used a Condom the Last Time Had Sex			
No	ref		
Yes	0.82	0.68 – 0.99	0.036
Penis Ever Cut, Scratched, or Abraded During Sex			
No	ref		

	Adjusted Odds Ratio	95% C.I.	P-Value
Yes	1.58	1.32 – 1.91	<0.001

ref = reference category for analysis

C.I. = confidence interval estimate, assuming a normal distribution for the log odds. All parameter estimates are adjusted for other covariates presented